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AMENDMENT 10 TO THE FISHERY MANGEMENT PLAN FOR SPINY LOBSTER IN THE GULF OF MEXICO AND SOUTH ATLANTIC with Draft Environmental Impact Statement, Initial Regulatory Flexibility Act Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement

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ABBREVIATIONS USED IN THIS DOCUMENT

ABC	acceptable biological catch
ACL	annual catch limit
ACOE	Army Corps of Engineers
ACT	annual catch target
ADCNR, MRD	Alabama Department of Conservation and Natural Resources, Marine Resources Division
AM	accountability measure
APA	Administrative Procedure Act
AP	advisory panel
ASMFC	Atlantic States Marine Fisheries Commission
B	Biomass
$B_{CURRENT}$	current biomass of stock
B_{MSY}	Biomass at MSY
CEQ	Council on Environmental Quality
CFMC	Caribbean Fishery Management Council
CFR	Code of Federal Regulations
Councils	Gulf of Mexico Fishery and South Atlantic Management Councils
CPUE	catch per unit effort
CL	Carapace Length
CSL	Caribbean Spiny Lobster
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DEIS	draft environmental impact statement
DOC	U. S. Department of Commerce
DOI	Department of Interior
DQA	Data Quality Act
EA	environmental assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFP	exempted fishing permit
EIS	Environmental Impact Statement
ELMR	Estuarine Living Marine Resources
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	instantaneous fishing mortality rate
FACA	Federal Advisory Committee Act
FAO	Food and Agriculture Organization (United Nations)
FDEP	Florida Department of Environmental Protection
FKNMS	Florida Keys National Marine Sanctuary
FMFC	Florida Marine Fisheries Commission
FMP	fishery management plan
FMRI	Florida Marine Research Institute
F_{MSY}	Fishing Mortality Rate Yielding MSY
FMU	fishery management unit
FWC	Florida Fish and Wildlife Conservation Commission

FWRI	Fish and Wildlife Research Institute
GC	general counsel
GCSE	General Counsel Southeast Region
GMFMC	Gulf of Mexico Fishery Management Council
HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
IFQ	Individual Fishing Quotas
IRFA	initial regulatory flexibility analysis
ITQ	individual transferable quota
LE	Law Enforcement
LEAP	Law Enforcement Advisory Panel
M	instantaneous natural mortality rate
MARFIN	Marine Fisheries Initiative
MDMR	Mississippi Department of Marine Resources
MFMT	Maximum Fishing Mortality Threshold
MMPA	Marine Mammal Protection Act
MP	million pounds
MPA	Marine Protected Area
MRFSS	Marine Recreational Fishery Statistics Survey
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	Same as NMFS
NOS	National Ocean Service
OFL	overfishing limit
OMB	Office of Management and Budget
OY	optimum yield
PRA	Paperwork Reduction Act
PSA	Productivity Susceptibility Analysis
RA	Regional Administrator of NMFS
RFA	Regulatory Flexibility Act
RIR	regulatory impact review
RSE	restricted species endorsement
SAFMC	South Atlantic Fishery Management Council
SAP	stock assessment panel
SBA	Small Business Administration
SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	Southeast Data Assessment Review (stock assessment
SEFSC	Southeast Fisheries Science Center of NMFS
SEIS	supplemental environmental impact statement
SEP	Socioeconomic Panel
SERO	Southeast Regional Office (NMFS)
SFA	Sustainable Fisheries Act

SMZ	special management zone
SPL	saltwater products license (FL)
SPR	spawning potential ratio
SSB	spawning stock biomass
SSBR	spawning stock biomass per recruit
SSC	Scientific and Statistical Committee
TAC	total allowable catch
TCP	trap certification program
TL	Tail Length
TW	Tail Weight
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VPA	virtual population analysis
YPR	yield per recruit
Z	instantaneous total mortality rate

AMENDMENT 10 TO THE FISHERY MANAGEMENT PLAN FOR SPINY LOBSTER IN THE GULF OF MEXICO AND SOUTH ATLANTIC REGIONS

INCLUDING A DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS), INITIAL REGULATORY FLEXIBILITY ANALYSIS (IRFA), DRAFT REGULATORY IMPACT REVIEW (DRIR), AND SOCIAL IMPACT ASSESSMENT/FISHERY IMPACT STATEMENT (SIA/FIS)

Proposed actions:	Specify Magnuson-Stevens Act required values including annual catch limits and accountability measures for species in the Spiny Lobster Fishery Management Plan.
Lead agency:	FMP Amendment – Gulf of Mexico and South Atlantic Fishery Management Councils EIS - NOAA Fisheries Service
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NOI for Amendment 10:	1/28/09 (74FR4943) – SAFMC ________________ - GMFMC
Scoping meetings held:	SAFMC as part of Comp. ACL Amendment (1/26/09 in Charleston, SC; 1/27/09 in New Bern, NC; 2/3/09 in Key Largo, FL; 2/4/09 in Cape Canaveral, FL and 2/5/09 in Pooler, GA) GMFMC (9/21/09 in Key West, FL and 9/22/09 in Marathon, FL)
NOI for EIS:	3/12/10 (75FR48:11843)
Public Hearings held:	__________________
DEIS filed:	__________________
DEIS notice published:	__________________
DEIS Comments received by:	__________________
FEIS filed:	__________________
FEIS Comments received by:	__________________

Abstract
To be added

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EXECUTIVE SUMMARY

To be drafted prior to public hearings by Gregg

1.0 INTRODUCTION

This Draft Environmental Impact Statement (DEIS) for Amendment 10 to the Fishery Management Plan for Spiny Lobster in the Gulf of Mexico and South Atlantic (Spiny Lobster FMP) will bring the FMP into compliance with Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requirements. The Spiny Lobster FMP is jointly managed by the Gulf of Mexico and South Atlantic Fishery Management Councils (Councils).

1.1 Background

In 2006, the Magnuson-Stevens Act was re-authorized and included a number of changes to improve conservation of managed fishery resources. The goals require that conservation and management measures "shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry". Included in these changes are requirements that the Regional Councils must establish both a mechanism for specifying annual catch limits (ACLs) at a level such that overfishing does not occur in the fishery, and accountability measures (AMs) to correct if overages occur. Accountability measures are management controls to prevent the ACLs from being exceeded and to correct by either in-season or post-season measures if they do occur.

The ACL is set by the Councils, but begins with specifying an overfishing limit (OFL), which is the yield above which overfishing occurs. Once an OFL is specified, an acceptable biological catch (ABC) is recommended by the Councils' Scientific and Statistical Committees. The ABC is based on the OFL and takes into consideration scientific uncertainty. The OFL and ABC are set by scientists, whereas the next two reference points, ACL and annual catch target (ACT) are set by managers. The ACT is not required, but if used should be set at a level that takes into account management uncertainty and provides a low probability of the ACL being exceeded. These measures must be implemented by 2010 for all stocks experiencing overfishing, and 2011 for all other stocks.

There are some exceptions for the development of ACLs; for example, when a species can be considered an ecosystem component species and species with annual life cycles. Stocks listed in the Fishery Management Unit are classified as either ''in the fishery'' or as an ''ecosystem component''. By default, stocks are considered to be "in the fishery" unless declared ecosystem component species. Ecosystem component species are exempt from the requirement for ACLs. In addition, ecosystem component species may, but are not required to be included in a FMP for any of the following reasons: data collection purposes; ecosystem considerations related to specification of optimum yield for the associated fishery; as considerations in the development of conservation and management measures for the associated fishery; and/or to address other ecosystem issues.

To be considered for possible classification as an ecosystem component species, the species should:

(A) Be a non-target species or non-target stock;
(B) Not subject to overfishing, approaching overfished, or overfished;
(C) Not likely to become subject to overfishing or overfished, according to the best available information, in the absence of conservation and management measures; and
(D) Not generally be retained for sale or personal use.

The original Spiny Lobster FMP included the Caribbean spiny lobster, *Panulirus argus*, and other incidental species of lobster (spotted spiny lobster, *Panulirus guttatus*; smoothtail spiny lobster, *Panulirus laevicauda*; Spanish slipper lobster, *Scyllarides aequinoctialis*, and ridged slipper lobster, *Scyllarides nodifer*) which inhabit or migrate through coastal waters and the fishery conservation zone now named the exclusive economic zone (EEZ) of the Gulf of Mexico and the South Atlantic (GMFMC and SAFMC 1982). All five species of lobster are in the fishery, but only two species, the Caribbean spiny lobster and ridged slipper lobster, are listed under the Fishery Management Unit (GMFMC and SAFMC 1986). The other species in the Spiny Lobster FMP (spotted spiny lobster, smoothtail spiny lobster, and Spanish slipper lobster) may qualify as ecosystem component species.

An ACL for a given stock or stock complex can be established in several ways: either a single ACL for the entire fishery, divided into sector ACLs (i.e., recreational and commercial sectors), divided into sector and gear types (i.e., recreational, commercial diving, bully netting, and commercial trapping), or divided into state-federal ACLs. In any of these cases, the sum of the ACLs cannot exceed the ABC.

Current regulations on the Caribbean spiny lobster, *Panulirus argus*, off the Gulf of Mexico and South Atlantic are summarized in Table 1.1.1 and defined in 50 CFR 640.2. *Scyllarides nodifer* is the other species in the Fishery Management Unit and codified in the regulations in four sections. The common name Slipper (Spanish) lobster as *Scyllarides nodifer* in the regulations (i.e., 50 CFR 640.2) is not the correct common name according to Williams et al. (1988) and FAO Fisheries Synopsis (1991) authorities on the correct common names of invertebrate species; the correct common name is ridged slipper lobster. For the purposes of this document this common name listed above will be used throughout the rest of the document. The regulations specified for ridged slipper lobster discuss conservation and management [50 CFR 640.1 (b)], define slipper lobster by genus species [640.2], prohibit harvest of a berried (egg-bearing) lobsters [640.21 9(a)], and prohibit the use of poisons and explosives to take slipper lobster in the exclusive economic zone [(640.22 9a)(3)].

Table 1.1.1. Current commercial and recreational Caribbean spiny lobster regulations for federal waters of the South Atlantic and the Gulf of Mexico.

	Permits required	Size Limits	Bag/Possession Limits	Closed areas	Closed Season	Gear Restrictions	Other Prohibitions
Commercial	Federal spiny lobster vessel permit except if fishing in federal waters off FL. FL commercial harvester permit required in EEZ off FL. Tailing permit if tailing lobster.	Carapace must be more than 3" (measured in the water), separated tails must be at least 5.5"	Off of NC, SC, and GA, 2 per person. Off FL and other Gulf states 6 per person per day.*	None	FL and other Gulf states: April 1 through August 5 NC, SC, or GA: No closed season.	No spear, hooks, piercing devices, explosives, or poisons. Degradable panel required on non-wooden traps.	Trap tending at night No taking of spiny lobster with eggs.
Recreational	State endorsement required to the fishing license.	Carapace must be more than 3" (measured in the water).	Off of NC, SC, and GA, 2 per person. Off FL and other Gulf states 6 per person per day.	None	FL and other Gulf states: April 1 through August 5 Exception off FL: 2-day non-trap mini-season last Wed and Thurs in July** Off other Gulf states: 2-day non-trap mini-season last Sat and Sun in July	No spear, hooks, piercing devices, or explosives. Degradable panel required on non-wooden traps.	No taking of spiny lobster with eggs.

* A person is exempt from the bag/possession limits off Florida if the harvest of Caribbean spiny lobster is by diving or by use of bully net, hoop net, or spiny lobster trap; and the vessel has on board the required commercial Florida state licenses.
**During the two-day mini-season off Florida, the bag limit is 12 Caribbean spiny lobsters per person per day, in or from the EEZ, other than off Monroe County. Off Monroe County the bag limit is 6 Caribbean spiny lobsters per person per day.

Explanation of Consultation Under the Endangered Species Act

The Endangered Species Act (ESA) of 1973 (16 U.S.C. Section 1531 et seq.) requires that federal agencies ensure actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered species or the habitat designated as critical to their survival and recovery. The ESA requires NOAA Fisheries Service to consult with the appropriate administrative agency (itself for most marine species and the U.S. Fish and Wildlife Service for all remaining species) when proposing an action that may affect threatened or endangered species or adversely modify critical habitat. Consultations are necessary to determine the potential impacts of the proposed action. They are concluded informally when proposed actions may affect but are "not likely to adversely affect" threatened or endangered species or designated critical habitat. Formal consultations, resulting in a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" threatened or endangered species or adversely modify designated critical habitat.

To satisfy the ESA consultation requirements, NOAA Fisheries Service completed a formal consultation, and resulting biological opinion, on the continued authorization of the Gulf of Mexico and South Atlantic spiny lobster fishery in 2009. When making determinations on FMP actions, not only are the effects of the specific actions proposed analyzed, but also the effects of all discretionary fishing activity under the affected FMPs. Thus, the biological opinion analyzed the potential impacts to ESA-listed species from the continued authorization of the federal spiny lobster fishery. The opinion stated the fishery was not likely to adversely affect ESA-listed marine mammals, Gulf sturgeon or designated critical habitat for elkhorn and staghorn corals. However, the opinion determined that the spiny lobster fishery would adversely affect sea turtles, smalltooth sawfish, and elkhorn and staghorn corals, but would not jeopardize their continued existence. An incidental take statement was issued for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, smalltooth sawfish, and both species of coral. Reasonable and prudent measures to minimize the impact of these incidental takes were specified, along with terms and conditions to implement them.

1.2 Purpose Statement

The purpose of this amendment is to bring the Spiny Lobster FMP into compliance with Magnuson-Stevens Act requirements for ACLs and AMs to prevent overfishing; update biological reference points, policies, and procedures; and consider adjustment of management measures to aid law enforcement and comply with measures to protect endangered species established under a biological opinion.

1.3 Need for the Proposed Action

Revisions to the Magnuson-Stevens Act in 2006 require FMPs contain ACLs for all managed species. ACLs must be set at a level that prevents overfishing and does not exceed the recommendations of the respective Councils' Scientific and Statistical Committees for ABC. Fisheries Management Plans are also required to establish AMs, which are management controls that ensure ACLs are not exceeded or provide corrective measures if overages occur. For stocks determined by the Secretary of Commerce to be subject to overfishing, ACLs and AMs must be effective in 2010; for all other stocks managed under an FMP, except species with annual life cycles and ecosystem component species, ACLs and AMs must be effective in 2011. No species in the Spiny Lobster FMP is known to be undergoing overfishing. The Councils intend to meet the 2011 deadline through Amendment 10 to the Spiny Lobster FMP.

Of the four other lobster species in the Spiny Lobster FMP, only the ridged slipper lobster is specified in the regulations; the other species are in the management unit for data collection purposes only. Landings information is not available on the smoothtail and spotted spiny lobsters. Low numbers of these species may be landed as Caribbean spiny lobster in either the commercial or recreational sector, but no records are available at this time. Spanish and ridged slipper lobsters also occur in federal waters along the west coast of Florida and are primarily landed as bycatch in shrimp trawls. Because landings information is scarce and incomplete, setting ACLs would be difficult for these species. The Councils could list these four species as ecosystem components or remove them from the FMP; in either case, ACLs and accountability measures would not be required. If these species are left in the FMP under the current designation, ACLs and accountability measures must be set.

Current definitions of maximum sustainable yield, optimum yield, overfishing, and overfished were set for Caribbean spiny lobster in Amendment 6. Currently, the Councils have different definitions for each criterion. The Councils may modify these definitions based on the results of the upcoming stock assessment update and the recommendations of the Scientific and Statistical Committees. A single definition for each biological reference point would simplify management.

An ACL for a given stock can be established as either a single ACL for the entire fishery, or separate ACLs for various sectors. If separate ACLs are set, the ABC must be divided among sectors. The State of Florida formed an ad hoc advisory board to develop such allocation plans. Their recommendations will be considered by the Councils for allocation in the federal fishery. A single ACL may be set at or below the ABC, and the sum of separate ACLs cannot exceed the ABC.

The implementation process for a plan amendment can take over a year from initial scoping to final implementation. Framework procedures provide a mechanism for timelier implementation of routine actions such as setting ACLs, and a guideline for implementing such actions in a consistent manner. The framework procedure in the Spiny Lobster FMP was set in Amendment 2 and allows changes to be made to gear and harvest restrictions. Under the reauthorized Magnuson-Stevens Act and the 2008 amended guidelines for National Standard 1 (74 FR 3178), ACLs and, if selected by the Council, ACTs should also be adjusted by framework. Revision of the current framework procedure would allow such adjustments. Further revisions would allow additional action to be implemented through the framework procedure. Amendment 2 also contains a process for the State of Florida to propose modifications to regulations. This process is now outdated and needs to be updated.

Two current federal regulations may be causing detrimental impacts to the resource as well as creating enforcement problems. First, under certain situations and with a federal tailing permit, Caribbean spiny lobster tails may be separated from the body onboard a fishing vessel. This allowance creates difficulties for law enforcement in determining if hooks and spears were used to harvest the resource. Second, up to 50 Caribbean spiny lobsters under the minimum size limit or one per trap, whichever is greater, may be retained aboard a vessel provided they are held in a live well. When in a trap, such juveniles or "short" lobsters are used to attract other lobsters for harvest. Federal regulations are not consistent with State of Florida regulations, which allow up to 50 Caribbean spiny lobsters under the minimum size limit and one per trap. However, some studies have shown this practice may increase the fishing mortality on juvenile lobsters and could facilitate their illegal trade. The Councils are considering modifying or repealing these two regulations.

On August 27, 2009, the ESA biological opinion evaluating the impacts of the continued authorization of the spiny lobster fishery on ESA-listed species was completed. The opinion concluded the continued authorization of the fishery would not adversely affect ESA-listed marine mammals or elkhorn and staghorn coral designated critical habitat. The opinion also concluded the continued authorization of the fishery may adversely affect, but would not jeopardize the continued existence of elkhorn and staghorn coral, five species of sea turtle (green, hawksbill, Kemp's ridley, leatherback, and loggerheads), and smalltooth sawfish. The opinion authorized a limited amount of incidental take for these species and prescribed non-discretionary reasonable and prudent measures to help minimize the impacts of those takes. Specific terms and conditions required to implement the prescribed reasonable and prudent measures include, but are not limited to: creating new or expanding existing closed areas to protect coral, allowing the public to remove trap-related marine debris, and implementing trap line-marking requirements. The Councils are considering alternatives to meet these requirements.

1.4 Management History

Fishery Management Plan for Spiny Lobster in the Gulf of Mexico and the South Atlantic (1982)
The Spiny Lobster FMP largely extended Florida's rules regulating the fishery to the EEZ throughout the range of the fishery, i.e., North Carolina to Texas. The FMP regulations were effective on July 2, 1982 (47 FR 29203). Major items are as follows:

- MSY is estimated as 12.7 million pounds annually for the maximum yield per recruit size of 3.5 inch carapace length.
- OY is specified to be all lobster more than 3 inch carapace length or not less than 5.5 inch tail length that can be harvested by commercial and recreational fishermen given existing technology and prevailing economic conditions.
- A minimum harvestable size limit of more than 3 inch carapace length or not less than 5.5 inch tail length shall be established.
- A closed season from April 1 through July 25 shall be established. During this closed season there shall be a five-day "soak period" from July 21-25 and a five-day grace period for removal of traps from April 1-5.
- All spiny lobster traps shall have a degradable surface of sufficient size so as to allow escapement of lobsters from lost traps.
- All spiny lobster taken below the legal size limit shall be immediately returned to the water unharmed except undersized or "short" lobsters which may be carried on the boat/vessel provided they are: for use as lures or attractants in traps and kept in a shaded "bait" box while being transported between traps. No more than

three live “shorts” per trap (traps carried on the boat) or 200 live “shorts”, whichever is greater, may be carried at any one time.

- A special two-day recreational non-trap season shall be established.
- The retention on boat boats or vessels or possession on land of “berried” female spiny lobsters taken from the FCZ at any time shall be prohibited. Stripping or otherwise molesting female lobsters to remove the eggs shall be prohibited. “Berried” female lobsters taken in traps or with other gear must be immediately returned to the water alive and unharmed.

Table 1.4.1. GMFMC/SAFMC FMP Amendments affecting spiny lobster.

Description of Action	FMP/Amendment	Effective Date
Updated the FMP rules to be more compatible with that of Florida (State). The management measures: limited attractants to 100 per vessel, required live wells, required a commercial vessel permit, provided for a recreational permit, limited recreational fishermen to possession of 6 lobsters, modified the special 2-day recreational season before the commercial season, modified the duration of the closed commercial season (April 1 – August 5 with a preseason soak period beginning August 1), provided a 10-day trap retrieval period, prohibited possession of egg-bearing spiny lobster, specified the minimum size limit for tails [The harvesting of *Panulirus argus* spiny lobsters with a carapace length 3" or less; or if the carapace and tail are separated, with a tail length of less than 5.5" shall be prohibited.], provided for a tail separation permit, and prohibited possession of egg-bearing slipper lobster.	Amendment 1 (1987)	July 15, 1987 (52 FR 22659) with certain rules deferred and implemented on May 16, 1988 (53 FR 17 196) and on July 30, 1990 (55 FR 26448).
Modified the problems/issues and objectives of the fishery management plan; modified the statement of optimum yield [OY is specified to be all spiny lobster more than 3" carapace length or not less than 5.5" tail length that can be legally harvested by commercial and recreational fishermen given existing technology and prevailing economic conditions. OY is estimated at 9.5 million pounds.]; established a protocol and procedure for an enhanced cooperative state/council management system for instituting future compatible State and federal rules without amending the FMP; and added to the vessel safety and habitat sections of the FMP.	Amendment 2 (1989)	October 27, 1989 (54 FR 48059)

Table 1.4.1. GMFMC/SAFMC FMP Amendments affecting spiny lobster. (continued)

Description of Action	FMP/Amendment	Effective Date
Contained provisions for adding a scientifically measurable definition of overfishing [overfishing exists when the eggs per recruit ratio of the exploited population to the unexploited population is reduced below 5% and recruitment of small lobsters into the fishery has declined for 3 consecutive fishing years. Overfishing will be avoided when the eggs per recruit ratio of exploited to unexploited populations is maintained above 5%.], an action plan to prevent overfishing, should it occur, as required by the Magnuson Act National Standards (50 CFR Part 602), and the requirement for collection of fees for the administrative cost of issuing permits.	Amendment 3 (1990)	March 25, 199 1 (5 6 FR 12357)
Included extension of the Florida spiny lobster trap certificate system for reducing the number of traps in the commercial fishery to the EEZ off Florida, revision of the FMP commercial permitting requirements; limitation of the number of live undersize lobster used as attractants for baiting traps; specification of gear allowed for commercial fishing in the EEZ off Florida, specification of the possession limit of spiny lobsters by persons diving at night; requirement of lobsters harvested by divers be measured without removing from the water; and specification of uniform trap and buoy numbers for the EEZ off Florida.	Regulatory Amendment 1 (1992)	
Included a change in the days for the special recreational season in the EEZ off Florida; a prohibition on night-time harvest off Monroe County, Florida, during that season; specification of allowable gear during that season; and different bag limits during that season off the Florida Keys and the EEZ off other areas of Florida.	Regulatory Amendment 2 (1993)	

Table 1.4.1. GMFMC/SAFMC FMP Amendments affecting spiny lobster. (continued)

Description of Action	FMP/Amendment	Effective Date
Allowed the harvest of two lobsters per person per day for all fishermen all year long but only north of the Florida/Georgia border. This measure was added to the framework procedure so that future potential changes to the limit do not require a plan amendment. [Developed by the SAFMC]	Amendment 4 (1994)	September 15, 1995 (60 FR 41 828)
Identified Essential Fish Habitat (EFH) and EFH-Habitat Areas of Particular Concern for spiny lobster. Areas which meet the criteria for EFH-HAPCs for spiny lobster include Florida Bay, Biscayne Bay, Card Sound, and coral/hard bottom habitat from Jupiter Inlet, Florida through the Dry Tortugas, Florida. [Developed by the SAFMC]	Amendment 5 (1998)	July 14, 2000
Amended the FMP as required to make definitions of MSY, OY, overfishing and overfished consistent with National Standard Guidelines; identified and defined fishing communities and addressed bycatch management measures. MSY for species in the spiny lobster management unit is unknown. The Council reviewed alternatives and concluded the best available data supports using 20% Static SPR as a proxy for MSY. OY for the spiny lobster fishery is the amount of harvest that can be taken by U.S. fishermen while maintaining the SPR at or above 30% Static SPR. Overfishing for species in the Spiny Lobster FMP can only be defined in terms of the fishing mortality component given the data-poor status of these species. Based on the written guidance from NMFS, the Council is setting the overfishing level as a fishing mortality rate (F) in excess of the fishing mortality rate at 20% Static SPR (F20% Static SPR). [Developed by the SAFMC]	Amendment 6 (1998)	December 2, 1999

Table 1.4.1. GMFMC/SAFMC FMP Amendments affecting spiny lobster. (continued)

Description of Action	FMP/Amendment	Effective Date
Identified EFH, described the distribution and relative abundance of juvenile and adult spiny lobster for offshore, near-shore, and estuarine habitats of the Gulf. [Developed by the GMFMC]	Generic Amendment (1998) (no Spiny Lobster amendment number)	Partially approved February 8, 1999 64 FR 13363
The amendment had proposed revision to maximum sustainable yield (MSY), optimum yield (OY), maximum fishing mortality threshold (MFMT), and maximum stock size threshold (MSST) for spiny lobster. MSY, OY, and MSST were disapproved because they were based on transitional spawning stock biomass per recruit (SSBRs). The amendment updated the description of the spiny lobster fisheries and provided fishing community assessment information for Monroe County, Florida. [Developed by the GMFMC]	Generic SFA Amendment (1999) (no Spiny Lobster amendment number)	Partially approved December 2, 1999 64 FR 59126
Created two no-use marine reserves. Tortugas South (60 square nautical miles) was cited in the GMFMC EEZ to encompass a spawning aggregation site for mutton snapper. Tortugas North (120 square nautical miles) included part of the fishery jurisdiction of the FKNMS, Dry Tortugas National Monument, GMFMC, and the state of Florida, and was cooperatively implemented by these agencies. [Developed by the GMFMC]	Generic Tortugas Marine Amendment/ Spiny Lobster Amendment 7	August 19,2002 67 FR 47467
Specified that the holder of a valid crawfish license or trap number, lobster trap certificate and state saltwater products license issued by the Florida FWC may harvest and possess, while in the EEZ off Florida, undersized lobster not exceeding 50 per boat and 1 per trap aboard each boat, if used exclusively for luring, decoying or otherwise attracting non-captive lobster into traps.	Regulatory Amendment 3 (2002)	

Table 1.4.1. GMFMC/SAFMC FMP Amendments affecting spiny lobster. (continued)

Description of Action	FMP/Amendment	Effective Date
Set minimum size limit for importation of spiny lobster; and disallowed importation of spiny lobster tail meat which is not in whole tail form with the exoskeleton attached and the importation of spiny lobster with eggs attached or importation of spiny lobster where the eggs, swimmerets, or pleopods have been removed or stripped.	Amendment 8 (2008)	February 11, 2009 (74 FR 1148)
CEBA-1 provides a presentation of spatial information for EFH and EFH-Habitat Areas of Particular Concern designations for species in the Spiny Lobster FMP.	Amendment 9 (2009)	

2.0 MANAGEMENT ALTERNATIVES

2.1 Action 1: Other species in the Spiny Lobster FMP

*Note: More than one alternative may be chosen as a preferred.

Alternative 1: No Action – Retain the following species: smoothtail spiny lobster**,** *Panulirus laevicauda,* spotted spiny lobster, *Panulirus guttatus,* Spanish slipper lobster, *Scyllarides aequinoctialis,* in the Fishery Management Plan for data collection purposes only, but do not add them to the Fishery Management Unit.

Alternative 2: Set annual catch limits and accountability measures using historical landings for Spanish slipper lobster *Scyllarides aequinoctialis,* after adding them to the Fishery Management Unit and for ridged slipper lobster, *Scyllarides nodifer,* currently in the Fishery Management Unit.

South Atlantic Preferred Alternative 3: List species as ecosystem component species:

Gulf Preferred Option a: smoothtail spiny lobster**,** *Panulirus laevicauda*
Gulf Preferred Option b: spotted spiny lobster, *Panulirus guttatus*
Option c: Spanish slipper lobster, *Scyllarides aequinoctialis*
Option d: ridged slipper lobster, *Scyllarides nodifer*

Alternative 4: Remove species from the Joint Spiny Lobster FMP:

Option a: smoothtail spiny lobster**,** *Panulirus laevicauda*
Option b: spotted spiny lobster, *Panulirus guttatus*
Gulf Preferred Option c: Spanish slipper lobster, *Scyllarides aequinoctialis*
Gulf Preferred Option d: ridged slipper lobster, *Scyllarides nodifer*

Comparison of Alternatives: Landings and regulations are established for two species of lobster within the fishery management unit, the Caribbean spiny lobster and the ridged slipper lobster (GMFMC and SAFMC 1982). Landings of lobster species by the recreational sector are not documented by the Marine Recreational Fisheries Statistics Survey (MRFSS); only finfish data are collected. Florida FWC documents recreational catch of Caribbean spiny lobster landings through a survey. Florida FWC also documents commercial landings of Caribbean spiny lobster and slipper lobster species by family, meaning they could be either Spanish or ridged slipper lobster.

No landings or bycatch information have been documented for smoothtail or spotted spiny lobster species. Because these species are found mostly inshore and are relatively small, neither commercial nor recreational fishers in the Florida Keys generally target these species in U.S. federal waters (W. Kelly, Florida Keys Commercial Fishermen's Association, personal communications). Outside of Brazil, the smoothtail spiny lobster is considered to be of minor importance (FAO 2007). In the commercial Caribbean spiny lobster fishery, spotted spiny lobsters are only captured in traps set directly on the reef (Sharp et al. 1997). Spotted spiny lobster rarely occupy the same dens as Caribbean spiny lobster (Sharp et al. 1997), so they are unlikely to be taken incidentally by divers.

Even though slipper lobster are not identified to species level when documented, the slipper lobster catch is believed to be primarily composed of ridged slipper lobster, because it is the only species commonly occurring in the Florida Keys that attains a size sufficient to be exploited for the industry (Sharp et al. 2007). Table 2.1.1 shows a decrease in landings, number of vessels, and trips over the past 20+ years (see Table 4.1.2.2). However, CPUEs (pounds per trip) may have actually increased. The change in landings seems to be the result of a change in effort. Major declines in effort occurred 98/99 to 99/00 and 03/04 to 04/05.

Table 2.1.1. Commercial effort, landings, and value of slipper lobsters in the Gulf and South Atlantic.

Fishing year	Trips	Pounds (x 1,000)	Pounds per trip (CPUE)	2008$ (x1000)
97/98	335	30.9	92	131.1
98/99	225	13.1	58	56.9
99/00	146	7.2	49	33.5
00/01	145	8.8	60	49.2
01/02	179	8.6	48	51.1
02/03	130	10.0	77	58.2
03/04	132	17.0	129	98.8
04/05	72	5.0	69	23.5
05/06	63	4.3	68	22.1
06/07	56	6.1	108	30.9
07/08	23	6.4	280	36.9
08/09	22	1.9	86	7.7

Source: SEFSC, FTT (19Mar10) data

Sharp et al. (2007) suggested decreased landings of slipper lobsters are related to decreased number of trips targeting shrimp, because much of the slipper lobster landings are incidental catch in shrimp trawls. Number of trips landing shrimp declined dramatically in 1999 and again in 2003; Gulf shrimp effort is down 77% for 2009 from the base years of 2001-2003 (Nance, unpub.). Effort (trips) of slipper lobster for 2009 is down 85% from the base-years average. Over the most recent three years (2006-2009), average slipper lobster effort is down 77%. So, decreases in effort for slipper lobster could be the result of decreased shrimp effort. We have also seen decreased effort in other fisheries due to economic issues (increased fuel prices, etc.). The possibility still exists that effort has decreased because of decreases in the resource, but the stable-to-increasing CPUEs indicate otherwise.

In contrast to the total average commercial Caribbean spiny lobsters landings, slipper lobster landings are low and constitute less than 1% of the total average landings in both federal and state waters of the South Atlantic and Gulf of Mexico (Table 2.1.2).

Table 2.1.2. Average commercial landings, number of trips, and value of slipper lobsters (Slipper) versus Caribbean spiny lobster (Spiny) from 1999 through 2008 for Gulf federal waters, South Atlantic federal waters, and state of Florida landings combined for both coasts. Average pounds landed are live whole animal weight.

Average	Gulf federal		Atlantic federal		Florida state waters	
	Slipper	Spiny	Slipper	Spiny	Slipper	Spiny
Pounds	6,527	164,912	996	998,218	1,594	3,419,293
# Trips	69	413	26	2,976	21	17,805
$ Value	$26,580	$828,149	$4,080	$4,878,155	$6,074	$17,655,979

Source: Florida FWC, Marine Fisheries Information System 2009, Note: These data are based on the trip ticket program. Only one space is available for waters fished. Fishers could fish in both state and federal waters within one day, based on the season and other fishing behaviors. This table should be viewed with some caution, because additional unaccounted variability could exist due to the way the data is recorded and analyzed.

In addition, to commercial landings data from the states on the ridged and Spanish slipper lobsters, bycatch information is also available from observer coverage of the U.S. Gulf of Mexico and Southeastern Atlantic shrimp fishery (Scott-Denton 2004). During these studies, observers did not always specify whether the species was a ridged or Spanish slipper lobster, instead often the family was recorded. An additional species from this family was recorded as bycatch, the Chace slipper lobster, *Scyllarus chacei*. This species is not currently within the Spiny Lobster FMP and bycatch of this species was the lowest of all three species characterized to the species level.

Bycatch of all the slipper lobster species was low for both the Gulf of Mexico and South Atlantic waters (Table 2.1.3). A majority of the observer data from the family Scyllaridae was documented off the west coast of Florida and some off the Louisiana/Texas coast (Figure 2.1.1). Ridged slipper lobster was documented more often than Spanish slipper lobster in the Gulf of Mexico, similar to Alabama and Florida documented landings. Low bycatch of the family Scyllaridae was also documented off the east coast of Florida (Figure 2.1.3). The South Atlantic had no historical bycatch documented for slipper or Caribbean spiny lobsters (1992-1995). Observers documented low numbers of species in the family Scyllaridae from current landings (2001-2007), with no Caribbean spiny lobster documented as bycatch from South Atlantic waters (Table 2.1.3).

Table 2.1.3. Current and historical bycatch of lobster species documented by observer coverage of the U.S. Gulf of Mexico and Southeastern Atlantic Shrimp Fishery.
Source: E. Scott-Denton, NMFS Galveston Laboratory.

Lobster species	**Gulf (current) (2001-2002)**	**Atlantic (current) (2001-2007)**	**Gulf (historical) (1992-1996)**	**Atlantic (historical) (1992-1995)**
Caribbean spiny lobster (*Panulirus argus)*	19	0	6	0
ridged slipper Lobster (*Scyllarides nodifer*)	101	1	103	0
Spanish slipper lobster (*Scyllarides aequinoctialis*)	16	1	41	0
Family Scyllaridae (slipper lobsters: ridged, Spanish or Chace)	68	45	0	0
Characterized Tows (Sum)	839	649	1,438	301

Recreational landings for slipper lobsters are not recorded by Florida FWC, only Caribbean spiny lobster landings. However, due to the intense recreational fishery for Caribbean spiny lobster, some fishers may harvest slipper lobster species if observed (Sharp et al. 2007). Inspection of intensive creel surveys, which were conducted for Caribbean spiny lobster during the peak season, indicated slipper lobsters are not targeted by recreational fishers in the state of Florida, and because of their cryptic nature it is unlikely a substantial recreational fishery would develop (Sharp et al. 2007). Also, due to the lack of data on slipper lobster species life history, growth rates, and reproductive biology, conducting an effective stock assessment would be difficult (Sharp et al. 2007).

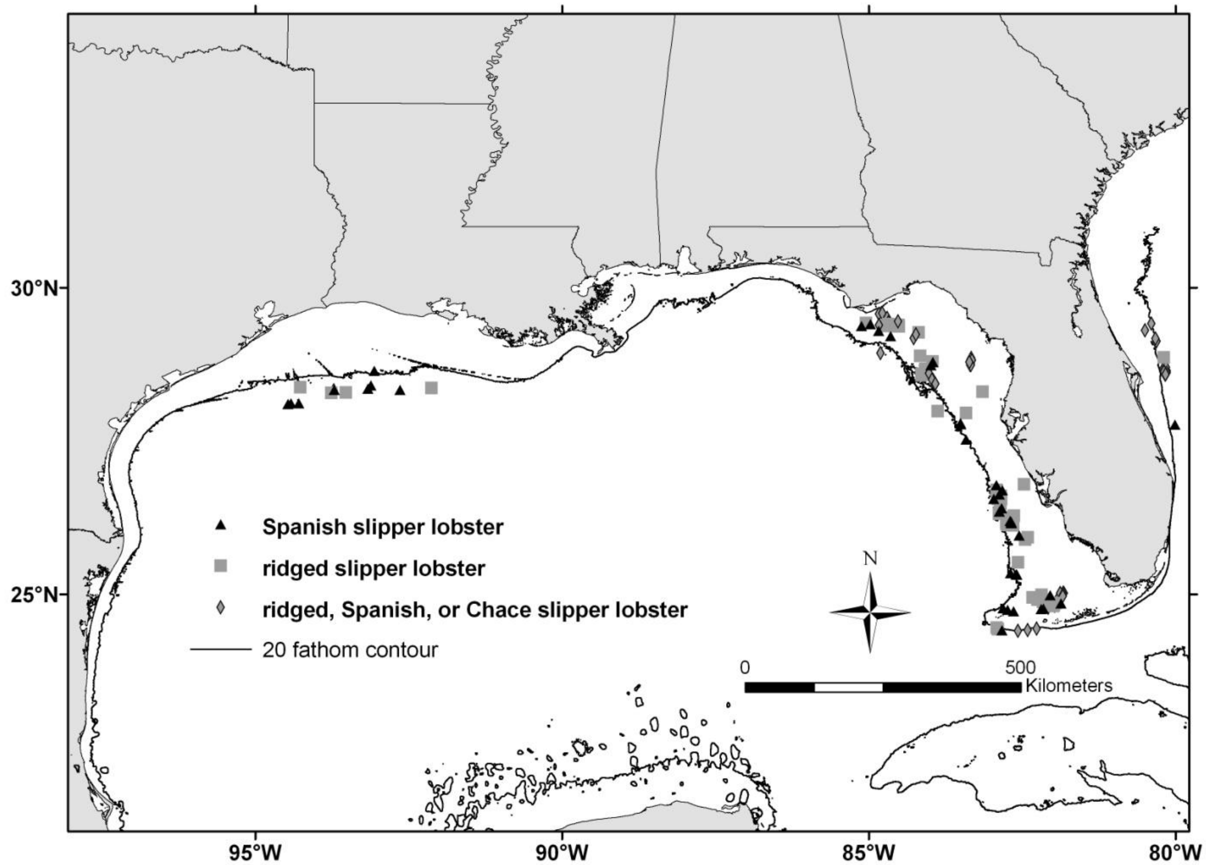

Figure 2.1.1. Location of bycatch documented from the observer shrimp trawl coverage of the U.S. Gulf of Mexico and Southeastern Atlantic coast.
Source: E. Scott-Denton, NMFS Galveston Laboratory, personal communication.

Alternative 1 would retain all species in the Spiny Lobster FMP for data collection purposes only, without adding them to the Fishery Management Unit. After 28 years, the Councils have not seen the need to add these stocks to the FMU. However, the Magnuson-Stevens Act requires ACLs for all species in the FMP except ecosystem component species, so this alternative would not comply with legal requirements.

Alternative 2 would set ACLs and AMs using historical commercial landings for Spanish slipper lobster after adding them to the Fishery Management Unit, and for ridged slipper lobster, currently in the Fishery Management Unit. The ACLs and AMs would need to be set for both species combined because commercial landings are recorded by family, meaning catch could be composed of Spanish slipper lobster, ridged slipper lobster or both. Positive biological benefits may be expected from setting ACLs and AMs; however, landings of these two species combined are low so the effect may be small. Due to a lack of monitoring and data collection sources for these two species, ACLs may be very difficult to track and accountability measures may need to be less restrictive to account for limited landings information and potential large fluctuations. The status of this stock is completely unknown, and further life history information is needed before an effective assessment can be undertaken, especially regarding recruitment dynamics, growth rates, behavior, and reproductive biology.

Alternative 3 would place any of the species in the Fishery Management Unit and list them as ecosystem component species (**Options a-d**). The option to use ecosystem component status is intended to encourage the incorporation of ecosystem considerations into fishery management plans (see Figure 2.1.3 as a guide). Species can be defined as ecosystem component species for reasons such as for ecosystem considerations related to specification of optimum yield for the associated fishery, as considerations in the development of conservation and management measures for the associated fishery, or to address other ecosystem issues.

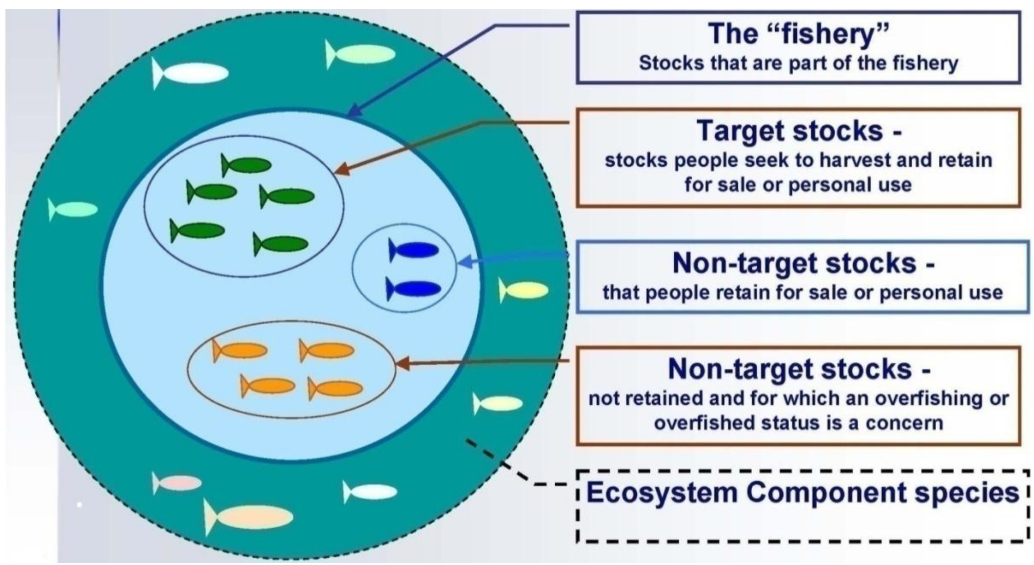

Figure 2.1.3. A conceptual model of stocks in the fishery and ecosystem component stocks. Source: National Standard 1 guidelines.

Gulf and South Atlantic Preferred Alternative 3, Options a and **b,** would place smoothtail and spotted spiny lobsters in the fishery management unit and list them as ecosystem component species. The smoothtail and spotted spiny lobsters meet all of the ecosystem component criteria, because they are non-targeted, not subject to overfishing or overfished, nor likely to become subject to overfishing or overfished (Table 2.1.4). The National Standard 1 final guidelines add new language in § 600.310(d)(5)(i)(D)—''not generally retained for sale or personal use''—in lieu of ''*de minimis* levels of catch'' and clarify that occasional retention of a species would not, in itself, preclude consideration of a species in the ecosystem component classification.

Table 2.1.4. Ecosystem component criteria for stocks in the Gulf of Mexico and South Atlantic. Average landings were calculated by combining Gulf and South Atlantic commercial landings.

Source: Florida FWC, Marine Fisheries Information System 2009. Note: An "X" indicates the National Standard 1 criteria apply to that species.

		National Standard 1 Guidelines Criteria			
Species	**Average Landings (pounds) 1999-2008**	**Non-target**	**Not overfished or overfishing?**	**Not likely to become overfished or overfishing**	**Not generally retained for sale or personal use**
smoothtail spiny lobster	0	X	Unknown	Unknown	X
spotted spiny lobster	0	X	Unknown	Unknown	X
Spanish slipper lobster	11,120	X	Unknown	Unknown	
ridged slipper lobster		X	Unknown	Unknown	

Commercial landings of the Spanish and ridged slipper lobsters (**South Atlantic Preferred Options c and d**) are low and average 11,120 lbs whole animal weight during 1999-2008. However, Spanish and ridged slipper lobster are generally retained for sale or personal; therefore, these species may not meet all the National Standard 1 guidelines for ecosystem component species. Florida FWC estimated that in the last nine years, 23% of the landings of slipper lobsters have been due to divers. If the Florida FWC trap limitation program proceeds and the commercial dive fishery increases, more of these species might be landed. However, little data exists to suggest commercial divers are targeting them, but instead are landing them coincidently with Caribbean spiny lobsters. Further Florida FWC intensive creel surveys, which were conducted for Caribbean spiny lobster during the peak season, showed no indication that slipper lobsters are targeted by recreational fishers in the state of Florida, and due to their cryptic nature are unlikely to support a substantial recreational fishery (Sharp et al. 2007). Placing these species in the ecosystem component classification, would allow them to remain in the fishery management plan for data collection, but not require setting ACLs.

Alternative 4 would remove a species from the Spiny Lobster FMP. Smoothtail and spotted spiny lobsters (**Option a** and **b**) have no landings information available, and if they do not need to be in the Spiny Lobster FMP for data collection or other management purposes, then it may be appropriate for these species to be removed. If any of the species are removed from the Spiny Lobster FMP without another agency taking over management, the potential for negative impacts to the physical and biological environments may occur, if fishing effort for these species increased. However, management by another agency would be just as difficult.

Of the two species of slipper lobster (**Gulf Preferred Option c** and **d**), the ridged slipper lobster currently has some federal regulations. The regulations specified for ridged slipper lobster discuss conservation and management [50 CFR 640.1 (b)], define slipper lobster by genus species (*S. nodifers*) [640.2], prohibit harvest of a berried (egg-bearing) lobsters [640.21 9(a)], and prohibit the use of poisons and explosives to take slipper lobster in the EEZ [(640.22 9a)(3)]. If these species were removed from the fishery management plan, the federal regulations for ridged slipper lobster would no longer apply. However, the state of Florida could manage the fishery in the EEZ off state waters, and Florida state regulations are more conservative than federal regulations in that they prohibit the harvest of egg-bearing females for all species of slipper lobster.

As stated above, commercial landings of slipper lobster are low and have been decreasing over the years. Most data indicate these species are only incidentally caught, primarily by the shrimp fishery, and effort and landings have decreased concurrent with decreased effort in the shrimp fishery. No recreational landings data are available, but creel surveys of spiny lobster recreational fishers indicated slipper lobsters are not targeted by these fishers. Further, because of their cryptic nature, behavior, and size, they are unlikely to support a substantial recreational fishery.

2.2 Action 2: Modify the Current Definitions of Maximum Sustainable Yield, Optimum Yield, Overfishing Threshold, and Overfished Threshold for Caribbean Spiny Lobster

2.2.1 Maximum Sustainable Yield (MSY)

Alternative 1: No Action- Use the current definitions of MSY as a proxy. The Gulf of Mexico definition**:** MSY is defined as a harvest strategy that results in at least a 20% transitional ~~SPR~~ SSBR? (spawning stock biomass per recruit) [Not approved by NOAA Fisheries Service letter received 1999]. The South Atlantic definition: MSY is defined as a harvest strategy that results in at least a 20% static SPR (spawning potential ratio).

Alternative 2: Modify the Gulf of Mexico definition to mirror the South Atlantic definition of MSY proxy, defined as 20% static SPR.

Alternative 3: MSY equals the yield produced by fishing mortality at maximum sustainable yield (F_{MSY}) or proxy for F_{MSY}. MSY will be defined by the most recent SEDAR and joint Scientific and Statistical Committee process.

Note: The SEDAR Review Panel believes that the model used is incorrect for this stock and retrospective adjustments do not represent reality. They are providing management reference values but with caveats about the nature of this stock (all recruitment from outside of stock makes biomass irreleveant, and the virus has changed natural mortality, M, in recent years). They have recommended that the management reference points not be used for management and that a benchmark assessment be done soon with a new, more appropriate model.

The MSY value provided in the assessment equals the yield at $F_{20\%SPR}$ or 6.4 million pounds.

The SSC Subcommittee reviewed the SEDAR 8 Update and suggested using values based on the assumed maturity schedule. The new MSY based on the yield at $F_{20\%SPR}$ would be 7.95 million pounds. However, the SSC Subcommittee rejected the assessment update and they have no confidence in the reference points.

2.2.2 Optimum Yield (OY)

The IPT recommends that OY be folded into the ACL action based on NOAA GC and NMFS RA guidance provided at the September 2010 South Atlantic Council meeting; a similar approach is being taken in the South Atlantic Council's Comprehensive ACL Amendment. This would move the OY alternatives shown below to Appendix A, Alternatives Considered but Eliminated from Detailed Consideration.

~~**Alternative 1:** No Action- Use the current definitions of OY. The Gulf of Mexico definition**:** OY is defined as a harvest strategy that results in at least achieving a 30% transitional SPR (SSBR). The South Atlantic definition: OY is the amount of harvest that can be taken by U.S. fishermen while maintaining the SPR at or above 30% static SPR.~~

~~**Alternative 2:** Modify the Gulf of Mexico definition to mirror the South Atlantic definition of OY: the amount of harvest that can be taken by U.S. fishermen while maintaining the SPR at or above 30% static SPR.~~

~~**Alternative 3:** OY equals the yield produced by F_{OY}. If a stock is overfished, F_{OY} equals the fishing mortality rate specified by the rebuilding plan designed to rebuild the stock to SSB_{MSY} within the approved schedule. After the stock is rebuilt, F_{OY} equals the yield produced by a fraction of F_{MSY} (e.g., 65%, 75% or 85% of F_{MSY}; Joint Councils to specify).~~

2.2.3 Overfishing Threshold

Alternative 1: No Action - Use the current definitions of overfishing threshold. The Gulf of Mexico definition: overfishing exists when the fishing morality rate (F) results in the transitional SPR being reduced below 20%. The South Atlantic definition: overfishing level as a fishing mortality rate (F) in excess of the fishing mortality rate at 20% static SPR (F20% static SPR).

Alternative 2: Modify the Gulf of Mexico definition to mirror the South Atlantic definition of overfishing threshold: (from transitional to static SPR).

Alternative 3: Specify the Maximum Fishing Mortality Threshold (MFMT) as F_{MSY} or F_{MSY} proxy. The most recent SEDAR and joint Scientific and Statistical Committees will define F_{MSY} or F_{MSY} proxy. This should equal the Overfishing Limit (OFL) provided by the Scientific and Statistical Committees. The Councils will compare the most recent value for the current fishing mortality rate (F) from the SEDAR/SSC process to the level of fishing mortality that would result in overfishing (~~maximum fishing mortality threshold or~~ MFMT) and if the current F is greater than the MFMT, overfishing is occurring. Comparing these two numbers:

- $F_{CURRENT}$/MFMT = X.XXX

*This comparison is referred to as the **overfishing ratio**. If the ratio is greater than 1, then overfishing is occurring.

Note: The SEDAR Review Panel believes that the model used is incorrect for this stock and retrospective adjustments do not represent reality. They are providing management reference values but with caveats about the nature of this stock (all recruitment from outside of stock makes biomass irreleveant, and the virus has changed natural mortality, M, in recent years). They have recommended that the management reference points not be used for management and that a benchmark assessment be done soon with a new, more appropriate model.

The current estimate of MFMT from SEDAR is F_{MSY}=F_{MSY} proxy = $F_{20\%SPR}$ = 0.39 per year. The SSC Subcommittee reviewed the SEDAR 8 Update and suggested using values based on the assumed maturity schedule. The new MFMT based on $F_{20\%SPR}$ would be 0.45. However, the SSC Subcommittee rejected the assessment update and they have no confidence in the reference points.

Since this is a proxy value, the Councils will need to specify the F_{MSY} proxy value they feel is appropriate. The Councils are not bound by SEDAR (or the SSC) for proxy values and should choose the value that they feel best incorporates the existing level of uncertainty.

2.2.4 Overfished Threshold

Alternative 1: No Action - Use the current definition of overfished threshold. The Gulf of Mexico is the only Council with a current definition: the proxy for Minimum Stock Size Threshold (MSST) is a level of 15% transitional SPR (SSBR). The South Atlantic Council decided to use the framework procedure to add a biomass based component to the overfished definition, due to no biomass levels and/or proxies being available.

Alternative 2: Specify the MSST as 7.56 million pounds or 1.150×10^{12} eggs. The MSST is defined by the most recent SEDAR and joint Scientific and Statistical Committees process. The Councils will compare the current spawning stock biomass (SSB) from the SEDAR and Scientific and Statistical Committees process to the level of spawning stock biomass that could be rebuilt to the level to produce the MSY in 10 years. Comparing these two numbers:

- $SSB_{CURRENT}/MSST$ = Y.YYY

This comparison is referred to as the **overfished ratio**. If the ratio is less than 1, then the stock is overfished.

Note: The SEDAR Review Panel believes that the model used is incorrect for this stock and retrospective adjustments do not represent reality. They are providing management reference values but with caveats about the nature of this stock (all recruitment from outside of stock makes biomass irreleveant, and the virus has changed natural mortality, M, in recent years). They have recommended that the management reference points not be used for management and that a benchmark assessment be done soon with a new, more appropriate model.

The current estimate of MSST from SEDAR, using $MSST=B_{MSY}*(1-M)$, = 7.56 million pounds. B_{MSY} = biomass at $F_{20\%SPR}$ = 11.46 million pounds and Bcurent = X.XX million pounds.

The SSC Subcommittee reviewed the SEDAR 8 Update and suggested using values based on the assumed maturity schedule. The new MSST based on the formula would be 1.150×10^{12} eggs. However, the SSC Subcommittee rejected the assessment update and they have no confidence in the reference points.

Comparison of Alternatives: This action explores various alternatives for establishing biological reference points: MSY, OY, overfishing threshold, and overfished threshold. Currently the Gulf of Mexico and the South Atlantic Councils have different definitions for these biological reference points and the South Atlantic Council does not currently have an overfished threshold definition (GMFMC 1999; SAFMC 1998; SEDAR 8 2005).

Transitional SPR versus static SPR is used for the definitions of MSY, OY, overfishing, and overfished threshold by the Gulf Council. As the name suggests SPR ratio expresses spawning per recruit as a ratio in a fished condition, relative to the maximum theoretical amount of spawning per recruit that occurs when there is no fishing (Slipke and Maceina 2000; MRAG Americas 2001). Due to increased fishing effort reducing the potential reproductive output, the denominator in the spawning potential ratio is always greater than or equal to the numerator, so the resulting values will range between 0 and 1 (MRAG Americas 2001).

Generally, static SPR is more frequently used than transitional SPR. Static SPR requires minimal data inputs, whereas transitional SPR requires data from a full age-based stock assessment (Parkes 2001). Static SPR is calculated on a per-recruit basis assuming equilibrium conditions of recruitment and mortality throughout their life span. Transitional SPR is computed on a yearly basis and uses actual annual variation in population structure and mortality rates; therefore it is considered a dynamic measure (MRAG Americas 2001; Slipke and Maceina 2001). The SEDAR 8 (2005) benchmark assessment terms of reference suggest that static SPR was used is the assessment based on the South Atlantic Fishery Management Council's Spiny Lobster Amendment 6 (SAFMC 1998).

Alternative 1 under each action would use the current definitions of MSY, OY, overfishing threshold, and overfished threshold, separately for each Council. Due to the spiny lobster fishery being a jointly managed species with a new update assessment taking place in 2010, it might be the best time for the Councils to adopt the same biological reference points in this full amendment.

Alternative 2 under **Actions 2.3.1, 2.3.2, and 2.3.3** would modify the two definitions of maximum sustainable yield, optimum yield, and overfishing threshold to mirror the South Atlantic Council's definitions which use static SPR instead of transitional SPR. Justification for using static SPR is based on projected yield streams at equilibrium, versus the current dynamic measure (transitional SPR), which may change in future years from the current estimate. This could make the projections less reliable than using equilibrium recruitment and morality conditions (static SPR). Since stock assessments are not usually completed on an annual basis, static SPR may be a better index to use for yield projections. Further, static SPR does not require constant recruitment, because it is expressed on a "per recruit" basis and is useful as a measure of overfishing (MRAG Americas 2001). Transitional SPR is often used to monitor overfished populations recovery; however, annual variation in recruitment (i.e., number of animals entering the population each year) could confound the results.

Alternative 3 under each action will modify all biological determination criteria from the current definitions to the most recent SEDAR and joint Scientific and Statistical Committee's process. This alternative would provide the best available science in the update assessment and modify the separate Council definitions into one biological reference point for MSY, OY, overfishing and overfished threshold.

2.3 Action 3: Establish Sector Allocations for Caribbean Spiny Lobster in State and Federal Waters from North Carolina through Texas

Alternative 1: No action – Do not establish sector allocations.

Alternative 2: Allocate the spiny lobster ACL by the following sector allocations: 80% commercial and 20% recreational.

Alternative 3: Allocate the spiny lobster ACL by the following sector allocations: 74% commercial and 26% recreational.

Alternative 4: Allocate the spiny lobster ACL by the following sector allocations: 78% commercial and 22% recreational.

Comparison of Alternatives:

Alternative 1 would prevent establishment of sector ACLs and make it more difficult to track total landings to ensure the ACL is not exceeded. In the South Atlantic Council's area, north of Florida, all fishermen are limited to two Caribbean spiny lobsters per person per day year round which effectively allocates 100% to the recreational sector in this area.

Alternative 2 is based on the "better year" which was the 1998/99 fishing season when the trap fishery had the highest proportion of total landings. This alternative was supported by 10 of the 14 members of the Advisory Board present at the May 23-24, 2006. The Councils are lumping the commercial sector into one allocation equal to 80%; the recreational allocation would equal 20%. **Alternative 3** is based on using 1993-94 landings for allocations and was supported by 3 of the 14 members of the Advisory Board. The Councils are lumping to commercial sector into one allocation equal to 74%; the recreational allocation would equal 26%. **Alternative 4** is the average of **Alternatives 2** and old Alterantive 3 (see Appendix A) and was supported by 11 of the 14 members of the Advisory Board present. This is the consensus recommendation of the Advisory Board for spiny lobster allocations. The Councils are lumping the commercial sector into one allocation equal to 78%; the recreational allocation would equal 22%. By way of comparing to recent landings, the recreational sector harvested 24% in 2008/2009. **Alternative 2** would represent a reduction of 4% to the recreational sector, **Alternative 3** would represent an increase of 2%, and **Alternative 4** would represent a decrease of 2%. Using the same base year, the commercial sector would see an increase of 4% under **Alternative 2**, a decrease of 2% under **Alternative 3**, and an increase of 2% under **Alternative 4**.

2.4 Action 4: Acceptable Biological Catch (ABC) Control Rule, ABC Level(s), Annual Catch Limits, and Annual Catch Targets for Caribbean Spiny Lobster

2.4.1 Acceptable Biological Catch (ABC) Control Rule

Acceptable biological catch is recommended by the Scientific and Statistical Committee (SSC) and specified by the Council. The South Atlantic SSC provided an ABC Control Rule at their April 2010 meeting. The Gulf of Mexico SSC is also developing an ABC Control Rule. These two rules will need to be consolidated and/or modified such that both SSCs agree on one ABC Control Rule for spiny lobster.

Alternative 1: No Action – Do not establish an ABC Control Rule for spiny lobster.

The South Atlantic Council approved a motion to move Alternative 2 to considered but eliminated from detailed analyses. The Gulf Council did not agree because additional options may be available in the future.

Alternative 2: Establish ABC based on:

Option a: the South Atlantic Council's Data-Poor ABC control rule.

Added by the Gulf Council- Option b: the Gulf Council's Data-Poor ABC control rule.

Alternative 3: Establish an ABC Control Rule where ABC equals OFL.

Alternative 4: Establish an ABC Control Rule where ABC equals a percentage of yield at MFMT:

Option a: ABC=yield at 65%MFMT.
Option b: ABC=yield at 75%MFMT.
Option c: ABC=yield at 85%MFMT.

The IPT recommends Alternative 5 be moved to the Appendix A, alternatives considered but eliminated from detailed consideration, because the P* analysis was not conducted.

~~**Alternative 5:** Establish an ABC Control Rule where ABC is a percentage of OFL. The percentage is based upon the level of risk of overfishing (P*):~~

~~**Option a:** ABC=X% of OFL. The X% is based upon P* equals .20.~~
~~**Option b:** ABC=X% of OFL. The X% is based upon P* equals .30.~~
~~**Option c:** ABC=X% of OFL. The X% is based upon P* equals .40.~~
~~**Option d:** ABC=X% of OFL. The X% is based upon P* equals .50.~~

Comparison of Alternatives: No estimate of MSY was provided in the last SEDAR assessment due to the lack of a Caribbean-wide assessment. The Assessment Update provided guidance that MSY equals the yield at F20%SPR which is estimated at 6.4 million lbs. The SSC Subcommittee reviewed the SEDAR 8 Update and suggested using values based on the assumed maturity schedule. The new MSY based on the yield at $F_{20\%SPR}$ would be 7.95 million pounds. However, the SSC Subcommittee rejected the assessment update and they have no confidence in the reference points. The SAFMC SSC may decide to develop ABC recommendations based on landings data.

Table 2.4.1. Spiny lobster landings.

Fishing Season	Com. Total	Rec. Total	Com. & Rec. Total
1991/92	6,836,015	1,815,791	8,651,806
1992/93	5,368,188	1,352,443	6,720,631
1993/94	5,309,790	1,883,114	7,192,904
1994/95	7,181,641	1,905,995	9,087,636
1995/96	7,017,134	1,930,718	8,947,852
1996/97	7,744,104	1,922,596	9,666,700
1997/98	7,640,177	2,304,186	9,944,363
1998/99	5,447,533	1,302,677	6,750,210
1999/00	7,669,207	2,461,981	10,131,188
2000/01	5,568,707	1,949,033	7,517,740
2001/02	3,079,263	1,251,081	4,330,343
2002/03	4,577,392	1,455,298	6,032,690
2003/04	4,161,589	1,411,509	5,573,097
2004/05	5,472,994		
2005/06	2,963,160	1,131,014	4,094,174
2006/07	4,799,493	1,304,511	6,104,004
2007/08	3,778,037	1,215,069	4,993,105
2008/09	3,269,397	1,263,509	4,532,906
2009/10	4,343,305	1,126,714	5,470,019

Source: Landings from Florida Fish & Wildlife Commission; current as of 6/24/10. The recreational numbers from 2000 onward reflect the retrospective analysis done to include additional recreational permit holders that were not incorporated into the original landings models. Total landings for the 2004/05 season are not shown because the recreational surveys were not conducted that season due to storms; previous estimates only included the 2-day season landings and substantially underestimated total recreational landings for that season.

2.4.2 Set Annual Catch Limits (ACLs) for Caribbean Spiny Lobster

The IPT recommends adding OY to the alternatives as shown below and adding subalternatives under Alternative 2 and 3:

Alternative 1: No Action – Do not set Annual Catch Limits.

Alternative 2: Set an Annual Catch Limit for the entire stock based on the Acceptable Biological Catch:

> **Gulf Preferred Option a:** Annual Catch Limit = OY = Acceptable Biological Catch.
> **Option b:** Annual Catch Limit = x% of Acceptable Biological Catch.
> **New Option b:** Annual Catch Limit = OY = 90% of Acceptable Biological Catch.
> **New Option c:** Annual Catch Limit = OY = 80% of Acceptable Biological Catch.

Alternative 3: Set Annual Catch Limits for each sector based on allocations determined in Action 3:

> **Option a:** Annual Catch Limit = OY = (sector allocation x Acceptable Biological Catch).
> **Option b:** Annual Catch Limit = OY = 80% or 90% x% of (sector allocation x Acceptable Biological Catch).
> **Option c:** Annual Catch Limit = OY = sector allocation x (80% or 90% x% of Acceptable Biological Catch).

Comparison of Alternatives: ACLs are set by managers and should take into account management uncertainty. Management uncertainty occurs because sufficient catch information is lacking, and may include late catch reporting, misreporting, and underreporting of catches. Management uncertainty is affected by the ability to control actual catch in the fishery. For example, a fishery with in-season catch data and in-season closure authority has better management control than a fishery without these features. ACLs, in coordination with accountability measures, must prevent overfishing. Potential ACL values will be determined after the joint Scientific and Statistical Committees (SSCs) have set an ABC.

The Caribbean spiny lobster stock was last assessed in 2005. This assessment determined the stock was not undergoing overfishing based on a static spawning potential ratio of 20% (F20%) as set in Amendment 6. However, because the spawning stock includes the entire Caribbean region, spawning biomass at the maximum sustainable yield (Bmsy) or the minimum stock size threshold (MSST) could not be determined; therefore, the assessment could not determine if the stock is overfished. A stock assessment update is ongoing; preliminary results were determined by the assessment panel in September 2010. The base run of the model determined the stock is not overfished or undergoing overfishing. The SSC Subcommittee reviewed the SEDAR 8 Update and suggested using values based on the assumed maturity schedule. The new values indicated no overfishing ($F_{current}/F_{20\%SPR} = 0.47$) and not overfished ($SSB_{current}/SSB\ F_{20\%SPR} = 1.29$). However, the SSC Subcommittee rejected the assessment update and they have no confidence in the reference points.

The Councils' joint SSCs are responsible for recommending an ABC control rule and ABC for each stock to the Councils. The ABC is the level of a stock's annual catch that accounts for the scientific uncertainty in the estimate of the overfishing level and any other scientific uncertainty; in most cases ABC will be reduced from the overfishing limit to reduce the probability overfishing might occur. For the Caribbean spiny lobster fishery, the joint SSCs will recommend an ABC after reviewing the 2010 stock assessment update.

An ACL for a given stock can be established as either a single ACL for the entire fishery, or separate ACLs for various sectors. One ACL for the entire stock (**Alternative 2**) may be appropriate if sector allocations are not set (Action 4). The ACL cannot exceed the ABC. If a Council recommends an ACL which equals ABC (**Option a**), and the ABC is equal to the overfishing limit, the Council must provide sufficient analysis and justification for the approach or the Secretary of Commerce may presume overfishing will not be prevented. The ACL can also be reduced from the ABC to account for management uncertainty (**Option b**).

Sector ACLs (**Alternative 3**) may be appropriate if allocations are set, or if based on landings data. Florida commercial landings data are available by gear (trap, diving, and bully net) from the 1991/1992 season through the 2007/2008 season. Recreational landings data in Florida are slightly less complete for the same time period. If more than one ACL is set, the sum of the ACLs can equal (**Option a**), but not exceed, the ABC. The ABC could be separated using the sector allocations chosen in Action 4, then each ACL could be reduced for management uncertainty particular to that sector (**Option b**). Alternately, the ABC could be reduced for overall management uncertainty first, then the resulting amount divided into separate sector ACLs (**Option c**).

2.4.3 Set Annual Catch Targets for Caribbean Spiny Lobster

Gulf Preferred Alternative 1: No Action – Do not set Annual Catch Targets.

Alternative 2: Set an Annual Catch Target for the entire stock.
The Gulf Council (10/2010) approved adding the following Sub-alternative "Option a" which would make the previous Sub-alternative "Option b":

> **Gulf Preferred Option a:** Annual Catch Target = Annual Catch Limit ~~Acceptable Biological Catch~~.
> **Option b:** Annual Catch Target = x% of Annual Catch Limit ~~Acceptable Biological Catch~~.

Alternative 3: Set Annual Catch Targets for each sector based on allocations from Action 3.
The Gulf Council (10/2010) approved the following sub-alternatives:

> **Option a:** Annual Catch Target = (sector allocation x Annual Catch Limit ~~Acceptable Biological Catch~~).
> **Option b:** Annual Catch Target = x% of (sector allocation x Annual Catch Limit ~~Acceptable Biological Catch~~).
> **Option c:** Annual Catch Target = sector allocation x (x% of Annual Catch Limit ~~Acceptable Biological Catch~~).

Comparison of Alternatives: The ACT is the amount of annual catch of a stock that is the management target of the fishery, and accounts for further management uncertainty in controlling the actual catch at or below the ACL. An ACT set less than the ACL provides a buffer so the risk of exceeding the ACL is reduced and, therefore, the likelihood of triggering accountability measures is reduced. An ACT lowers the allowed catch below the ACL, but provides stability for fisheries that are apt to fluctuate around a target catch rate. Potential values for ACTs will be determined after the joint SSCs have set an ABC.

Alternative 1 would not set an ACT for Caribbean spiny lobster. The National Standard 1 Guidelines do not require ACTs be established, but provide that ACTs may be used as part of a system of accountability measures. Accountability measures are required regardless of whether ACTs are established. If no ACT is set, the accountability measures would be based on the ACL.

One ACT could be set for the entire Caribbean spiny lobster stock (**Alternative 2**) if a single ACL is set for the stock (Action 4.2 Alternative 2). A single ACT would constrain harvest for all sectors and any accountability measures would be triggered simultaneously. Currently, no quotas constrain harvest of Caribbean spiny lobster. An ACT less than the ACL acts as a quota and creates a buffer which might prevent triggering more severe accountability measures that could disrupt the fishery.

Sector ACTs **(Alternative 3)** could be set if separate sector ACLs are set **(**Action 4.2, Alternative 4**)** or if a single ACL is set for the stock **(**Action 4.2, Alternative 2**)**. In the second case, the accountability measures could be based on the stock ACL allowing one or more of the separate ACTs to be exceeded without severe consequences. This separation might be useful if one group consistently has landings below their allocation and can "absorb" any overage from another group. If separate ACTs are set, the sum of the ACTs can equal the ACL (**Option a**). The ACL could be separated using the sector allocations chosen in Action 4, then each ACT could be reduced for management uncertainty particular to that sector (**Option b**). Alternately, the ACL could be reduced for overall management uncertainty first, then the resulting amount divided into separate sector ACTs (**Option c**).

2.5 Action 5: Accountability Measures (AMs) by Sector

*Note: More than one alternative, option, sub-option, or combinations thereof, may be chosen as preferred.

Alternative 1: No Action – Do not set accountability measures.
IPT recommends adding: Currently there are no management measures in place that could be considered AMs.

Alternative 2: Establish commercial in-season accountability measures**:**

Option a: quota closure.

IPT recommends changing Option a to read: close the commercial fishery when the ACL or ACT is projected to be met.

Option b: implement a commercial trip limit when 75% of the commercial ACL or ACT is projected to be met.

Alternative 3: Establish post-season accountability measures:

Option a: Commercial

Sub-option i: ACL payback in the fishing season following a previous years ACL overage.
Sub-option ii: Adjust the length of the fishing season following an ACL overage.
Sub-option iii: Implement a trip limit.

Option b: Recreational

Sub-option i: ACL payback in the fishing season following an ACL overage. To estimate the overage, compare the recreational ACL with recreational landings over a range of years. For 2011, use only 2011 landings. For 2012, use the average landings of 2011 and 2012. For 2013 and beyond, use the most recent three-year running average.
Sub-option ii: Adjust the length of the fishing season following an ACL overage. To estimate the overage, compare recreational ACL with recreational landings over a range of years. For 2011, use only 2011 landings. For 2012, use the average landings of 2011 and 2012. For 2013 and beyond, use the most recent three-year running average.
Sub-option iii: Adjust bag limit for the fishing season following a previous seasons ACL overage.

Option c: Recreational and commercial combined accountability measures

Sub-option i: Adjust season length for both recreational and commercial harvest of spiny lobster in the fishing season following an ACL overage
Sub-option ii: Recreational and commercial ACL payback in the fishing season following a previous years ACL overage (if a combined ACL is chosen).

<u>Comparison of Alternatives</u>: Accountability measures are designed to provoke an action once either the ACL or ACT is reached during the course of a fishing season to reduce the risk overfishing will occur. However, depending on how timely the data are, it might not be realized that either the ACL and/or ACT has been reached until after a season has ended. Such AMs include prohibited retention of species once the sector annual catch target is met, shortening the length of the subsequent fishing season to account for overages of the ACL, and reducing the ACL in the subsequent fishing season to account for overages.

The National Standard 1 guidelines recognize that existing FMPs may use terms and values that are similar to, associated with, or may be equivalent to AMs in many fisheries for which annual specifications are set for different stocks or stock complexes. In these situations the guidelines suggest that, as Councils revise their FMPs they use the same terms as set forth in the National Standard 1 guidelines. Current Caribbean spiny lobster regulations include size limits, a seasonal closure, bag limits, and certain prohibited gear types (Table 2.1.1). There is no previously specified measure that would be considered an AM. Therefore, AMs for the Caribbean spiny lobster fishery in the Gulf and South Atlantic must be specified pursuant to Magnuson-Stevens Act requirements.

There are several types of AMs that may be applied in the Caribbean spiny lobster fishery. In-season AMs are those that are triggered during the fishing season and are typically before an ACL is exceeded. Some examples of in-season AMs include quota closures, trip or bag limit reductions, gear restrictions, or catch shares. Post-season AMs would be triggered if the ACL is exceeded and would typically be implemented the following fishing season. Post-season AMs could include seasonal closures, reduced trip limits, bag limits, and quotas, or shortening of the fishing season implemented in the subsequent year. National Standard 1 guidelines recommend the use of ACTs in systems of AMs so that an ACL is not exceeded. For fisheries without in-season management control to prevent the ACL from being exceeded, AMs may utilize ACTs that are set below ACLs so that catches do not exceed the ACLs. The objective for establishing an ACT and related AMs is that the ACL not be exceeded.

Alternative 1, no action, would not establish AMs for the spiny lobster fishery. The Magnuson-Stevens Act requires that ACLs and AMs be established in 2011; therefore, if **Alternative 1** were chosen as a preferred alternative the Spiny Lobster FMP would not be incompliance with those requirements.

Under **Alternative 2,** in-season AMs would be triggered in order to prevent the ACL from being exceeded. Florida trip ticket data would be used to track the commercial landings. Comparing actual and projected landings to the commercial quota will allow managers to close the commercial fishery before the ACL is exceeded.

Under **Alternative 2,** in-season AMs would be triggered in order to prevent the ACL from being exceeded. Once the ACL or ACT is projected to be met, the Regional Administrator would publish a notice notifying the fishery of the closing date for the season. After that data all harvest and possession, and purchase and sale, of spiny lobster would be prohibited for those holding commercial spiny lobster permits. The efficacy of in-season AMs is largely reliant upon in-season monitoring of landings, which may be especially difficult for the recreational sector. The Marine Recreational Fishing Statistics Survey (MRFSS) and the newly implemented Marine Recreational Information Program (MRIP) does not collect landings information on crustaceans. Tracking recreational landings could only be done through the current survey method employed by the state of Florida, which is not able to provide reliable results during the short duration of a given fishing season. Therefore, in-season tracking of Caribbean spiny lobster landings in the recreational sector would not be practical.

The Council may choose one or more post-season AMs under **Alternative 3** to supplement any of the in-season AMs under **Alternative 2**. This would be the most administratively burdensome scenario; however, if an ACL overage were to occur after an in-season AM has been implemented, a post-season AM would be available to the Regional Administrator as a means to correct an overage and prevent overfishing.

Under **Alternative 3** post-season AMs would be implemented the fishing season following the season when an ACL is exceeded. Post-season AMs would allow all landings for a particular season to be reported before any harvest restricting measures would take effect. This method of accountability alone may correct for one year's or several year's overages; however, it does little to prevent an overage from occurring again unless it is chosen in conjunction with an in-season AMs. Implementing post-season AMs for the recreational sector may be more pragmatic than doing so in-season since MRFSS and MRIP does not collect landings information on crustaceans; however, Florida's data survey method would be the primary means of tracking recreational landings unless some other method of recreational data collection is implemented.

2.6 Action 6: Develop or Update a Framework Procedure and Protocol for Enhanced Cooperative Management for Spiny Lobster

*Note: more than one alternative may be chosen as a preferred.

Alternative 1: No Action – Do not update the Protocol for Enhanced Cooperative Management or the Regulatory Amendment Procedure.

Gulf Preferred Alternative 2: Update the current Protocol for Enhanced Cooperative Management.

Alternative 3: Update the current Regulatory Amendment Procedures to develop a Framework Procedure to modify ACLs and AMs.

Alternative 4: Revise the current Regulatory Amendment Procedures to create an expanded Framework Procedure:

- **Option 1:** Adopt the base Framework Procedure
- **Option 2:** Adopt the more broad Framework Procedure
- **Option 3:** Adopt the more narrow Framework Procedure

*Note highlighted options and alternatives are recommended by the IPT.

Comparison of Alternatives: The current Protocol for Enhanced Cooperative Management outlines the roles of the federal and State of Florida agencies in managing Caribbean spiny lobster. The current Regulatory Amendment Procedure outlines the actions that can be implemented through framework actions, such as gear and harvest restrictions. The current Protocol and Procedure, was developed through Amendment 2 (GMFMC 1989). This action proposes to modify and update the *protocol* to include relevant agency names and authorities. The framework *procedure* would also be updated to include relevant terms and adjustments to ACLs, ACTs, and accountability measures.

Alternative 1 (No Action) would not modify the current protocols or procedures to include modern terminology and adjustments to ACLs, ACTs, and accountability measures. The Regional Administrator (RA) would maintain his/her current ability to adjust trip limits, bag limits, size limits, seasonal closures, and gear restrictions, but no means would exist of making needed adjustments to the National Standard 1 harvest parameters or management measures in a timely manner.

Alternative 2 would retain the current agreement with the State of Florida, but update the language to be consistent with changes in agency names and terminology since 1989. This alternative could be chosen in conjunction with either **Alternative 3** or **4**.

Proposed Language for the Updated Protocol

Protocol for Roles of Federal and State of Florida Agencies for the Management of Gulf and South Atlantic Spiny Lobster

1. The Gulf of Mexico and South Atlantic Fishery Management Councils (Councils) and NOAA Fisheries Service acknowledge that the fishery is largely a State of Florida (State) fishery, which extends into the exclusive economic zone (EEZ), in terms of current participants in the directed fishery, major nursery, fishing, and landing areas, historical regulation of the fishery. As such, this fishery requires cooperative state/federal efforts for effective management through the Fishery Management Plan for the Spiny Lobster Fishery of the Gulf of Mexico and South Atlantic (Spiny Lobster FMP).

2. The Councils and NOAA Fisheries Service acknowledge that the State is managing and will continue to manage the resource to protect and increase the long-term yields and prevent depletion of lobster stocks and that the State Administrative Procedure Act and rule implementation procedures, including final approval of the rules by Governor and Cabinet, provide ample and fair opportunity for all persons to participate in the rulemaking procedure.

3. The Florida Fish and Wildlife Conservation Commission (FWC) acknowledges that rules proposed for implementation under any fishery management plan amendment, regulatory or otherwise, must be consistent with the management objectives of the Spiny Lobster FMP, the National Standards, the Magnuson-Stevens Fishery Conservation and Management Act, and other applicable law. Federal rules will be implemented in accordance with the Administrative Procedures Act.

4. The Councils and NOAA Fisheries Service agree that, for any rules defined within an amendment to the Spiny Lobster FMP, the State may propose the rule directly to NOAA Fisheries Service, concurrently informing the Councils of the nature of the rule, and that NOAA Fisheries Service will implement the rule within the EEZ provided it is consistent under paragraph three. If either of the Councils informs NOAA Fisheries Service of their concern over the rule's inconsistency with paragraph three, NOAA Fisheries Service will not implement the rule until the Councils, FWC, and NOAA Fisheries Service resolve the issue.

5. The State will have the responsibility for collecting and developing the information upon which to base the fishing rules, with assistance as needed by NOAA Fisheries Service, and cooperatively share the responsibility for enforcement with federal agencies.

6. Florida FWC will provide to NOAA Fisheries Service and the Councils written explanations of its decisions related to each of the rules; summaries of public comments; biological, economic and social analysis of the impacts of the proposed rule and alternatives; and such other relevant information.

7. The rules will apply to the EEZ for the management area of North Carolina through Texas, unless the Regional Administrator (RA) determines those rules may adversely impact other state and federal fisheries. In that event, the RA may limit the application of the rule, as necessary, to address the problem.

8. NOAA Fisheries Service and the Councils agree that their staffs will prepare the proposed and final rules and the associated National Environmental Policy Act documentation and other documents required to support the rule.

Under **Alternatives 3** and **4**, adjustments to ACLs, ACTs, accountability measures, and other management measures could be made relatively quickly as new fishery and stock abundance information becomes available. Alternatives that would update or revise the current procedure would likely be biologically beneficial for spiny lobster because they would allow periodic adjustments to National Standard 1 guideline harvest parameters, and management measures could be altered in a timely manner in response to stock assessment or survey results.

Alternative 3 and **4** would be expected to increase the efficiency and effectiveness of management change, potentially allowing less severe corrective action when necessary, or the quicker receipt of social and economic benefits associated with less restrictive management. In the long term, positive social and economic effects, relative to the status quo, would be expected from more timely management adjustments.

Alternative 3 would update language and formatting, as well as allow adjustments to ACLs, ACTs, and accountability measures. When the procedure was originally developed, these parameters were not in use. The updates would streamline the process for making these changes if a new stock assessment indicates their necessity. However, the procedure remains fairly restrictive both substantively and procedurally. The changes are summarized in Table 2.6.1. The full text of the updated framework procedure follows.

Table 2.6.1. Proposed framework modifications under Alternative 3.

Items retained from current framework	Items modified from current framework	Items added to current framework
Adjustments to or implementation of trip limits, bag limits (including zero bag limits), minimum sizes, gear restrictions, and seasonal/area closures	Change the term "Regional Director" to "Regional Administrator"	Use of SEDAR reports or other documentation the Councils or FWC deem appropriate to provide biological analyses
	Change the term "FMFC" to "Florida Fish and Wildlife Conservation Commission (FWC)"	The SSC prepares a written report to the Councils and FWC specifying OFL and a range of ABCs for species in need of catch reductions to achieve OY
		The SEDAR report or SSC will recommend rebuilding periods
Adjustment to or implementation of timeframes for recovery of an overfished species		Adjustments to ABCs, ACLs, and/or sector ACLs
Initial specification and subsequent adjustments of biomass levels and age structured analysis		Adjustment to or implementation of ACTs and AMs
Inclusion of public input in the framework adjustment process		Adjustments to or establishment of MSY
		Adjustments to or implementation of quotas, including closing any commercial fishery when the quota is filled

Proposed Language for Updated Framework Procedure

Joint Fishery Management Plan for the Spiny Lobster Fishery of the Gulf of Mexico (Gulf) and South Atlantic Framework Procedure for Specification of Annual Catch Limits, Annual Catch Targets, Overfishing Limits, Acceptable Biological Catch, Accountability Measures, and annual adjustments:

1. At times determined by NOAA Fisheries Service Southeast Regional Office and Florida Fish and Wildlife Conservation Commission (FWC), the Gulf of Mexico and South Atlantic Councils (Councils), and the Southeast Data, Assessment, and Review (SEDAR) steering committee, stock assessments or assessment updates for spiny lobster in the Gulf and South Atlantic will be conducted under the SEDAR process. Each SEDAR stock assessment or assessment update will: 1) assess, to the extent possible, the current biomass (B), biomass proxy, or spawning potential ratio (SPR) levels for each stock; 2) estimate fishing mortality (F) in relation to F_{MSY} (maximum fishing mortality threshold [MFMT]) and F_{OY}); 3) determine the overfishing limit (OFL); 4) estimate other population parameters deemed appropriate; 5) summarize statistics on the fishery; 6) specify the geographical variations in stock abundance, mortality, recruitment, and age of entry into the fishery for each stock or stock complex; and 7) develop estimates of B_{MSY}.

2. The Councils and the FWC will consider SEDAR stock assessments, or other documentation deemed appropriate, to provide the biological analysis and data listed above in paragraph 1. Either the Southeast Fisheries Science Center or the stock assessment branch of a State agency may serve as the lead in conducting the analysis, as determined by the SEDAR Steering Committee. The joint Gulf and South Atlantic Scientific and Statistical Committees (SSCs) or some subgroup thereof, will prepare a written report specifying an OFL to the Councils and FWC and may recommend a range of acceptable biological catch (ABC) for attaining or maintaining optimum yield (OY). The OFL is the annual harvest level corresponding to fishing at MFMT (F_{MSY}). The ABC range is intended to provide guidance to the joint SSC subgroup, and is the OFL as reduced due to scientific uncertainty to reduce the probability overfishing will occur in a year. To the extent practicable, the probability overfishing will occur at various levels of ABC and the annual transitional yields (i.e., catch streams) calculated for each level of fishing mortality within the ABC range should be included with the recommended range.

If the spiny lobster stock is determined to be undergoing overfishing or is overfished, the recommended ABC range shall be calculated so as to end overfishing and achieve spiny lobster levels at or above B_{MSY} within the rebuilding periods specified by the Councils and FWC and approved by NOAA Fisheries Service. The SEDAR panel or joint SSC subgroup will recommend rebuilding periods based on the National Standard 1 guidelines, including generation times for the affected stocks. Generation times are to be specified by the stock assessment panel based on the biological characteristics of the individual stocks. The subgroup or panel will recommend a B_{MSY} level and a minimum stock size threshold (MSST) from B_{MSY} to the Councils and FWC. The panel or subgroup may also recommend more appropriate estimates of $F_{MSY,}$ MSY proxy, OY, the overfishing threshold (MFMT), and the overfished threshold (MSST). Where data are inadequate to compute an OFL and recommended ABC range, the subgroup or panel will use other available information as a guide in providing their best estimate of an OFL corresponding to MFMT and ABC range that should result in not exceeding the MFMT.

3. The joint SSC sub-group will examine SEDAR reports or other new information, the OFL determination, and the recommended ABC range. In addition, the joint SSC sub-group will examine information provided by the social scientists and economists from the Councils' staffs and from the Southeast Regional Office analyzing social and economic impacts of any specification demanding adjustments of allocations, annual catch limits (ACLs), annual catch targets (ACTs), accountability measures (AMs), quotas, bag limits, or other fishing restrictions. The joint SSC sub-group will use the ABC control rule to set ABC at or below the OFL, taking in account scientific uncertainty. If the joint SSC sub-group set ABC equal to OFL, they will provide rational why they believe that level of fishing will not exceed MFMT.

4. The Councils and FWC may conduct a public hearing on the reports and the joint SSCs' ABC recommendation at, or prior to, the time it is considered by the Councils for action. Other public hearings also may be held. The Councils and FWC may convene their Spiny Lobster Advisory Panels, and optionally their socioeconomic experts, to review the report before taking action.

5. If necessary, the Councils and FWC will utilize the following criteria in selecting an ACL, ACT, AM, and a stock restoration time period, in addition to taking into consideration the recommendations and information provided in paragraphs 1-4:

> **a.** Set ACL at or below the ABC specified by the joint SSC sub-group or set a series of annual ACLs at or below the projected ABCs to account for management uncertainty. If the Councils and FWC set the ACL equal to ABC, and ABC has been set equal to OFL, the Councils and FWC will provide rationale why they believe that level of fishing will not exceed MFMT.
> **b.** Optionally, subdivide the ACLs into commercial, for-hire, and private recreational sector ACLs or gear specific ACLs that maximize the net benefits of the fishery to the nation. The sector ACLs will be based on allocations determined by criteria established by the Councils and FWC, and specified by the Councils through a plan amendment. If spiny lobster is overfished, and harvest in any year exceeds the ACL or sector ACL, management measure and catch levels for that sector will be adjusted in accordance with the AMs established for that stock.
> **c.** Optionally, set ACTs or sector ACTs at or below ACLs and in accordance with the provision of the AMs for spiny lobster. The ACT is the management target that accounts for management uncertainty in controlling the actual catch at or below the ACL. If an ACL is exceeded repeatedly, the Councils and FWC have the option to establish an ACT if one does not already exist for a particular stock, and to adjust or establish AMs for that stock as well.

6. The Councils will provide to the RA: 1) the joint SSC sub-group specification of OFL and recommendation of ABCs, ACLs, sector ACLs, ACTs, sector ACTs, AMs, sector AMs; 2) stock restoration target dates for each stock or stock complex; 3) estimates of B_{MSY} and MSST; 4) estimates of MFMT, and; 5) the quotas, bag limits, trip limits, size limits, closed seasons, and gear restrictions necessary to avoid exceeding the ACL or sector ACLs. The Councils will also provide the joint SSC subgroup reports, a regulatory impact review, proper National Environmental Policy Act documentation, and the proposed regulations within a predetermined time as agreed upon by the Councils, FWC and RA. The Councils and FWC may also recommend new levels or statements for MSY (or proxy) and OY.

7. The RA will review the Councils' recommendations and supporting information; if he/she concurs the recommendations are consistent with the objectives of the Spiny Lobster FMP, the National Standards, and other applicable law, he/she shall prepare a framework action and forward notice of proposed rules to the Assistant Administrator for publication (providing appropriate time for additional public comment). The RA will consider all public comment and information received and will forward a final rule for publication in the Federal Register within 30 days of the close of the public comment, or such other time as agreed upon by the Councils and RA.

8. Appropriate regulatory changes that may be implemented by final rule in the Federal Register include:

a. ACLs or sector ACLs, or a series of annual ACLs or sector ACLs.
b. ACTs or sector ACTs, or a series of annual ACTs or sector ACTs, and establishment of ACTs for stocks which do not have an ACT.
c. AMs, or sector AMs.
d. Bag limits, size limits, vessel trip limits, closed seasons or areas, gear restrictions, and quotas designed to achieve OY and keep harvest levels from exceeding the ACL or sector ACL.
e. New levels or statements of MSY (or proxy) and OY for any stock.
f. Fishing season/year adjustments.

9. The RA is authorized, through notice action, to conduct the following activities.

a. Close the commercial fishery for spiny lobster at such time as projected to be necessary to prevent the commercial sector from exceeding the commercial sector ACL or ACT for the remainder of the fishing year or sub-quota season.
b. Close the recreational fishery for spiny lobster at such time as projected to be necessary to prevent recreational sector ACLs or ACTs from being exceeded.
c. Reopen a commercial or recreational season that had been prematurely closed if needed to assure that a sector ACL or ACT can be reached.

10. If NOAA Fisheries Service decides not to publish the proposed rule of the recommended management measures, or to otherwise hold the measures in abeyance, then the RA must notify the Councils and FWC with the reasons for concern along with suggested changes to the proposed management measures that would alleviate the concerns. Such notice shall specify: 1) The applicable law with which the amendment is inconsistent; 2) the nature of such inconsistencies; and 3) recommendations concerning the action that could be taken by the Councils to conform the amendment to the requirements of applicable law.

The options in **Alternative 4** would increase the flexibility of the Councils and NOAA Fisheries Service by identifying additional measures that could be changed under the procedure. In addition, these framework options would clarify the appropriate process needed for each type of change. The major differences among the options are highlighted in Table 2.7.2. The full text of the revised framework procedure for each option follows.

Table 2.6.2. Comparison of Alternative 4 options for a framework procedure.

	Option a (Base)	Option b (Broad)	Option c (Narrow)
Types of framework processes	Open abbreviated Open standard Closed	Open Closed	Open Closed
When open framework can be used	New stock assessment New information or circumstances When changes are required to comply with applicable law or a court order	In response to any new information or changed circumstances	Only when there is a new stock assessment
Actions that can be taken	Abbreviated Open framework can be used for actions that are considered minor and insignificant Standard Open framework used for all others *Representative lists of actions that can be taken under Abbreviated and Standard Open framework are given, but are not exclusive* Closed framework can be used for a specific list of actions	Open framework can be used for a representative list of actions, plus other measures deemed appropriate by the Councils Closed framework can be used for a specific list of actions, plus any other immediate action specified in the regulations	Open framework can only be used for specific listed actions Closed framework can only be used for a specific list of actions
Public input	Requires public discussion at one meeting for each Council	Requires public discussion at one meeting for each Council	Requires public discussion during at least three meetings for each Council, and discussion at separate public hearings within the areas most affected by the proposed measures.
AP/SSC participation	Each Council may convene their SSC, SEP, or AP, as appropriate	Convening the SSC, SEP, or AP, prior to final action is not required	Each Council shall convene their SSC, SEP, and AP
How a request of action is made	Abbreviated requires a letter or memo from the Councils with supporting analyses Standard requires a completed framework document with supporting analyses	Via letter, memo, or the completed framework document with supporting analyses.	Via letter, memo, or completed framework document with supporting analyses.

Option a (Base)

This framework procedure provides standardized procedures for implementing management changes pursuant to the provisions of the Spiny Lobster Fishery Management Plan (FMP) managed jointly between the Gulf of Mexico and South Atlantic Fishery Management Councils (Councils). Two basic processes are included: the open framework process and the closed framework process. The open framework addresses issues where more policy discretion exists in selecting among various management options developed to address an identified management issue, such as changing a size limit to reduce harvest. The closed framework addresses much more specific factual circumstances, where the FMP and implementing regulations identify specific action to be taken in the event of specific facts occurring, such as closing a sector of a fishery when the quota is or is projected to be harvested.

Open Framework:

1. Situations under which the open framework procedure may be used to implement management changes include the following:
    a. A new stock assessment results in changes to the overfishing limit, acceptable biological catch, or other associated management parameters.
    In such instances the Councils may, as part of a proposed framework action, propose an annual catch limit (ACL) or series of ACLs and optionally an annual catch target (ACT) or series of ACTs, as well as any corresponding adjustments to maximum sustainable yield (MSY), optimum yield (OY), and related management parameters.
    b. New information becomes available or circumstances change.
    The Councils will, as part of a proposed framework action, identify the new information and provide rationale why this new information indicates management measures should be changed.
    c. Changes are required to comply with applicable law such as the Magnuson-Stevens Act, Endangered Species Act, Marine Mammal Protection Act, or are required as a result of a court order.
    In such instances the Regional Administrator (RA) will notify the Councils in writing of the issue and that action is required. If there is a legal deadline for taking action, the deadline will be included in the notification.
2. Open framework actions may be implemented in either of two ways: abbreviated documentation or standard documentation process.
    a. Abbreviated documentation process. Regulatory changes that may be categorized as routine or insignificant may be proposed in the form of a letter or memo from the Councils to the RA containing the proposed action, and the relevant biological, social, and economic information to support the action. Either Council may initiate the letter or memo, but both Councils must approve it. If multiple actions are proposed, a finding that the actions are also routine or insignificant must also be included. If the RA concurs with the determination and approves the proposed action, the action will be implemented through publication of appropriate notification in the Federal Register. Changes that may be viewed as routine or insignificant include, among others:
        i. Reporting and monitoring requirements,

ii. Permitting requirements,
iii. Bag and possession limit changes of not more than one lobster,
iv. Size limit changes of not more than 10% of the prior size limit,
v. Vessel trip limit changes of not more than 10% of the prior trip limit,
vi. Closed seasons of not more than 10% of the overall open fishing season,
vii. Restricted areas (seasonal or year-round) affecting no more than a total of 100 nautical square miles,
viii. Respecification of ACL, ACT, or quotas that were previously approved as part of a series of ACLs, ACTs or quotas,
ix. Specification of MSY proxy, OY, and associated management parameters (such as overfished and overfishing definitions) where new values are calculated based on previously approved specifications,
x. Gear restrictions, except those that result in significant changes in the fishery, such as complete prohibitions on gear types,
xi. Quota changes of not more than 10%, or retention of portion of an annual quota in anticipation of future regulatory changes during the same fishing year.

b. Standard documentation process. Regulatory changes that do not qualify as routine or insignificant may be proposed in the form of a framework document with supporting analyses. Non-routine or significant changes that may be implemented under a framework action include, among others:
i. Specification of ACTs or sector ACTs,
ii. Creation of rebuilding plans and revisions to approved rebuilding plans,
iii. Changes specified in section 2(a) that exceed the established thresholds.

3. Either Council may initiate the open framework process to inform the public of the issues and develop potential alternatives to address the issues. The framework process will include the development of documentation and public discussion during at least one meeting for each Council.
4. Prior to taking final action on the proposed framework action, each Council may convene their SSC, SEP, or AP, as appropriate, to provide recommendations on the proposed actions.
5. For all framework actions, the initiating Council will provide the letter, memo, or the completed framework document along with proposed regulations to the RA in a timely manner following final action by both Councils.
6. For all framework action requests, the RA will review the Councils' recommendations and supporting information and notify the Councils of the determinations, in accordance with the Magnuson-Stevens Act (Section 304) and other applicable law.

Closed Framework:

Consistent with existing requirements in the FMP and implementing regulations, the RA is authorized to conduct the following framework actions through appropriate notification in the Federal Register:

a. Close or adjust harvest in any sector of the fishery for a species, sub-species, or species group that has a quota or sub-quota at such time as projected to be necessary to prevent the sector from exceeding its sector-quota for the remainder of the fishing year or sub-quota season,
b. Reopen any sector of the fishery that had been prematurely closed,
c. Implement an in-season accountability measure for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL, or implement a post-season accountability measure for a sector that exceeded its ACL in the current year.

Option b (Broad)
This framework procedure provides standardized procedures for implementing management changes pursuant to the provisions of the Spiny Lobster Fishery Management Plan (FMP) managed jointly between the Gulf of Mexico and South Atlantic Fishery Management Councils (Councils). Two basic processes are included: the open framework process and the closed framework process. The open framework addresses issues where more policy discretion exists in selecting among various management options developed to address an identified management issue, such as changing a size limit to reduce harvest. The closed framework addresses much more specific factual circumstances, where the FMP and implementing regulations identify specific action to be taken in the event of specific facts occurring, such as closing a sector of a fishery when the quota is or is projected to be harvested.

Open Framework:

1. The Councils may utilize this framework procedure to implement management changes in response to any additional information or changed circumstances.
   The Councils will, as part of a proposed framework action, identify the new information and provide rationale why this new information requires management measures be adjusted.
2. Open framework actions may be implemented at any time based on information supporting the need for adjustment of management measures or management parameters:
   Changes that may be implemented via the open framework procedure include:
   a. Reporting and monitoring requirements,
   b. Permitting requirements,
   c. Bag and possession limits,
   d. Size limits,
   e. Vessel trip limits,
   f. Closed seasons,
   g. Restricted areas (seasonal or year-round),
   h. Re-specification of annual catch limits (ACLs), annual catch targets (ACTs), or quotas that were previously approved as part of a series of ACLs, ACTs or quotas,
   i. Specification of maximum sustainable yield (MSY) proxy, optimum yield (OY), and associated management parameters (such as overfished and overfishing definitions) where new values are calculated based on previously approved specifications,

j. Gear restrictions, except those that result in significant changes in the fishery, such as complete prohibitions on gear types,
k. Quota,
l. Specification of ACTs or sector ACTs,
m. Creation of rebuilding plans and revisions to approved rebuilding plans,
n. Any other measures deemed appropriate by the Council.

3. Either Council may initiate the open framework process to inform the public of the issue and develop potential alternatives to address the issue. The framework process will include the development of documentation and public discussion during one meeting for each Council.
4. For all framework actions, the initiating Council will provide the letter, memo, or the completed framework document along with proposed regulations to the Regional Administrator (RA) following final action by both Councils.
5. For all framework action requests, the RA will review the Councils' recommendations and supporting information and notify the Councils of the determinations, in accordance with the Magnuson-Stevens Act (Section 304) and other applicable law.

Closed Framework:

Consistent with existing requirements in the FMP and implementing regulations, the RA is authorized to conduct the following framework actions through appropriate notification in the Federal Register:

a. Close or adjust harvest in any sector of the fishery for a species, sub-species, or species group that has a quota or sub-quota at such time as projected to be necessary to prevent the sector from exceeding its sector-quota for the remainder of the fishing year or sub-quota season,
b. Reopen any sector of the fishery that was prematurely closed,
c. Implement an in-season accountability measure for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL, or implement a post-season accountability measure for a sector that exceeded its ACL in the current year,
d. Take any other immediate action specified in the regulations.

Option c (Narrow)

This framework procedure provides standardized procedures for implementing management changes pursuant to the provisions of the Spiny Lobster Fishery Management Plan (FMP) managed jointly between the Gulf of Mexico and South Atlantic Fishery Management Councils (Councils). Two basic processes are included: the open framework process and the closed framework process. The open framework addresses issues where more policy discretion exists in selecting among various management options developed to address an identified management issue, such as changing a size limit to reduce harvest. The closed framework addresses much more specific factual circumstances, where the FMP and implementing regulations identify specific action to be taken in the event of specific facts occurring, such as closing a sector of a fishery when the quota is or is projected to be harvested.

Open Framework:

1. The open framework procedure may be used to implement management changes include only when a new stock assessment results in changes to the overfishing limit, acceptable biological catch, or other associated management parameters. In such instances the Councils may, as part of a proposed framework action, propose an annual catch limit (ACL) or series of ACLs and optionally an annual catch target (ACT) or series of ACTs, as well as any corresponding adjustments to maximum sustainable yield (MSY), optimum yield (OY), and related management parameters.
2. Actions that may be implemented via the framework procedure include:
    a. Reporting and monitoring requirements,
    b. Bag and possession limits,
    c. Size limits,
    d. Closed seasons,
    e. Restricted areas (seasonal or year-round),
    f. Quotas.
3. Either Council may initiate the open framework process to inform the public of the issue and develop potential alternatives to address the issue. The framework process will include the development of documentation and public discussion during at least three meetings for each Council, and shall be discussed at separate public hearings within the areas most affected by the proposed measures.
4. Prior to taking final action on the proposed framework action, each Council shall convene its SSC, SEP, and AP to provide recommendations on the proposed actions.
5. For all framework actions, the initiating Council will provide the letter, memo, or the completed framework document, and all supporting analyses, along with proposed regulations to the RA in a timely manner following final action by both Councils.
6. For all framework action requests, the RA will review the Councils' recommendations and supporting information and notify the Councils of the determinations, in accordance with the Magnuson-Stevens Act (Section 304) and other applicable law. The RA will provide the Councils weekly updates on the status of the proposed measures.

Closed Framework:

Consistent with existing requirements in the FMP and implementing regulations, the RA is authorized to conduct the following framework actions through appropriate notification in the Federal Register:

a. Close or adjust harvest in any sector of the fishery for a species, sub-species, or species group that has a quota or sub-quota at such time as projected to be necessary to prevent the sector from exceeding its sector-quota for the remainder of the fishing year or sub-quota season,
b. Reopen any sector of the fishery that was prematurely closed,
c. Implement an in-season accountability measure for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL,

or implement a post-season accountability measure for a sector that exceeded its ACL in the current year.

2.7 Action 7: Modify Regulations Regarding Possession and Handling of Short Caribbean Spiny Lobsters as "Undersized Attractants"

Alternative 1: No Action – Allow the possession of no more than 50 undersized Caribbean spiny lobsters, or one per trap aboard the vessel, whichever is greater, for use as attractants.

Alternative 2: Prohibit the possession and use of undersized Caribbean spiny lobsters as attractants.

Alternative 3: Allow undersized Caribbean spiny lobsters, but modify the number of allowable undersized lobsters, regardless of the number of traps fished:

Option a: allow 50 undersized lobsters
Option b: allow 35 undersized lobsters

Gulf Preferred Alternative 4: Allow undersized spiny lobster not exceeding 50 per boat and 1 per trap aboard each boat if used exclusively for luring, decoying or otherwise attracting non-captive spiny lobsters into the trap**.**

Comparison of Alternatives: Under the no action **Alternative 1**, the same enforcement and biological concerns would persist as under the current regulations.

Currently, regulations at 50 CFR 640.21(c) state:

> *A live spiny lobster under the minimum size limit specified in paragraph (b)(1) of this section that is harvested in the EEZ by a trap may be retained aboard the harvesting vessel for future use as an attractant in a trap provided it is held in alive well aboard the vessel. No more than fifty undersized spiny lobsters, or one per trap aboard the vessel, whichever is greater, may be retained aboard for use as attractants. The live well must provide a minimum of ¾ gallons (1.7 liters) of seawater per spiny lobster. An undersized spiny lobster so retained must be released alive and unharmed immediately upon leaving the trap lines and prior to one hour after official sunset each day.*

Alternative 2 would eliminate both the difficulties law enforcement officials currently have in prosecuting undersized spiny lobster cases and any negative biological impacts attributable to undersized lobster as attractants. Prohibiting the use of undersized spiny lobster as attractants may therefore, lead to a reduced risk of exceeding the annual catch limit in any given year and hedge against future overfishing. The enforcement and biological benefits under **Alternative 2** are positive; however, the socioeconomic impacts of prohibiting the use of undersized spiny lobster as attractants could be significant given a significant portion of commercial fishermen fishing for spiny lobster do indeed use undersized lobster as attractants and so very successfully. Subsequent to the allowance for the use of undersized spiny lobsters as attractants in state regulation in 1977, Amendment 1 to the Spiny Lobster FMP (1987) stated as a major issue:

> *The illegal market in undersize lobsters, on board handling and exposure of undersize lobsters and their confinement in traps as attractants are*

significant sources of undersize lobster mortality that are preventing the fishery from harvesting optimum yield. Although undersize lobsters are an effective attractant, the mortality associated with their use as attractants, in combination with increasing number of traps being fished, are contribution to the fishery's inability to achieve optimum yield…..

Several of these issues still exist today despite the implementation of the "50 Short" rule; although, the requirement to use live wells to maintain undersize spiny lobster onboard fishing vessels greatly decreased mortality associated with using undersized lobsters as attractants. The most recent SEDAR assessment for spiny lobster assumed a 10 percent mortality rate of undersized spiny lobsters used as attractants. Biological problems related to using undersized lobsters would likely be remedied under **Alternative 2**. **Alternative 3** would not improve law enforcement in the fishery; however, it could potentially reduce the negative biological impacts of using undersized spiny lobster under the status quo without incurring significant socioeconomic impacts. The number of undersized lobster handled, held in live wells, and confined to traps, would decrease under this alternative. Therefore, measureable improvement in stock abundance may be expected. **Preferred Alternative 4** is very similar to **Alternative 1** in that it would allow spiny lobster to be kept onboard for use as attractants ; however, it would change the provision to allow 50 spiny lobster *plus* one per trap, rather than 50 spiny lobster "*or*" one per trap, and it would remove the "whichever is greater" portion of the provision. **Preferred Alternative 4** would mirror Florida's state regulations, and ease some enforcement concerns related to inconsistent regulations across the state /federal water boundary. However, **Preferred Alternative 4** is the least biologically beneficial of all the alternatives considered since it would increase the number of spiny lobsters able to be maintained onboard a vessel, and there are concerns allowing an increased number of undersized lobster to be used as attractants may violate National Standard 9 of the Magnuson-Stevens Act.

2.8 Action 8: Modify Tailing Requirements for Caribbean Spiny Lobster for Vessels that Obtain a Tailing Permit

*Note: more than one alternative may be chosen as a preferred alternative.

Alternative 1: No Action – Possession of a separated Caribbean spiny lobster tail in or from the EEZ is allowed only when the possession is incidental to fishing exclusively in the EEZ on a trip of 48 hours or more, and a federal tailing permit is issued to and on board the vessel.

Alternative 2: Eliminate the Tail-Separation Permit for all vessels fishing for Caribbean spiny lobster in Gulf and South Atlantic waters of the EEZ.

Gulf and South Atlantic Preferred Alternative 3: Revise the current regulations to clearly state that all vessels must have either a federal spiny lobster permit or a Florida Restricted Species Endorsements associated with a Florida Saltwater Products License in order to obtain a tailing permit.

Gulf and South Atlantic Preferred Alternative 4: All Caribbean spiny lobster landed must either be landed all "whole" or all "tailed".

Note: Previous "Alternative 4: Modify the requirements for obtaining a Tail-Separation Permit" was moved to considered, but rejected by the South Atlantic Council.

Comparison of Alternatives: **Alternative 1** would not modify the current Tail-Separation Permit regulations for Caribbean spiny lobster. A Tail-Separation Permit would still be required in order to land spiny lobsters tailed, and the trips would still be required to be 48 hours or longer in duration. The ability to tail spiny lobsters is important to fishermen who do not have the storage capacity to hold large amounts of whole spiny lobster onboard over long trip durations. Tailing allows such fishermen to safely store more product in coolers without compromising quality, thus maximizing the profitability of each trip. Some fishermen; however, may be tailing lobsters in an effort to conceal the fact that they may be undersized. **Alternative 2** would be the most biologically beneficial of all the alternatives being considered under this action. Removing the ability for fishermen to tail any Caribbean spiny lobster before landing would increase the probability that most lobsters landed would be of legal size because they could easily be measured. Fishermen making multi-day trips need to tail the lobsters in order to maintain a quality product; tails are treated with an anti-blackening agent and put on ice to prevent the meat from turning black. Many of these vessels do not have freezers and so fishermen cannot freeze the lobsters whole. **Preferred Alternative 3** would address the issue of recreational fishermen obtaining Tail-Separation Permits, but it would not address the issue of commercial fishermen landing undersized lobster by tailing them. **Preferred Alternative 3** would provide a minimal biological benefit since it is thought that there are very few recreational fishermen who have in their possession a Tail-Separation Permit.

Preferred Alternative 4 would address the issue of some fishermen landing part of their catch whole and part of it tailed; presuming they are tailing select lobsters in order to land sub-legal spiny lobsters for profit. If under **Preferred Alternative 4**, most fishermen choose to land the majority of their Caribbean spiny lobster harvest whole because the product is in greater demand, the action would biologically beneficial. Additionally, if **Preferred Alternative 3** were chosen in combination with **Preferred Alternative 4** the issue of recreational fishermen obtaining Tail-Separation Permits would be addressed, and could; therefore, result in greater biological benefit than if **Preferred Alternative 4** were chosen alone.

2.9 Action 9: Limit Spiny Lobster Fishing in Certain Areas in the EEZ off Florida to Address Endangered Species Act Concerns for Staghorn and Elkhorn Corals

IPT Recommends changing to read: Action 9: Limit Spiny Lobster Fishing in Certain Areas in the EEZ off Florida to Protect Threatened Staghorn and Elkhorn Corals (*Acropora*)

Alternative 1: No Action – Do not limit spiny lobster fishing in certain areas in the EEZ off Florida to address ESA concerns for *Acropora*.

Alternative 2: Prohibit spiny lobster trapping on all known hardbottom in the EEZ off Florida (in areas under the SAFMC's jurisdiction with water depths less than 30 meters).

Alternative 3: Expand existing and/or create new closed areas to prohibit spiny lobster trapping in the EEZ off Florida, with an emphasis on protecting priority conservation areas and areas of *Acropora* colony abundance.

- **Option a**: Expand existing and/or create new closed areas with no buffer zone between the boundary of the closed area and closest *Acropora* colony.
- **Option b**: Expand existing and/or create new closed areas with a minimum buffer zone of at least 15 ft, but less than 100 ft, between the boundary of the closed area and closest *Acropora* colony.
- **Option c**: Expand existing and/or create new closed areas with a minimum buffer zone of at least 100 ft between the boundary of the closed area and closest *Acropora* colony.

Alternative 4: Expand existing and/or create new closed areas to prohibit all spiny lobster fishing in the EEZ off Florida, with an emphasis on protecting priority conservation areas and areas of *Acropora* colony abundance.

- **Option a**: Expand existing and/or create new closed areas with no buffer zone between the boundary of the closed area and closest *Acropora* colony.
- **Option b**: Expand existing and/or create new closed areas with a minimum buffer zone of at least 15 ft, but less than 100 ft, between the boundary of the closed area and closest *Acropora* colony.
- **Option c**: Expand existing and/or create new closed areas with a minimum buffer zone of at least 100 ft between the boundary of the closed area and closest *Acropora* colony.

IPT Recommends replacing Alternatives 2-4 with the following:
Alternative 2: Prohibit spiny lobster trapping on all known hardbottom in the EEZ off Florida in water depths less than 30 meters.

Alternative 3: Expand existing and/or create new closed areas to prohibit spiny lobster trapping in the EEZ off Florida.

- **Option a:** Create 25 "large" closed areas to protect threatened *Acropora* corals.
- **Option b:** Create 37 "medium" closed areas to protect threatened *Acropora* corals.
- **Option c:** Create 52 "small" closed areas to protect threatened *Acropora* corals.

Alternative 4: Expand existing and/or create new closed areas to prohibit all spiny lobster fishing in the EEZ off Florida.

> **Option a:** Create 25 "large" closed areas to protect threatened *Acropora* corals.
> **Option b:** Create 37 "medium" closed areas to protect threatened *Acropora* corals.
> **Option c:** Create 52 "small" closed areas to protect threatened *Acropora* corals.

Comparison of Alternatives:

The biological opinion on the spiny lobster fishery requires the Councils protect areas of *Acropora* by expanding existing or created new closed areas. These alternatives are being developed to meet those requirements. Figures 2.9.1 through 2.9.3c depict the locations of proposed and existing areas closed to trapping from west to east.

The Florida Keys National Marine Sanctuary (FKNMS) has designated 15 special use or sanctuary preservation areas in federal waters where trap fishing is prohibited [15 CFR 922.164(d)(iii)]. *Acropora* occur at relatively high densities in many of these areas. However, colonies of high conservation vale and additional areas of high *Acropora* density exist outside these closed areas. Creating new closed areas or expanding existing closed to include these areas of high *Acropora* density would help reduce the likelihood of interactions between spiny lobster traps and coral colonies.

The alternatives in this action propose several options for creating new or expanding existing closed areas to protect threatened coral colonies. The original alternatives required selecting a buffer zone size. However, it became clear that this approach would likely create closed areas so small that they may be difficult to locate and avoid at sea. Small areas can also create law enforcement challenges. To address these concerns, the alternatives considered were changed.

The current alternatives propose closed areas of varying sizes. The primary challenge with selecting closed areas is balancing impacts to the fishery and benefits to the environment. Larger areas are more easily enforced, fewer in number, and more likely to provide protection to corals. Larger areas are bigger because they encompass multiple reefs/hardbottom areas where *Acropora* colonies are found. However, they also include (and would prohibit trapping on) sand/rubble habitats where fishers prefer to set traps. As the closed areas get smaller, the amount of sand/rubble habitat that would be closed to fishing also decreases. However, as areas get smaller their overall number increases and problems with enforcement also increase.

The proposed closed areas were selected for several reasons. Colonial size data were used to establish three conservation priority categories for *Acropora* colonies. The largest "super colonies" have been designated as conservation priority 1 because of their importance to sexual reproduction. *Acropora* corals are generally considered sexually mature when the surface area of live tissue exceeds 100 cm^2. Elkhorn corals with a living tissue surface area of 1000 cm^2 could be considered "super colonies." A similar distinction could be made for staghorn corals with a living tissue surface area of 500 cm^2. Colonies of this size have exponentially higher reproductive potential compared to other sexually mature colonies, and represent essential sources of gamete production. Colonies of this size are also exceedingly rare. Sampling at over 1,000 locations throughout the Florida Keys and the Dry Tortugas identified only 17 super colonies (6 staghorn colonies and 9 elkhorn colonies). The same level of sampling has also identified 62 sexually mature colonies (32 staghorn colonies and 30 elkhorn colonies) and 61 non-sexually mature colonies (58 staghorn colonies and 3 elkhorn colonies). Smaller, but still sexually mature colonies were designated as conservation priority 2, and non-sexually mature colonies were designated conservation priority 3.

Additional data indicating the location of *Acropora* colonies were also used to develop the proposed areas. These data points simply reflect whether *Acropora* colonies were present at the time of sampling and do not include colonial size information. Since no size information is available for these colonies conservation priorities could not be assigned. It is important to remember that locations without assigned conservation priorities are not of low conservation value; rather they are areas with minimal data. In all likelihood, areas of high *Acropora* occurrence provide significant conservation benefits and should be viewed as areas requiring special attention and protection

The boundaries of all the closed areas run along lines of latitude and longitude, and only form right angles. No angled boundaries are proposed to improve compliance and support enforcement. In general, the "large" areas span whole minutes of lat./long. (i.e., 24°34'0" to 24°33'0"), and the "medium" areas span 30 second intervals of lat./long. (i.e., 24°33'30" to 24°33'0"). "Small" areas do not follow any particular sizing pattern.

Alternative 1 (No Action) would have the least biological benefit to *Acropora*, and would perpetuate the existing level of risk of interaction between these species and the fishery. **Alternative 1** would not meet the requirement established under the biological opinion. **Alternative 2** would provide the greatest biological benefit to *Acropora* and other hardbottom/coral resources. **Alternative 2** would prohibit trapping on all hardbottom in the Florida EEZ, which includes areas under both the SAFMC's and GMFMC's jurisdiction. The vast majority of *Acropora* colonies in the Florida EEZ occur in waters under the SAFMC's jurisdiction. While areas of hardbottom habitat in the Florida EEZ fall under the jurisdiction of the GMFMC, the water quality in these areas is generally too poor to sustain *Acropora* colonies. However, if water quality improves these areas would likely support *Acropora*. Prohibiting trapping on all hardbottom areas would close approximately X% of the EEZ off Florida to trapping. The negative social and economic impacts of **Alternative 2** are likely to be significant. Closing all hardbottom areas to trapping would significantly reduce the area available to trapping and may make trapping all together impractical. Relative to **Alternative 2**, **Alternatives 3 and 4** would be less biologically beneficial to *Acropora* colonies located outside the closed areas. **Alternative 3, Options a-c** would reduce the risk of trap damage to *Acropora* by prohibiting the use of traps near areas of high *Acropora* density or near colonies with high conservation value. **Alternative 3, Option a** would likely provide the greatest biological benefit because it closes a larger area to trapping. **Alternative 3, Option b and c** would likely have decreasing biological benefits, respectively. As closed areas get smaller the potential for interactions between trap gear and corals increase. The negative social and economic impacts from **Alternative 3, Options a-c** would likely be reduced as the size of the closed areas gets smaller. However, the burden of enforcing closed areas would increase as closed areas get smaller. **Alternative 4** and the associated options would provide slightly more biological benefit to *Acropora* colonies than **Alternative 3** and the associated options because it would prohibit all fishing for spiny lobster in the proposed closed areas. **Alternative 4, Options a-c** would likely have additional social and economic impacts than **Alternative 3** since it would apply to both the commercial and recreational sectors. However, requirements for both sectors may be viewed as more equitable. **Alternatives 2, 3, and 4** would fulfill the requirements of the terms and conditions prescribed in the biological opinion.

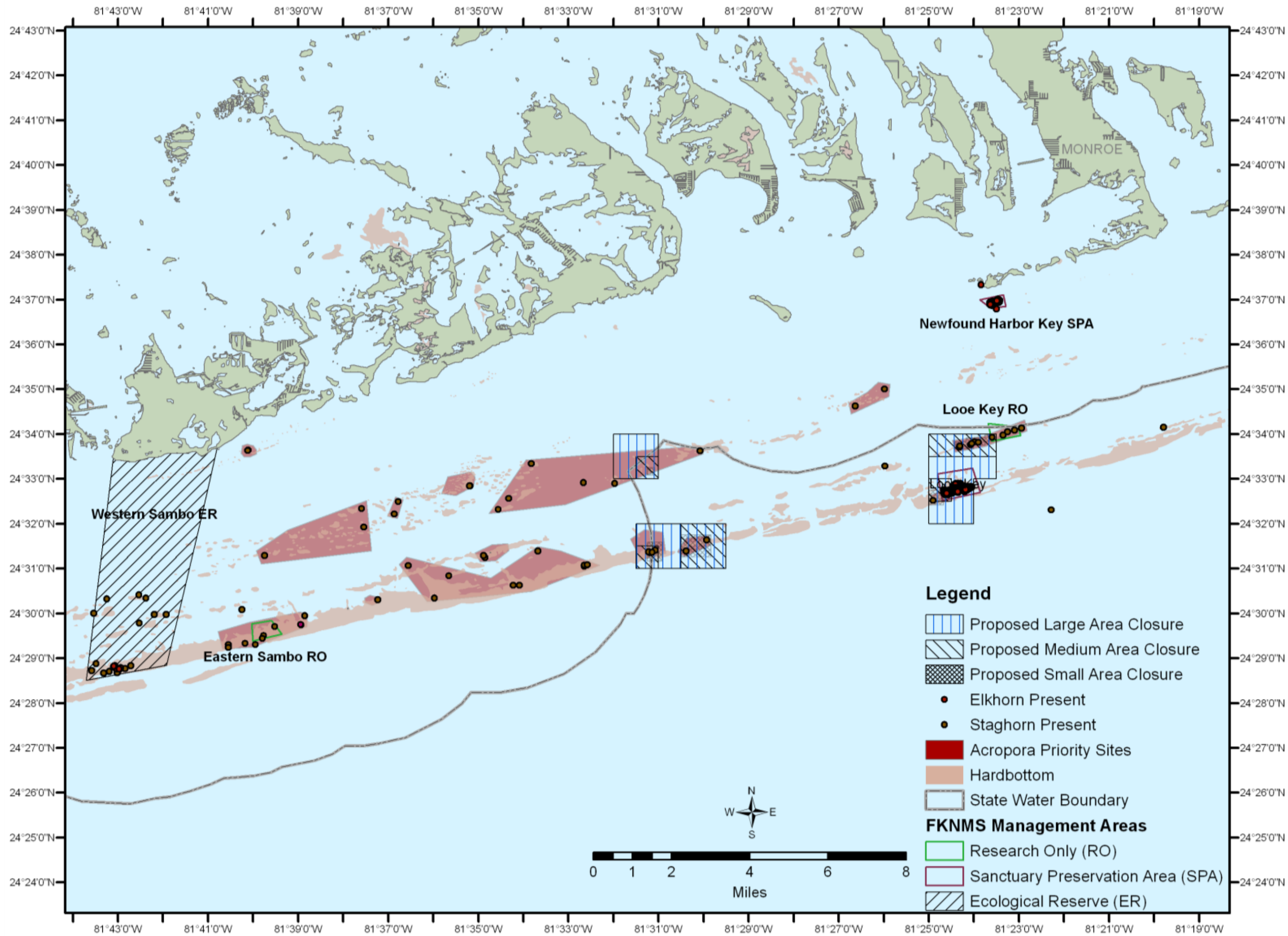

Figure 2.9.1. Proposed closed areas in the Lower Keys.

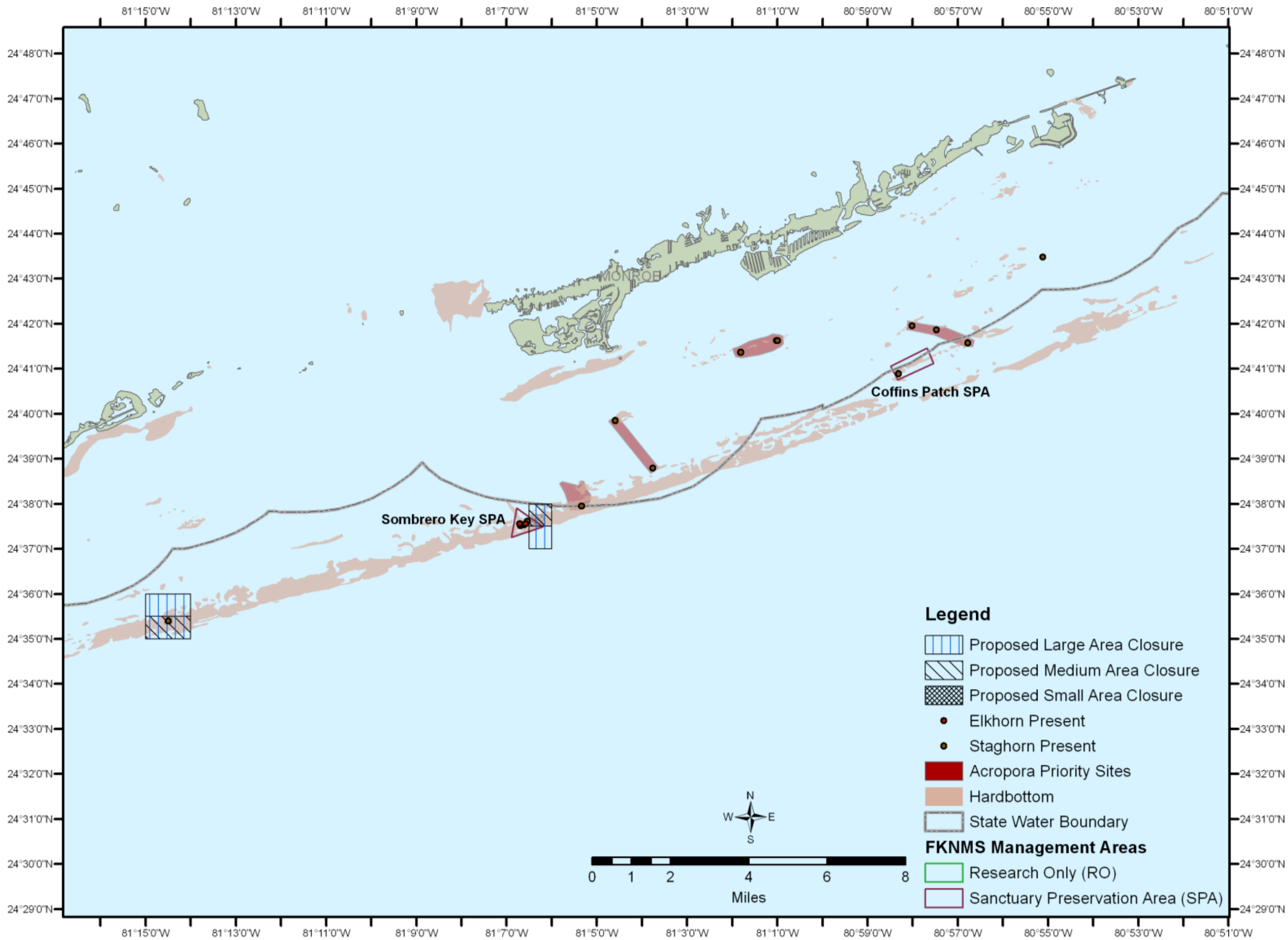

Figure 2.9.2. Proposed closed areas in the Middle Keys.

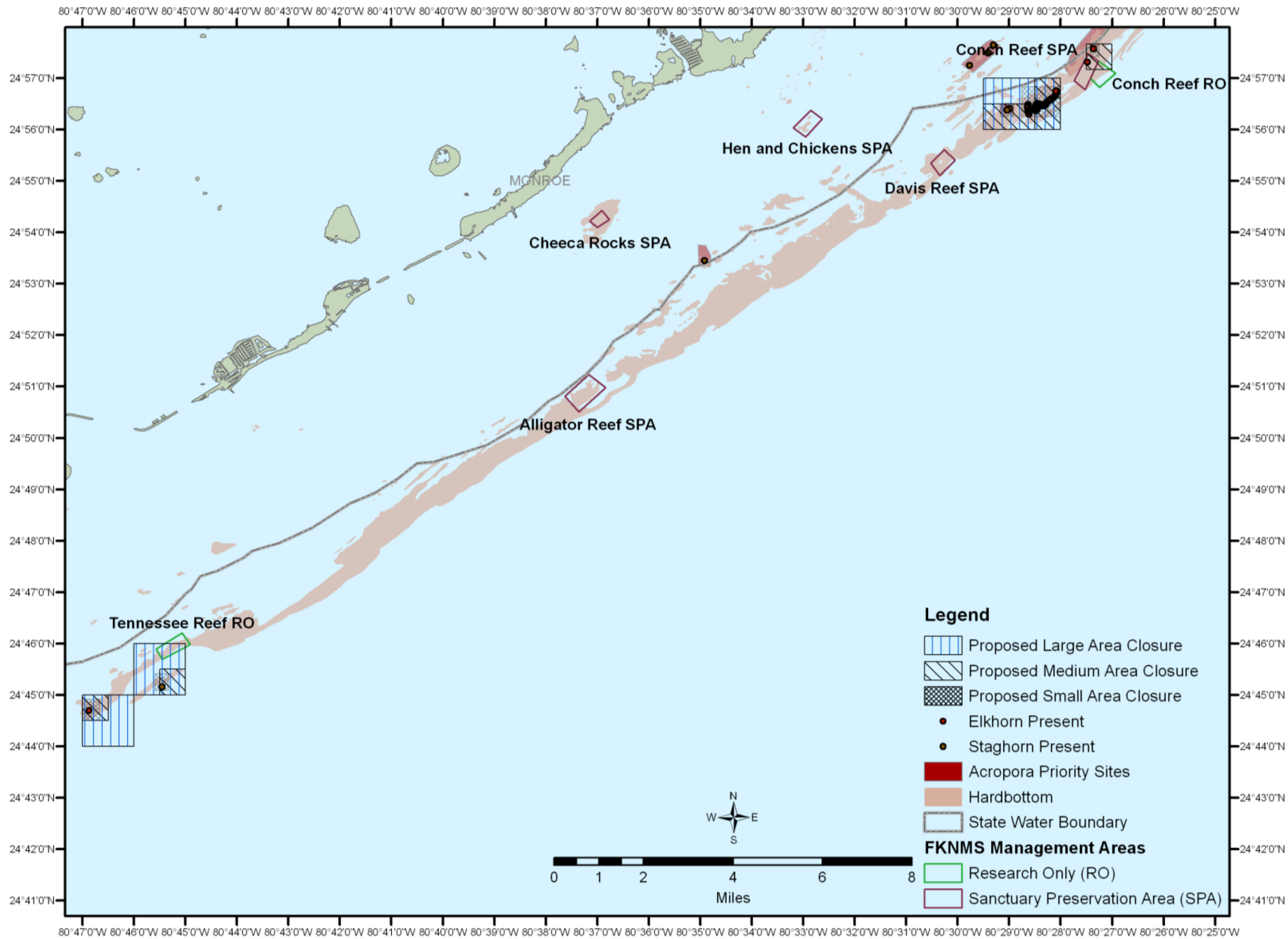

Figure 2.9.3a. Proposed closed areas in the Upper Keys.

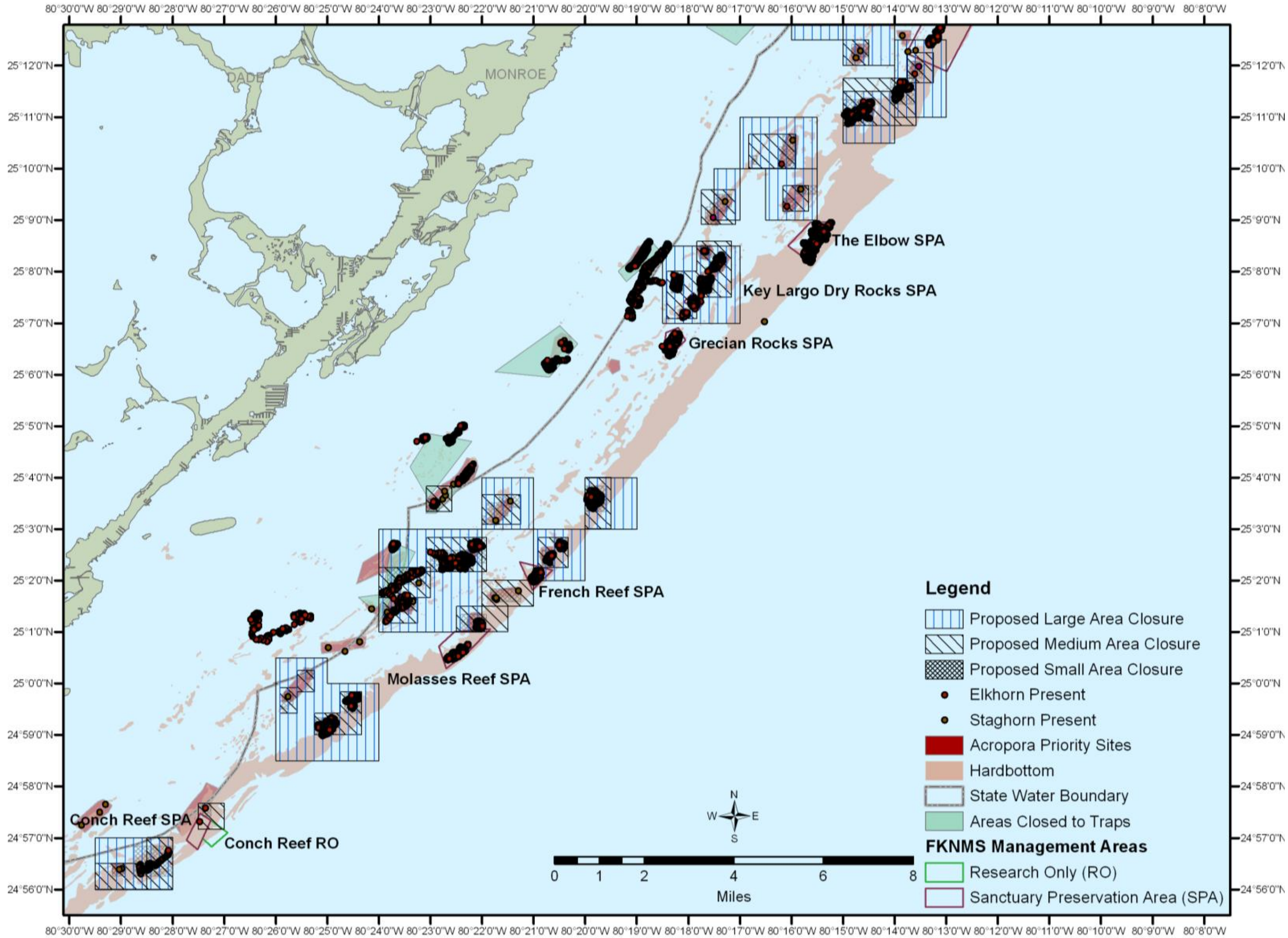

Figure 2.9.3b. Proposed closed areas in the Upper Keys con't.

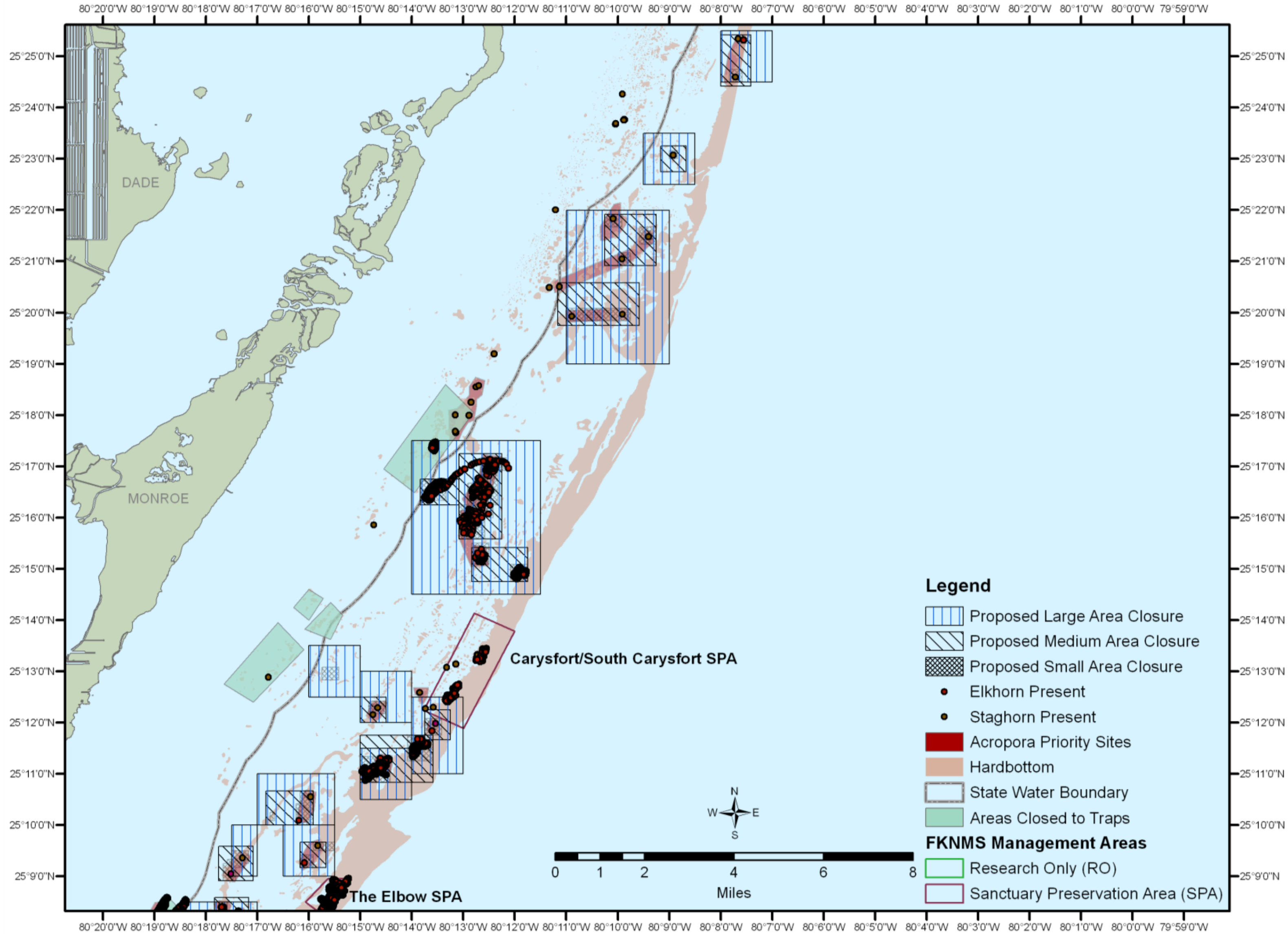

Figure 2.9.3c. Proposed closed areas in the Upper Keys con't.

2.10 Action 10: Require Gear Markings so All Spiny Lobster Trap Lines in the EEZ off Florida are Identifiable

Alternative 1: No Action – Do not require gear marking measures for spiny lobster trap lines.

Alternative 2: Require all spiny lobster trap lines in the EEZ off Florida to be a specific color, **"not currently in use in other fisheries"**, along its entire length.

Alternative 3: Require all spiny lobster trap lines in the EEZ off Florida to have easily identifiable patterns/markings, **"not currently in use in other fisheries"**, along its entire length.

Alternative 4: Require all spiny lobster trap lines in the EEZ off Florida to be a specific color and have easily identifiable patterns/markings, **"not currently in use in other fisheries"**, along its entire length.

Note: The Gulf Council requested that the phrase "not currently in use in other fisheries" be deleted in Alternatives 2, 3, and 4 due to vagueness. The South Atlantic Council did not remove the phrase but requested that the team work with other federal groups that have implemented gear marking requirements and develop alternatives for a comprehensive gear marking system for southeast trap fisheries.

IPT Recommends replacing Alternatives 2-4 with the following:

*Note: More than one alternative may be chosen as a preferred.

Alternative 2: Require all spiny lobster trap lines in the EEZ off Florida to be COLOR, or have a COLOR marking along its entire length. All gear must comply with marking requirements no later than August 2014.

Alternative 3: Require all spiny lobster trap lines in the EEZ off Florida to have a permanently affixed 4-inch COLOR marking every 15 ft along the buoy line or at the midpoint if less than 15 ft. All gear must comply with marking requirements no later than August 2014.

~~**Alternative 4:** Require all spiny lobster trap lines in the EEZ off Florida to be marked in accordance with either Alternative 2 or Alternative 3. All gear must comply with marking requirements no later than August 2014.~~

Note: The Gulf Council (10/2010) approved adding the August 2014 deadline to all alternatives.

<u>Comparison of Alternatives</u>: The biological opinion on the fishery requires the establishment of buoy line marking requirements no later than August 2014, and that the incidental take of protect species be monitored. These alternatives are being developed to meet those requirements. Currently, all spiny lobster traps fished in the EEZ off Florida must follow the gear marking requirements established by the State of Florida at 68B-24 in the Florida Administrative Code (F.A.C). Those regulations require a buoy or a time-release buoy to be attached to each spiny lobster trap or at each end of a weighted trap trotline. Each buoy must be a minimum of six inches in diameter and constructed of Styrofoam, cork, molded polyvinyl chloride, or molded polystyrene [F.A.C. 68B-24.006(3)]. Additionally, each trap and buoy used must have the fishers' current lobster license or trap number permanently affixed in legible figures. On each buoy, the affixed lobster license or trap number shall be at least two inches high [F.A.C. 68B-24.006(4)].

Lines are consistently found as marine debris and most frequently recovered without the buoys or traps still attached. Miller et al. (2008) reported lost pot/trap gear was the second most prevalent type of marine debris in the Florida Keys and the most damaging to benthic habitat. In all cases, lines were without buoys. While current gear marking regulations require buoys and traps to be marked, buoys are frequently dislodged from lines and the lines used in the spiny lobster fishery are also used in other fisheries and for other purposes. These conditions make it extremely difficult to determine if line found in the environment, or entangling protected species, originated from the spiny lobster fishery. A lack of uniquely identifiable markings also makes monitoring incidental take in the fishery difficult. Trap line marking requirements would allow for greater accuracy in identifying fishery interactions impacts to benthic habitats and protected species leading to more targeted measures to reduce the level and severity of those impacts.

Marine debris surveys conducted in the Florida Keys documented that 21% of trap lines found were less than 15 ft long and approximately 53% were between 15 and 45 ft in length with the remainder being longer than 50 ft (Miller et al 2008). The average length of line encountered was approximately 35 ft (Miller et al 2008). Requiring gear marks along the entire length of the line or at least every 15 ft (**Alternative 3**) improves the likelihood that line found in the environment can be identified properly.

Trap line marking requirements are currently in place for other fisheries in other regions. Under the Atlantic Large Whale Take Reduction Plan trap/pot fisheries in the Northeast and Mid-Atlantic regions must use red, orange, or black markings on their gear depending on the fishery. When the line in use is the same color as the required gear marking color scheme, those lines are marked with a white line.

Since color marking schemes using red, orange, and black are currently in use, those colors were not considered here. Spiny lobster industry members requested that only colors that were not likely to attract sea turtle be considered for gear marking requirements. Most sea turtles appear to have at least some color vision and most are able to see a color spectrum similar to what humans observe (Liebman and Granda 1971, Granda and O'Shea 1972, Liebman and Granda 1975, Levenson et al 2004, Mäthger et al 2007). Limited research has not yet identified any particular color that would be less likely to attract sea turtles. However, anecdotal evidence from sea turtle rehabilitation suggests that bright colors such as pinks, yellows, and bright greens can capture their attention (S. Schaf, Florida Fish and

Wildlife Conservation Commission, pers. comm. 2010). Given this information, COLOR (to be determined) was selected for the gear marking requirement in **Alternative 2** because it was not currently in use elsewhere.

Three methods for marking gear were tested and found to work satisfactorily in the Northeast Region under normal conditions (Figure 4.10.1.1). At the top, colored twine is seized around the line and woven between the strands. In the center, the line was spray-painted; this method requires that the line be dry. At the bottom, colored electrical tape was wrapped in one direction and then back over itself to form two layers. Similar marking techniques would likely be sufficient for the spiny lobster fishery. Requiring a specific color trap line would also be sufficient.

Figure 2.10.1. Examples of satisfactory gear markings for buoy lines in the Northeast Region.

The State of Florida could greatly improve the efficacy of gear marking requirements for spiny lobster gear fished in the EEZ off Florida by creating compatible gear marking requirements for spiny lobster trap gear in state waters. The selection of a gear marking scheme does not preclude non-spiny lobster fishers for using the same color. The State of Florida could further improve the efficacy of gear marking requirements proposed under this action by instituting gear marking requirements for other state water trap fisheries (i.e., blue crab and stone crab).

Alternative 1 (No Action) would have no biological benefit for protected species and would not satisfy the trap line marking requirements of the biological opinion. This alternative is unlikely to have any social or economic impact. **Alternatives 2** would likely have slightly more biological benefit than **Alternative 3.** Requiring gear markings along the entire length of trap lines would minimize the likelihood that a portion of a spiny lobster trap line is recovered without an identifiable mark. **Alternative 3** would provide greater biological benefit than **Alternative 1** but the benefits would likely be less than **Alternative 2** for the reason described above. The social and economic impacts from **Alternatives 2 and 3** would likely be similar. Additional costs would be incurred to replace existing trap lines with trap lines of specific color (**Alternative 2**). However, trap lines are generally replaced after several years due to wear and the phase in provision of this action should allow fishers to begin using lines that meet the gear marking requirements as they replace old lines. The materials needed to meet the requirements of **Alternative 3** would likely cost less than those required in **Alternative 2.** However, the time commitment need to properly marking all lines as proposed in **Alternative 3** may greater than the time required to switch out old lines.

2.11 Action 11: Allow the Public to Remove Trap Line, Buoys, or Otherwise make Unfishable, any Spiny Lobster Gear Found in the EEZ off Florida

IPT Recommends changing Action 11 to read: Allow the Public to Remove Derelict or Abandoned Spiny Lobster Traps Found in the EEZ off Florida

South Atlantic Preferred Alternative 1: No Action – Do not allow public to remove any spiny lobster trap found in the EEZ off Florida

Alternative 2: Allow the public to remove any spiny lobster trap found in the EEZ off Florida following the end of lobster season trap removal period (usually April 5) until the beginning of the next season's trap deployment period (August 1).

Alternative 3: Allow the public to remove any spiny lobster trap found in the EEZ off Florida during the closed season of both the spiny lobster and stone crab fishing seasons (May 20-July 31).

Alternative 4: Allow the public to make any spiny lobster trap unfishable by removing trap line, buoys, and throats if found in the EEZ off Florida from following the end of season trap removal period (usually April 5) until the beginning of the next season's trap deployment period (August 1).

Alternative 5: Allow the public to make any spiny lobster trap unfishable by removing trap line, buoys, and throats if found in the EEZ off Florida during the closed season of both the spiny lobster and stone crab fishing seasons (May 20-July 31).

Gulf Preferred Alternative 6: Delegate regulations to Florida FWC regarding removal of trap lines, buoys, or otherwise making unfishable any spiny lobster gear.

IPT Recommends changing the alternatives to read (Note: The Councils will need to clarify preferred.):

Alternative 1: No Action – Do not allow the public to remove any derelict or abandoned spiny lobster trap found in the EEZ off Florida.

Alternative 2: Allow the public to completely remove from the water any derelict or abandoned spiny lobster trap found in the EEZ off Florida from the end of lobster season trap removal period (usually April 5) until the beginning of the next season's trap deployment period (August 1).

Alternative 3: Allow the public to completely remove from the water any derelict or abandoned spiny lobster trap found in the EEZ off Florida during the closed seasons for both spiny lobster and stone crab (May 20-July 31).

Alternative 4: Allow the public to remove spiny lobster trap lines, buoys, and/or throats, but otherwise leave in place, any trap found in the EEZ off Florida from the end of season trap removal period (usually April 5) until the beginning of the next season's trap deployment period (August 1).

Alternative 5: Allow the public to remove spiny lobster trap lines, buoys, and/or throats, but otherwise leave in place, any trap found in the EEZ off Florida during the closed seasons for both spiny lobster and stone crab (May 20-July 31).

Alternative 6: Delegate authority to regulate the removal of derelict or abandoned spiny lobster traps occurring in the EEZ off Florida to the Florida FWC.

Comparison of Alternatives: The biological opinion on the spiny lobster fishery requires the Councils explore allowing the public to remove derelict trap gear from the EEZ off Florida. Current federal regulations state that any trap, buoy, or rope found in the EEZ of Florida and any other Gulf state outside of this authorized period is considered unclaimed or abandoned property and may be disposed of in any manner considered appropriate by the Assistant Administrator or authorized officer [50 CFR 640.20(b)(3)(iii)]. Those regulations also state that pulling or tending another person's spiny lobster trap, without prior authorization is prohibited.

Florida regulations allow spiny lobster traps to be deployed beginning August 1 of each year and require all traps be removed from the water by April 5 (with the opportunity for an extension under certain circumstances). The State of Florida considers trap remaining in the environment outside of the authorized fishing season to be derelict (F.A.C. 68B-55.004).

At any time, local, state, or federal government personnel may remove trap debris and derelict traps from areas permanently closed to trapping without prior authorization from Florida FWC (F.A.C. 68B-55.002 and 68B-55.004). During the spiny lobster season, Florida FWC employees, local, state, or federal personnel may retrieve derelict traps at any time deemed appropriate by Florida FWC. Members of a fishery participant organization may also remove derelict traps, at any time deemed appropriate by Florida FWC during the season, if they have a Florida FWC-approved trap retrieval plan. During the closed season for spiny lobster, and after any authorized trap retrieval period together with any extensions, nonprofit nongovernmental organizations, fishery participant organizations, or other community or citizens groups may retrieve derelict traps as part of coastal cleanup events authorized by Florida FWC (F.A.C. 68B-55.004).

Trap debris may be removed at any time from shoreline areas shoreward of mean low water, and from mangroves or other shoreline vegetation by nonprofit nongovernmental organizations, fishery participant organizations, or other community or citizens groups when they organize, promote, and participate in coastal cleanup events for the purpose of removing marine debris. Prior authorization from Florida FWC is required for any coastal clean-up events that remove trap debris occurring in state waters seaward of mean low water (F.A.C. 68B-55.002).

The specific State of Florida trap debris/derelict trap regulations are as follows:

68B-55.001 Definitions

(2) “Trap debris” means any piece of a trap, or any combination of such pieces not constituting a fishable trap.

(3) “Derelict trap” means any trap during any closed season for the species, or any fishable trap during the open season that lacks more than two of the following elements:

(a) Buoy.
(b) Line.
(c) Current Commission-issued trap tag (if required).
(d) Current license.

(4) “Fishable trap” means a trap that has 6 intact sides and at least two of the following elements:

(a) Buoy.
(b) Line.
(c) Current Commission-issued trap tag (if required).
(d) Identification.

(5) “Fishery Participant Organization” means a group of commercial fishermen all of whom possess a current saltwater products license and a blue crab, stone crab or spiny lobster endorsement. For the purpose of participation in the retrieval of derelict traps this means participants who receive and possess written permission from each other to bring their traps into land or move them back into line, who work under law enforcement supervision to retrieve traps, or who prepare a plan for Commission authorization pursuant to this rule.

68B-55.002 Retrieval of Trap Debris

(1) Local, state, or federal governmental entities, nonprofit nongovernmental organizations, fishery participant organizations, or other community or citizens groups are hereby authorized to remove trap debris from shoreline areas landward of mean low water, and from mangroves or other shoreline vegetation when they organize, promote, and participate in coastal cleanup events for the purpose of removing marine debris.

(2) Except as provided in subsection (3), other coastal cleanup events for the purpose of removing trap debris from all other areas of state waters shall only be undertaken with prior authorization from the Commission, to assure that such removal is adequately supervised.

(3) Local, state, or federal government personnel may remove trap debris located in areas that are permanently closed to trapping without prior authorization from the Commission.

Specific Authority Art. IV, Sec. 9, Fla. Const. Law Implemented Art. IV, Sec. 9, Fla. Const. History–New 7-1-03, Amended 10-15-07.

68B-55.004 Retrieval of Derelict Traps and Traps Located in Areas Permanently Closed to Trapping.

(1) During the closed season for the harvest of any species for which traps are allowable gear, and after any authorized trap retrieval period together with any extensions, traps are considered to be derelict and may be retrieved as part of coastal cleanup events conducted by local, state, or federal government entities, nonprofit nongovernmental organizations, fishery participant organizations, or other community or citizens groups. Except as provided in subsection (3), such events shall only be undertaken with prior authorization from the Commission, to assure that such removal is adequately supervised but without the mandatory reporting required in Rule 68B-55.003, F.A.C.

(2) During the open season for harvest of any species for which traps are allowable gear, retrieval of derelict traps may occur at any time deemed appropriate by the Commission. Commission employees, local, state, or federal personnel, or members of a fishery participant organization may retrieve derelict traps. Except as provided in subsection (3), retrieval other than by Commission personnel shall only be pursuant to a Commission approved plan. The plan shall include the operational area and time period proposed, authorized personnel, the number of vessels, methods of disposition, and number and qualifications of supervisory personnel. An approved plan shall also include notification of the Commission's Division of Law Enforcement no less than 24 hours prior to commencement of retrieval under this program with final float plan information including contact information, vessel registration numbers, trip times, and number of days.

(3) Local, state, or federal government personnel may retrieve traps located in areas that are permanently closed to trapping without prior authorization from the Commission.
Specific Authority Art. IV, Sec. 9, Fla. Const. Law Implemented Art. IV, Sec. 9, Fla. Const. History–New 7-1-03, Amended 10-15-07.

Trap losses in the spiny lobster fishery range from 10 to 20% of all traps fished, or 50,000 to 100,000 traps, annually (Lewis et al. 2009). Years with strong or frequent tropical systems (i.e., tropical storms and/or hurricanes) can increase the number. For example, during the 2005–06 lobster seasons approximately 60% of registered traps were lost because of hurricanes Katrina, Rita, and Wilma (Lewis et al. 2009). Of the traps lost only a small percentage are ever recovered.

Lost traps pose multiple threats to the environment and protected species. Lost traps can "ghost" fish for a year or more (FWC unpubl. data, Lewis et al. 2009), and trailing trap lines can become entangled on the reef, damaging corals and sponges (Chiappone et al. 2005). Marine mammals and ESA-listed sea turtles and marine fish can also become entangled in trailing ropes (Guillroy et al. 2005, Seitz and Poulakis 2006, Lewis et al. 2009). Wooden traps eventually degrade after many months, but plastic trap throats and polystyrene buoys persist indefinitely in the marine environment. Seagrass meadows can be damaged when traps are lost or left for periods longer than six weeks (Uhrin et al. 2005). Thousands of lost and abandoned traps can have a significant effect on the reef environment and benthic habitats.

Unlike nearshore areas where traps can be located during aerial surveys or by boats during low tides, traps lost in federal waters are more difficult to identify. Traps identified in the nearshore environment are also more conducive to trap clean-up events because of their proximity to boat ramps and areas where recovered traps can be off loaded. Organized clean ups for the sole purpose of removing derelict trap gear in federal waters is generally expensive and difficult to conduct. Allowing the public to remove derelict trap gear (**Alternatives 2 and 3**) would promote many individual contributions, which could have a large cumulative effect.

Arguments against allowing the public to remove derelict or abandoned traps cite concerns that legally fishing traps may be removed by someone other than themselves, either intentionally or by accident. However, some industry members did recognize the potential environmental impacts of lost traps and suggested their own alternative that would allow the public to make traps unfishable (**Alternatives 4 and 5**). Specifically, they recommended authorizing the removal of buoys, trap lines, and throats from derelict spiny lobster traps in the EEZ. They stated that these actions would render the trap unlikely to ghost fish, and would reduce a traps likelihood of moving during storm events. This proposal also ensured that no one other than the owner of the trap would be authorized to remove the trap from the water.

Another argument against allowing the public to pull derelict traps is a concern over confusion between similar looking traps. For example, some industry members voiced concerns that legally fishing stone crab traps would be confused for derelict spiny lobster traps by the public and pulled. **Alternatives 3 and 5** would only allow the public to remove derelict traps during the closed seasons for both spiny lobster and stone crabs. Limiting the removal of traps to the closed seasons for both species ensures that only truly derelict traps are removed.

Alternative 1 (No Action) would have no biological benefit for protected species or benthic habitat and would perpetuate the existing level of risk for interactions between these protected species and lost trap gear. No negative social or economic impacts are anticipated under this alternative. **Alternative 2** would likely have the greatest biological benefits. This alternative would allow for the complete removal of all derelict or abandoned traps and authorize that removal for the longest period of time, likely increasing the number of derelict or abandoned traps removed. **Alternative 3** would also allow for the complete removal of derelict or abandoned trap gear, but for a shorter period. As a result, the biological benefit of **Alternative 3** may be less than **Alternative 2**. The potential social and economic impacts from **Alternative 2** include the accidental or intentional removal of legally fishing traps. Well meaning members of the public may accidentally remove a legally fishing lobster trap from the water. Likewise, well meaning members of the public may accidentally remove similar looking traps (i.e., stone crab traps). The potential social and economic impacts from **Alternative 3** would likely be similar those expected from **Alternative 2**; however the likelihood of the accidental removal of legally fished, similar looking traps may be reduced.

Since fines may be levied for derelict traps recovered by law enforcement or during Florida FWC contracted trap removal programs, allowing the public to remove traps may have positive economic impacts in the form of avoided fines. **Alternatives 4 and 5** would likely have less biological benefit than **Alternatives 2 and 3**. Allowing the public to remove trap line, buoys, and throats, would help reduce the potential impacts from ghost fishing and entanglement. However, traps remaining in the environment still have the potential to cause damage to benthic habitat. **Alternative 4** would allow more time for the public to remove trap line, buoys, and throats from derelict or abandoned traps, potentially increasing the biological benefit. Compared to **Alternatives 2-4**, **Alternative 5** would likely have the least biological benefit. The social and economic impacts of **Alternatives 4 and 5** would likely be similar to **Alternatives 2 and 3**. Removal of lines and throats from a legally fishing trap would likely result in the same economic impacts to fishers as the complete removal of a trap from the water. It is unclear if the owner of recovered derelict trap that had previously had its trap lines, buoys, and/or throats removed would still be subject to fines. If so, the potential economic benefits from **Alternatives 2 and 3** may not be realized with **Alternatives 4 and 5**. It is currently unclear what type of biological impact **Alternative 6** would have. If the delegation of authority to the Florida FWC leads to the removal of more derelicts traps and trap debris, the biological benefits from the alternative would likely be within the range anticipated from **Alternatives 2-5**. If **Alternative 6** ultimately results in no change or fewer derelict traps and trap debris being removed, then its biological benefit would likely be similar to the effect anticipated under **Alternative 1**. The social and economic impacts of **Alternative 6** are unclear.

3.0 AFFECTED ENVIRONMENT

3.1 Description of the Fishery

3.1.1 Caribbean Spiny Lobster – Commercial Fishery

Introduction

From 1962 through 2003, continental U.S. commercial landings of Caribbean spiny lobster have ranged from a low of 1,424 metric tons in 1962 to a high of 5,358 metric tons in 1972. Since 1992, an average of 2,626 metric tons has been landed in the continental U.S. annually. Commercial landings of Caribbean spiny lobster in the contiguous United States have been reported in Alabama, Georgia, Florida, Mississippi, South Carolina, and Texas since 1962; however, Florida dominates (Table 3.1.1.1). In 35 of the 45 years from 1962 through 2006, Florida landings accounted for all of the annual commercial landings; and in each of the other 10 years, annual landings in Florida represented at least 94% of the total pounds commercially landed that year. This explains why the species is also called the Florida spiny lobster.

Table 3.1.1.1. Commercial landings of Caribbean spiny lobster by state, 1962 – 2006, in pounds.

Year	Pounds Landed by State						TOTAL
	FL	GA	MS	AL	SC	TX	
1962	3,107,000	32,200	0	0	0	0	3,139,200
1963	3,585,200	0	0	0	0	0	3,585,200
1964	3,631,100	0	0	0	0	0	3,631,100
1965	5,714,100	35,000	0	0	0	0	5,749,100
1966	5,350,200	0	0	0	0	0	5,350,200
1967	4,413,600	0	0	0	0	0	4,413,600
1968	6,154,900	1,004,200	0	0	0	0	7,159,100
1969	7,581,200	882,200	0	0	0	0	8,463,400
1970	9,869,500	0	212,700	0	33,000	0	10,115,200
1971	8,206,000	0	373,500	132,600	0	0	8,712,100
1972	11,416,800	0	191,000	39,000	165,100	0	11,811,900
1973	11,171,700	0	21,000	1,500	0	0	11,194,200
1974	10,882,600	0	0	800	0	0	10,883,400
1975	7,408,400	0	0	100	0	0	7,408,500
1976	5,345,600	0	0	0	0	0	5,345,600
1977	6,344,100	0	0	0	0	0	6,344,100
1978	5,601,903	0	0	0	0	0	5,601,903
1979	7,828,269	0	0	0	0	0	7,828,269
1980	6,694,842	0	0	0	0	0	6,694,842
1981	5,894,005	0	0	0	0	0	5,894,005
1982	6,496,804	0	0	0	0	0	6,496,804
1983	4,317,000	0	0	0	0	0	4,317,000
1984	6,251,917	0	0	0	0	0	6,251,917
1985	5,739,393	0	0	0	0	0	5,739,393
1986	5,006,704	0	0	0	0	0	5,006,704

Year	Pounds Landed by State						TOTAL
	FL	GA	MS	AL	SC	TX	
1987	6,082,439	0	0	1,141	0	67	6,083,647
1988	6,308,430	0	0	0	0	0	6,308,430
1989	7,673,159	0	0	0	0	0	7,673,159
1990	5,986,170	0	0	0	0	0	5,986,170
1991	7,022,809	0	0	0	0	0	7,022,809
1992	4,486,421	0	0	0	0	0	4,486,421
1993	5,378,807	0	0	0	0	0	5,378,807
1994	7,104,204	0	0	0	0	0	7,104,204
1995	7,023,938	0	0	0	0	0	7,023,938
1996	7,868,547	0	0	0	0	0	7,868,547
1997	7,107,518	0	0	0	0	0	7,107,518
1998	5,829,132	0	0	0	0	0	5,829,132
1999	7,529,605	0	0	0	0	0	7,529,605
2000	5,772,670	0	0	0	0	0	5,772,670
2001	3,411,253	0	0	0	0	0	3,411,253
2002	4,484,598	0	0	0	0	0	4,484,598
2003	4,269,831	0	0	0	0	0	4,269,831
2004	5,006,383	0	0	0	0	0	5,006,383
2005	3,369,856	0	0	0	0	0	3,369,856
2006	4,773,995	0	0	0	0	0	4,773,995
2006/07*	4,799,000	0	0	0	0	0	4,799,000
2007/08*	3,782,000	0	0	0	0	0	3,782,000
2008/09*	3,271,000	0	0	0	0	0	3,271,000
2009/10*	3,541,000	0	0	0	0	0	3,541,000

Source: NMFS Accumulated Landings System.
*Harvests tabulated on a fishing year basis (July-June) and not calendar year. Assessment conducted for the entire Southeast and not by state, but all landings assumed to occur in Florida, consistent with history of the fishery.

The Caribbean spiny lobster in the U.S. Exclusive Economic Zone (EEZ) of the Atlantic Ocean and Gulf of Mexico is jointly managed by the South Atlantic and Gulf of Mexico Fishery Management Councils (Councils) through the Fishery Management Plan for Spiny Lobster (Spiny Lobster FMP) in the Gulf of Mexico and South Atlantic. In the U.S. EEZ of the Caribbean Sea surrounding Puerto Rico and the U.S. Virgin Islands, the resource is managed by the Caribbean Fishery Management Council through a separate FMP. In the Gulf and South Atlantic, the commercial fishery, and to a large extent the recreational fishery, occurs off South Florida, primarily in the Florida Keys. In order to streamline a management process that involves both state and federal jurisdictions, the Spiny Lobster FMP basically extends the Florida FWC rules regulating the state fishery to the southeastern U.S. EEZ from North Carolina to Texas.

Currently, harvest or possession of spiny lobsters in the U.S. South Atlantic EEZ is regulated in the Code of Federal Regulations (CFR). According to 50 CFR 640.4, anyone who sells, trades, or barters or attempts to sell, trade, or barter spiny lobster that was harvested or possessed in the EEZ off Florida, or harvested in the EEZ other than off Florida and landed in Florida must have licenses and certificates specified to be a commercial harvester, as defined in the Florida Administrative Code. Similarly, any person who sells, trades, or barters or attempts to sell, trade, or barter a Caribbean spiny lobster harvest in the U.S. EEZ other than off Florida, a Federal vessel permit must be issued and on board the harvesting vessel (50 CFR §640.4(a)(1)(ii)). In 2010, the state of Florida issued 1,286 commercial spiny lobster permits and 293 commercial dive permits. As of November 15, 2010, NOAA Fisheries Service listed 196 valid federal spiny lobster permits.

The commercial and recreational fishing season for spiny lobster in the EEZ off Florida and the EEZ off the Gulf States, other than Florida, begins on August 6 and ends on March 31 (50 CFR §640.20(b)). Spiny lobster traps may be worked during daylight hours only, and no spiny lobster can be harvested by diving at night in excess of the bag limit. Specifications for traps and buoys, identification requirements, and prohibited gear are detailed in the Florida Administrative Code (68B-24.006).

No person may possess a Caribbean spiny lobster in or from the Gulf and South Atlantic EEZ with a carapace length of 3.0 inches (7.62 cm) or less or a separated tail with a length less than 5.5 inches (13.97 cm) (50 CFR §640.21(b)), except under particular circumstances. The holder of a valid crawfish license, lobster trap certificates, and a valid SPL may harvest and possess, while on the water, undersized spiny lobsters to use as attractants. Florida regulations allow for 50 such undersized attractants plus one per trap aboard each vessel, but Federal regulations allow for 50 or one per trap. Both sets of regulations require the use of live wells for undersized lobsters that follow specific guidelines. The possession aboard a fishing vessel of a separated spiny lobster tail is allowed only during trips of 48 hours or more if Federal tail-separation permit has been issued to that vessel. As of November 15, 2010, NOAA Fisheries Service listed 357 valid federal tailing permits.

Current regulation prohibits the possession of a spiny lobster or parts thereof in or from the Gulf and South Atlantic EEZ from which the eggs, swimmerettes or pleopods have been removed (50 CFR §640.21(a)); and requires any berried spiny lobster to be returned immediately to the water (50 CFR §640.7(g)).

3.1.2 Other Federal Laws and Regulations that Protect Spiny Lobster

Lacey Act

The Lacey Act, as amended in 1981 (16 USC §§ 3372 et seq.) prohibits any person from importing, exporting, transporting, selling, receiving, acquiring, or purchasing in interstate or foreign commerce any fish or wildlife taken, possessed, transported, or sold in violation of any law or regulation of any state or in violation of any foreign law. For example, it is a violation of the Lacey Act to import Caribbean spiny lobster that is in violation of the exporting country's minimum harvest-size standard. Many of the countries that harvest Caribbean spiny lobster have minimum harvest size standards.

Florida Keys National Marine Sanctuary and Protection Act

In November 1990, Congress passed the Florida Keys National Marine Sanctuary and Protection Act that established the Florida Keys National Marine Sanctuary (FKNMS) (Pub.L 101-605).[1] The FKNMS is comprised of 9,660 square kilometers (about 2,900 square nautical miles) of coastal waters off the Florida Keys. It extends approximately 220 miles southwest of the southern tip of the Florida peninsula and includes the world's third largest coral barrier reef. Within the Sanctuary are 24 no-take zones. Fifty-eight percent of the Sanctuary resides in Florida waters and 42% is in federal waters. Both NOAA and the State of Florida manage the Sanctuary. The waters of the FKNMS are within the jurisdiction of both the South Atlantic and Gulf of Mexico fishery management councils.

Biscayne Bay National Park

Originally established as a national monument by Congress in 1968, Biscayne Bay National Park was re-designated as a national park in 1980. The Park's purpose is to preserve and protect its rare combination of terrestrial and aquatic natural resources. The Park includes approximately 173,000 acres in Miami-Dade County, and is about 22 miles long. The park extends from shore about 14 miles to the 60-foot contour and contains about 72,000 acres of coral reefs. Under existing Supervisor's rules for the Park, several areas are closed year-round to public entry to protect sensitive resources and wildlife. This also means not taking Caribbean spiny lobster in those areas.

Dry Tortugas National Park

The Dry Tortugas National Park was established by Congress in 1992 (Public Law 102-525). Possession of Caribbean spiny lobster is prohibited within boundaries of the park unless the individual took the lobster outside the park waters and the person in possession has proper State/Federal licenses and permits (36 CFR § 7.27(b)(4)(i)). The presence of lobster aboard a vessel in park waters, while one or more persons from such vessel are overboard constitutes prima facie evidence that the lobsters were harvested from park waters in violation of the above regulation.

State Spiny Lobster Laws and Fisheries Histories

Descriptions and discussions of the development of the spiny lobster fishery in Florida are provided in Labisky et al. (1980), Moe (1991), Florida Marine Fisheries Commission (1991), Prohaska and Baarda (1975), and Williams (1976) and are incorporated herein by reference. Significant events or facts about the development of the fishery include the fishery being primarily a bait fishery up until the twentieth century (Labisky et al. 1980); the development of freeze processing enabling the expansion of the retail market in the 1940's; the development of SCUBA, hydraulic systems to haul traps, and the use of shorts (Moe 1991); the first gear restriction imposed in 1965 (trap regulations; Prohaska and Baarda 1975 and Williams 1976); the establishment of the first minimum size limit (3 inches carapace length and 5.5 inches tail length) in 1965; the enactment of the special two-day sport season in 1975; the development of the state fishery management plan in 1987; and the creation in 1991 of the recreational spiny lobster license initiation of annual

[1] The National Marine Sanctuary System was created in 1972. Two areas in the Florida Keys were designated as sanctuaries, the first in 1975 and the second in 1981. These areas were included in the Florida Keys National Marine Sanctuary in November 1990.

surveys to estimate recreational harvests.

The number of traps increased greatly from the mid 1970s through the 1980s, rising from 219,100 in 1970 to 979,766 in 1991 (Figure 3.1.1.1). This rapid growth resulted in increased user conflicts on the water, excessive mortality of shorts, declining yield per trap, and concerns about trap debris (FWC 2007)."

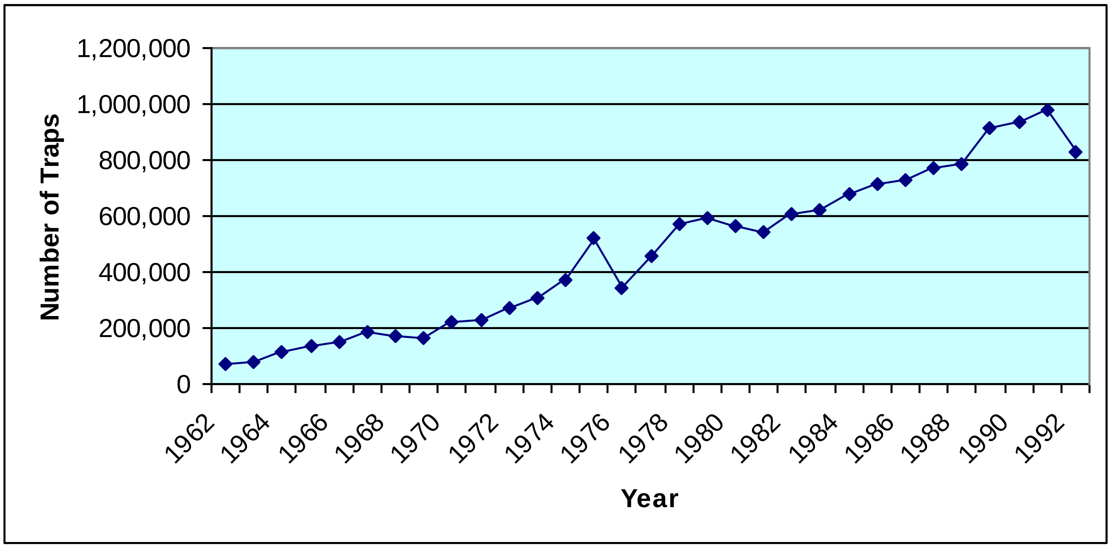

Figure 3.1.1.1. Annual numbers of lobster traps, 1962 – 1993.

In 1992, Florida implemented the spiny lobster Trap Certificate Program (TCP), which regulated the total number of traps by requiring a certificate for each trap and setting a limit on the number of certificates. When first implemented, the initial certificate allocation was based on the trap use that had been reported for the three preceding years (Larkin and Milon ?).

The FWC is authorized to reduce the total number of certificates by decreasing the number of each individual's traps by no more than 10% annually. In 1993, Caribbean spiny lobster fishermen set 704,234 traps. That same year, the Florida FWC implemented the TCP to reduce the number of lobster traps allowed in the fishery. Since the initial allocation of certificates, the Florida FWC has decreased the number of certificates four times at 10% reductions: 1994, 1995, 1996, and 1999. In 2001, the Florida FWC set the target number of spiny lobster traps at 400,000 and implemented a 4% annual reduction in traps. The Florida FWC suspended the annual trap reduction in 2003; nonetheless, the program has resulted in a significant reduction in the annual numbers of traps set. During the 2005 - 2006 season, 497,042 trap tag certificates were issued; followed by 473,943 for the 2006 - 2007 season and as of December 21, 2007, there were a total of 475,320 trap tag certificates for the 2007 - 2008 season.

A crawfish endorsement or crawfish license, also known as a trap number, is required for any person to use traps to harvest spiny lobster or take spiny lobster in commercial quantities (68B-24.0055(1)). No one who owns one or more lobster trap certificates can be issued a commercial dive permit (68B-24.0055(2)(b)). As of January 1, 2005, and until January 1, 2010, no new commercial dive permits will be issued and no commercial dive permit will be renewed or replaced except those that were active during the 2004 – 2006 fishing season. Existing permits may only be issued to a single saltwater products license with a valid crawfish endorsement and a valid restricted species endorsement (68B-24.005(2)(c)). Failure to renew the commercial dive permit by September 30 of each year results in forfeiture of the permit. Numbers of both types of permits have declined over the years (Figure 3.1.1.2).

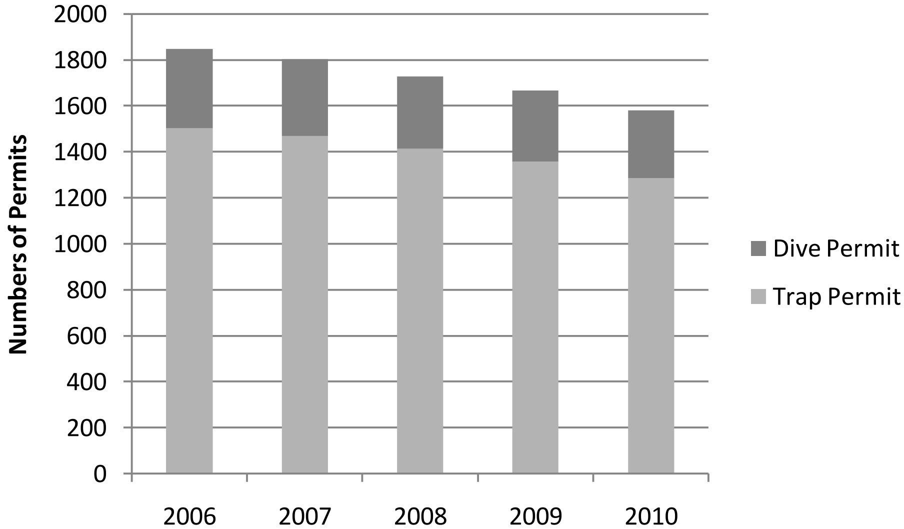

Figure 3.1.1.2. Number of commercial crawfish/lobster endorsements issued by Florida.
Source: Florida Fish and Wildlife Conservation Commission.

On August 5, 1994, the Special Recreational Crawfish License (SRCL) was issued after the implementation of the commercial spiny lobster trap certificate program (68B-24.0035, FAC). The SRCL was intended to reduce the adverse impact on recreational fishers who were commercially licensed and using traps, but were prohibited from using lobster traps because they did not meet the qualifications that were established from the commercial lobster trap certificate program.[2] SRCLs are not issued to persons who did not possess a crawfish trap number (Crawfish Endorsement) and a Saltwater Products License during the 1993 – 1994 license year (68B-24.0035(2)(b), FAC). No person issued a SRCL may also possess a Crawfish Endorsement. An SRCL is not valid unless the holder also possesses a valid Recreational Crawfish Permit required by Section 372.57(8)(d), Florida Statutes. Moreover, if the SRCL is not renewed every year, the holder loses the license. The SRCL applies to recreational fishers in state, not federal, waters, and does not permit harvesting lobsters during the two-day sport season. License holders are required to file quarterly reports with the Florida FWC detailing the amount of spiny lobster harvested in the previous quarter together with the amount harvested by other recreational harvesters aboard the license holder’s vessel (68B-24.0035(2)(e), FAC).

[2] A commercial license was/is required because traps were/are not legally acceptable gear in the recreational spiny lobster fishery.

Currently, Florida law requires anyone who commercially harvests or sells spiny lobster to have a Saltwater Products License (SPL). An SPL may be issued in the name of an individual or a valid vessel registration number issued in the name of the licensed applicant. The State also requires anyone who sells spiny lobster to have an RSE and Crawfish Endorsement.

Spiny lobster harvested in Florida waters must remain in a whole condition while on or below state waters and the practice of separating the tail from the body is prohibited (68B-24.003(4), FAC). Possession of spiny lobster tails that have been separated on or below state waters is prohibited unless the spiny lobster is being imported pursuant to 68B-24.0045 (FAC), or were harvested outside state waters and the separation was pursuant to a federal permit allowing such separation. If tails are separated from the body, tails must be at least 5.5 inches in length,[3] otherwise, if whole, the carapace must be greater than 3 inches long (68B-24.003(1), FAC.).

In Florida, the harvest or possession of egg-bearing spiny lobster is prohibited and any egg-bearing lobster found in traps must be immediately returned to the water free, alive and unharmed (68B-24.007 FAC). The practice of stripping or otherwise molesting egg-bearing spiny lobster in order to remove the eggs is prohibited and the possession of spiny lobster or spiny lobster tails from which the eggs, swimmerets or pleopods have been removed or stripped is prohibited (68B-24.007 FAC).

Possession of undersized lobster is prohibited, except in the spiny lobster trap fishery, where fishermen use undersized lobsters to attract legal-sized ones. Allowable gears are traps, hand-held net, hoop net (diameter no larger than 10 feet), bully net (diameter no larger than 3 feet), and by diving. The vessel limit for harvest with a bully net is 250 lobsters per vessel per day, for the trap fishery there is no bag or trip limit, and limits for the dive fishery are regional. Additional restrictions and requirements depend on the method of harvest.

For those in the spiny lobster trap fishery, trap certificates and tags are required for all traps. A tag must be securely attached to each trap; spiny lobster trap specifications and trap, buoy, and vessel marking requirements apply; and traps, buoys, and vessels must display the Crawfish endorsement number. Traps must be constructed of wood or plastic and be no larger than 3 feet by 2 feet or the volumetric equivalent (12 cubic feet) with the entrance located on top of the trap. Each plastic trap must have a degradable panel. Traps may be baited and placed in the water beginning August 1. Traps may be worked during daylight hours only. Traps may not be placed within 100 feet of the intracoastal waterway or any bridge or seawall. Traps must be removed from the water by April 5 each year. Harvest is prohibited in designated areas of John Pennekamp Coral Reef State Park. Florida law authorizes Florida FWC to retrieve traps left in the water after the close of the season and fines the traps' owners to cover the costs of retrieving the traps.

All vessels used by persons commercially harvesting lobster by diving, scuba, or snorkel must display the Commercial Dive Permit on the vessel SPL. A person with a Commercial Dive Permit cannot have a trap certificate. After January 1, 2005, no diver

[3] No less than 5.5 inches not including any protruding muscle tissue.

permits were issued, renewed or replaced except those that were active in 2004-05. Dive permits that are not renewed by September 30 of each year are forfeited. A 250-lobster daily vessel limit applies in Broward, Dade, Monroe, Collier, and Lee counties and adjoining federal waters.

The commercial and regular recreational Caribbean spiny lobster seasons start on August 6 and end on March 31 (68B-24.005(1). No person can harvest, attempt to harvest, or have in his possession, regardless of where taken, any spiny lobster during the closed season of April 1 through August 5 of each year, except during the two-day sport season, for storage and distribution of lawfully possessed inventory stocks or by special permit issued by the Florida FWC (68B-24.005(1)). During the two-day sport season no person can harvest spiny lobster by any means other than by diving or with the use of a bully net or hoop net.

A Wholesale Dealer License is required for any person, firm or corporation that sells spiny lobster to any person, firm, or corporation except to the consumer and who may buy spiny lobster from any person pursuant to section 370.06(2) of the Florida Statutes or any licensed wholesale dealer.

Zoning laws have indirectly affected the spiny lobster fishery in south Florida. In August 1986, Monroe County changed its zoning laws by implementing the Monroe County Land Use Plan (Plan). Under the Plan, commercial fishers must store, build, repair, and dip traps in industrial or commercially zoned areas, within areas designated as commercial fishing villages or in areas termed specific fishing districts (Johnson & Orbach, 1990).[4] Prior to the zoning change, fishers could store and work on traps on residential property. Under Article V, Section 9.5 – 143(f) of the Monroe County Ordinances, where a nonconforming use of land or structure is discontinued or abandoned for 6 months or 1 year in the case of stored lobster traps, then such use may not be reestablished or resumed, and subsequent use must conform to provisions detailed in the chapter of the ordinances.

3.1.3 Recreational Fishery – Caribbean Spiny Lobster

Introduction

Like the commercial fishery, the recreational fishery is concentrated along the Florida Keys. In 2008, for example, approximately 63.5% of the 962,000 lobsters that were harvested during the two-day sport season and first month of the regular season were harvested in the Keys, and approximately 35.9% (345,000) were harvested in the southeast coast of the state. See Figure 3.1.2.1. Less than 1% as harvested elsewhere in the state. Approximately 60% of the statewide effort is located in the Florida Keys (Florida Fish and Wildlife Conservation Commission 2002).

[4] Traps used to be dipped in recycled oil to protect them from the marine environment. However, that practice was prohibited beginning in 1995. Now fishermen soak traps in a brine solution to extend the life of their traps.

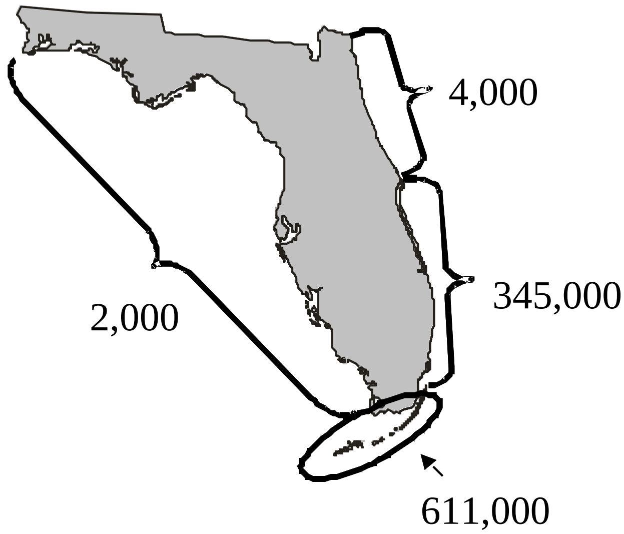

Figure 3.1.2.1. Preliminary estimate of numbers of lobsters landed by recreational lobster fishers during the 2008 Special Two-Day Sport Season and first month of the regular lobster fishing season.
Source: Florida Fish & Wildlife Conservation Commission, Florida Fish & Wildlife Research Institute.

The large majority of recreational landings are taken by divers who tend to target spiny lobster in similar areas as commercial divers. Little fishing effort occurs north of Monroe County on the Gulf side. The recreational fishery is largely observed from docks, boats, residential properties, and numerous other places along the Florida Keys and southernmost counties where a diver can get into the water from shore or from boats or platforms where an individual can use a bully or hoop net. The geographic variability has made the inclusion of spiny lobster in the Marine Recreational Fisheries Statistics Survey (MRFSS) cost prohibitive. There has been and continues to be no evidence of subsistence fishing for spiny lobster (SAFMC & GFMC 1982: p. 8-3).

The recreational spiny lobster fishing season has two parts: a two-day sport season that occurs before commercial spiny lobster fishers place their traps in the water and a regular season that coincides with the commercial fishing season. The two-day sport season has been and remains popular as illustrated by a July 28, 1991, article in the *St. Petersburg Times* that concerns "lobstermania" and a July 30, 2009, *Miami Herald* article with the title, "Lobster hunters turn out in droves for Florida mini-season." Recreational spiny lobster fishers individually spend hundreds of dollars for fuel, ramp fees, food, beverages, scuba, snorkeling and hooking equipment and licenses annually. At the same time, however, there have been and continue to be residents and business and commercial interests in the Keys who favor abolishing the sport season. Processors are among those who are critical of the sport season. Shivlani *et al*. (2004) reported that 11% of the processors that they interviewed blamed the sport season for declining commercial landings.

Mail surveys of Florida's recreational lobster permit holders indicate that they fish only a few days each fishing season. Ninety-five percent fish 10 days or less, 59% fish 4 days or less, and 30% fish 1 or 2 days (FFWCC 2006a).

The state of Florida has a variety of permits that will allow recreational fishers to take spiny lobster. In 2010, the state issued 129,865 annual or five-year crawfish permits; in addition, they issued 36,030 other permits, such as Sportsman Gold or Saltwater Lifetime permit, that also allow holders to take spiny lobster. NOAA Fisheries Service does not require a permit for recreational fishing in the EEZ.

The commercial and regular recreational fishing season for spiny lobster in the EEZ off Florida and the EEZ off the Gulf States, other than Florida, begins on August 6 and ends on March 31 (50 CFR §640.20(b)). No person may possess a Caribbean spiny lobster in or from the Gulf and South Atlantic EEZ with a carapace length of 3.0 inches (7.62 cm) or less or a separated tail with a length less than 5.5 inches (13.97 cm) (50 CFR §640.21(b)).

State Spiny Lobster Laws and Fisheries Histories

The popularizations of scuba and hookah diving and development of small fiberglass pleasure boats in the 1950s and 1960s increased recreational access to the spiny lobster fishery. Fiberglass boats had many advantages over wooden boats. First, the average retail price of a fiberglass boat was significantly less than the price of a similarly sized wooden boat because fiberglass boats could be constructed faster and cheaper. Second, because the hulls of fiberglass boats were lighter than those of comparably sized wooden boats, fiberglass boats could be powered by smaller engines or outboard motors, which were less costly. Third, the location of outboard motors at the back of the boat increased the rate of speed that a boat could travel because inboard motors were at the middle of the boat giving it a more forward center of gravity that slowed the boat. Fourth, smaller fiberglass boats could be towed on a trailer and didn't require a marina or dock space for storage. Recreational fishers could now trailer their boats, and get to and from fishing areas faster and with less costly boats.

Recreational diving for lobsters and associated tourism increased in the Florida Keys in the 1960s (Labisky *et al*. 1980). By the early 1970s, there were increasing conflicts between Florida's commercial fishers and recreational divers who harvested spiny lobster, so in 1975 the state enacted legislation that created the Special Two-Day Sport Season, which was originally established as July 20 and 21 of each year before the regular season began on July 26. Another purpose of the sport season was to increase tourism in the Keys, which in the early to mid 1970s was experiencing an economic downturn (Shivlani 2009). By the early 1980s free divers taking lobsters by hand accounted for most of the recreational catch. Divers from the outside of southern Florida generally used charter or party boats. The charter boats were typically hired by diving clubs, while party boats operated out of dive shops along the Florida Keys. Those boats carried from 30 to 50 divers and had a commercial lobster license that allowed for the combined harvests of the divers.

The Gulf and South Atlantic Spiny Lobster FMP was implemented on July 26, 1982 (47 *Federal Register (FR)* 29203). The federal FMP, for the most part, extended Florida's rules of regulating the fishery to the EEZ throughout the range of the fishery (see Section 1.4).

The Florida Marine Fisheries Commission (FMFC) adopted its first fisheries management plan (state FMP) for spiny lobster on July 2, 1987. For the most part, the management plan continued existing practices. A recreational bag limit of six lobsters per person per day was established for both the regular and two-day sport seasons. In 1987, the sport season was switched to the last weekend in July.

In November 1990, Congress passed the Florida Keys National Marine Sanctuary and Protection Act that established the Florida Keys National Marine Sanctuary (FKNMS) (Pub.L 101-605). The FKNMS is comprised of 9,660 square kilometers (about 2,900 square nautical miles) of coastal waters off the Florida Keys. It extends approximately 220 miles southwest of the southern tip of the Florida peninsula and includes the world's third largest coral barrier reef. Within the Sanctuary are 24 no-take zones. Fifty-eight percent of the Sanctuary resides in Florida waters and 48% is in federal waters. Both NOAA and the State of Florida manage the Sanctuary. The waters of the FKNMS are within the jurisdiction of both the South Atlantic and Gulf of Mexico fishery management councils. Lobster fishing is prohibited in the following no-take areas of the FKNMS: Carysfort Reef, Elbow, Key Largo Dry Rocks, Grecian Rocks, French Reef, Molasses Reef, Conch Reef, Hen and Chicken, Davis Reef, Cheeca Rocks, Alligator Reef, Tennessee Reef Research Only, Coffins Patch, Sombrero Key, Newfound Harbor, Looe Key Research Only, Looe Key, Eastern Sambo, Western Sambo, Eastern Dry Rocks, Rock Key, Sand Key, and Tortugas (Figure 3.4.2.2). No lobster fishing is allowed in the John Pennekamp Coral Reef State Park during the Special Two-Day Sport Season. During the regular season, no person can harvest lobster from or within any coral formation (patch reef). Lobster fishing is also prohibited in artificial habitat in Florida waters, Biscayne Bay/Card Sound Spiny Lobster Sanctuary, Everglades National Park, and Dry Tortugas National Park. Biscayne Bay National Park includes approximately 173,000 acres in Miami-Dade County and is about 22 miles long. The park extends from shore to about 14 miles to the 6-foot contour and contains about 72,000 acres of coral reefs.

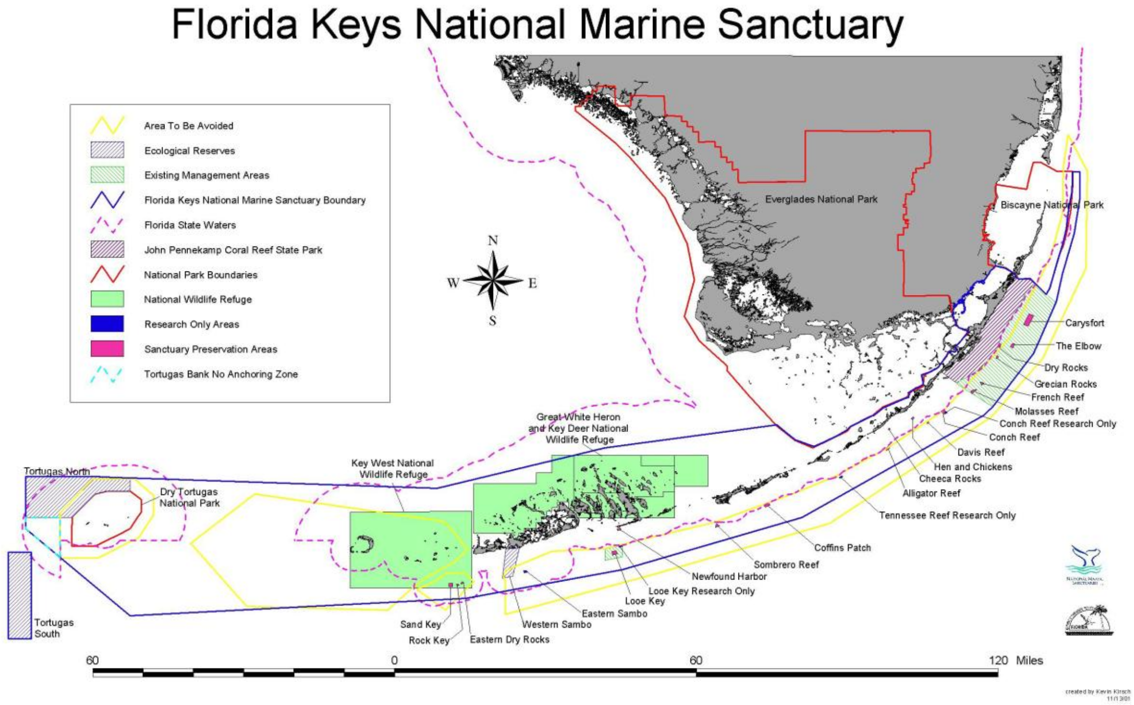

Figure 3.1.2.2. Florida Keys National Marine Sanctuary.

Until 1991, the recreational spiny lobster fishery had been an open-access fishery managed through a personal daily bag limit, a closed season and gear restrictions. There was no institutional mechanism to estimate the number of recreational spiny lobster fishers and their landings. Florida instituted a recreational spiny lobster permit/license in 1991, which was purchased as an additional endorsement to the state's saltwater fishing license. That same year, the state began to use two annual mail surveys of persons with a recreational lobster permit to estimate the number of persons who harvested lobsters under the permit and their landings of lobsters during the Special Two-Day Sport Season and from opening day to the first Monday in September of the regular fishing season. Reviews of the 1991 survey resulted in several modifications that are seen in the 1992 survey and thereafter.

By 1991, the popularity of the two-day sport season during the last weekend in July was so great that the St. Petersburg Times described it as "lobstermania." The large number of participants in the sport season "created extensive problems that lead to a general consensus by the county commission and Key West Chamber of Commerce that the [sport] season should be abolished or otherwise modified to spread out recreational fishing over a longer period" (GFMC and SAFMC 1993: 2). Significant numbers of Keys residents and businesses also supported the elimination or modification of the two-day sport season. Among the problems were: 1) the inability of law enforcement to function effectively in the face of overwhelming effort, 2) enormous harvester-related traffic congestion (both on land and in the water) and associated safety problems, and 3) a high incidence of resource violations for lobster and other marine species, including unintentional damage to coral. Among the violations cited by law enforcement were taking of undersized lobsters, no dive flags, exceeding the bag limit, and use of prohibited gear. Unsafe practices included, but were not limited to, poor seamanship and diving in heavily traveled boat lanes. Recreational fishers and dive operations, however, strongly supported retention of the sport season, and argued that it contributed significantly to the economy of Monroe County despite its brevity.

In response to growing criticism of the sport season, the FMFC implemented a series of regulatory changes prior to the 1992-93 season that were designed to reduce the growing numbers of fishers traveling to the Keys during the two-day sport season and their associated negative impacts (Sharp *et al*. 2005). The changes included rescheduling the sport season from the weekend to the last Wednesday and Thursday in July, increasing the daily lobster bag limit outside the Florida Keys from 6 to 12 lobsters per person, and banning night diving in the Keys. The timing of the federal two-day sport season, however, did not change for the 1992 season and remained to be during the last weekend in July, resulting in two sport seasons that year. Since 1993, however, both the state and federal special sport seasons have co-occurred on the last Wednesday/Thursday in July (William Sharpe, Florida Fish and Wildlife Conservation Commission, personal communication, November 2010).

The Dry Tortugas National Park was established by Congress in 1992 (Public Law 102-525). Possession of Caribbean spiny lobster is prohibited within boundaries of the park unless the individual took the lobster outside the park waters and the person in possession has proper State/Federal licenses and permits (36 CFR § 7.27(b)(4)(i)). The presence of lobster aboard a vessel in park waters, while one or more persons from such vessel are overboard constitutes prima facie evidence that the lobsters were harvested from park waters in violation of the above regulation.

Until 1993, recreational harvesters included persons who purchased a commercial permit to exceed the bag limit and to use traps. Florida's implementation of the restricted species endorsement (RSE) in 1993 for lobsters meant those recreational harvesters were no longer able to exceed the bag limit because they would not meet the qualifications required of the endorsement. On August 5, 1994, the Special Recreational Crawfish License (SRCL) was issued after the implementation of the commercial spiny lobster trap certificate program. The SRCL was intended to reduce the adverse impact on recreational fishers who had been commercially licensed and using traps, but were prohibited from using lobster traps because they did not meet the qualifications that were established from the commercial lobster trap certificate program. Recreational fishers with commercial licenses who used traps with few or no reported landings received ten trap tags pursuant to the trap reduction program. SRCLs are no longer issued and cannot be transferred from the original person it was issued to. Moreover, if the SRCL is not renewed every year, the holder loses the license. The SRCL applies to recreational fishers in state, not federal, waters, and does not permit harvesting lobsters during the two-day sport season.

Information provided in Sharp *et al*. (2005) suggests Florida's regulatory changes combined with subsequent federal regulatory changes have been successful in reducing the adverse impacts caused by the two-day sport season; however, by 2006 there remained political pressure to either end the sport season or further restrict it (Florida FWC 2006c).

Presently, the sport season is scheduled the last consecutive Wednesday and Thursday of July each year, one week before the start of the commercial season. During the Special Two-Day Sport Season, recreational fishers are allowed up to six lobsters per person per day in Monroe County and Biscayne Bay National Park and up to 12 lobsters per person per day in other areas of the state. The bag limit during the regular recreational lobster-fishing season is six lobsters per person per day. During the sport season diving at night for lobster is not permitted in Monroe County or adjacent federal waters. Bully netting and hoop netting are allowed at night. During the regular season, diving at night for lobster is allowed.

A person does not need a saltwater fishing license or spiny lobster permit if s/he is fishing from a for-hire vessel (guide, charter, party boat) that has a valid vessel license in Florida waters (http://myfwc.com/License/LicPermit_RecreationalHF.htm). Hence, not all persons who harvest spiny lobster have a permit (because they are not required to) and are not included in the official numbers of recreational fishers.

Recreational Landings and Catch per Unit Effort

Estimates of the recreational spiny lobster landings are provided in Figure 3.1.2.3 and Tables 3.1.2.1 and 3.1.2.2. Statewide recreational fishing effort showed a marginally significant decreasing trend from 1993 to 2002 (Figure 3.1.2.3), as did recreational fishing for lobster in the Keys (Sharp *et al*. 2005). However, a statistically significant declining trend did not occur in the southeast region. From 1999 to 2002, there was a general decline in the number of persons holding a lobster permit and the average number of days a person fished. In 2004, there were numerous tropical storms, which substantially disrupted recreational lobster fishing. Although recreational landings fell substantially from 1999 to 2005 and sport landings fell similarly during this period, the recreational fishery's share of the total lobster catch did not similarly slide (Table 3.1.2.2).

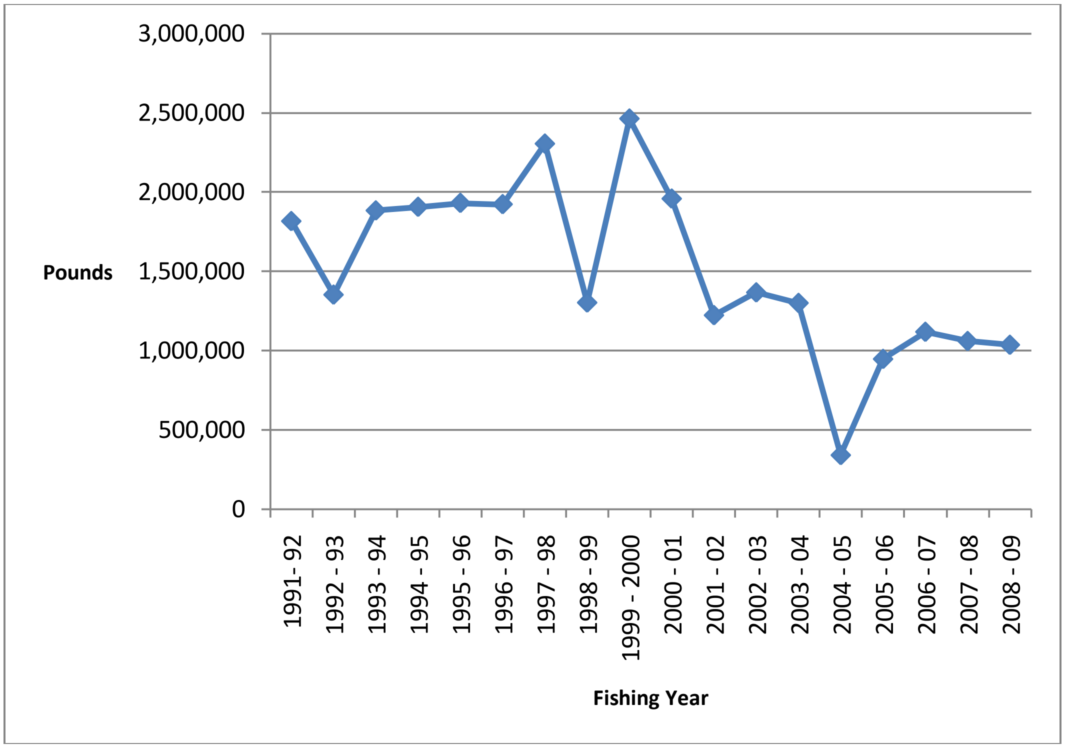

Figure 3.1.2.3. Recreational Landings of Spiny Lobster, 1991-92 to 2008-09.
Source: Florida Fish & Wildlife Conservation Commission, Updated 9/29/09.

Average recreational landings from 1991-92 to 2008-09 were approximately 1.5 million pounds, though landings were consistently higher than this average during the 1990's through 2001, declining to closer to 1 million pounds per season in recent years (see Figure 3.1.2.3 and Table 3.1.2.2).

Table 3.1.2.1. Florida Landings of Caribbean Spiny lobster, 1991-92 through 2003-2004 Fishing Seasons.

Fishing Season	Percent Recreational Landings	Percent Commercial Landings
1991-92	20.99	79.01
1992-93	20.12	79.88
1993-94	26.18	73.82
1994-95	20.97	79.03
1995-96	21.58	78.42
1996-97	19.89	80.11
1997-98	23.17	76.83
1998-99	19.30	80.70
1999-00	24.30	75.70
2000-01	25.93	74.07
2001-02	28.89	71.11
2002-03	24.12	75.88
2003-04	25.33	74.67
2004-05	*	*
2005-06	27.62	72.38
2006-07	21.37	78.63
2007-08	24.33	75.67
2008-09	27.87	72.13
2009-10	20.60	79.40

Source: Florida Fish & Wildlife Conservation Commission.
*The recreational survey was not completed in 2004 due to storms.

Table 3.1.2.2. Average Recreational Landings (Pounds), 1991-92 to 2008-09, Various Years.

Fishing Season	Recreational Landings (lbs)
1991-92 to 2003-04	1,765,109
1993-94 to 2001-02	1,957,538
2001-02 to 2003-04	1,372,629
2005-06 to 2009-10	1,208,163

Historical estimates of catch per unit effort are provided in Bertelsen and Hunt (1991) and Sharpe et al. (2005). The individual catch rate during the 1991 special two-day season was estimated to be 7.7 lobster per person per day for individuals fishing in the Keys (4.6 lobster for fishing outside the Keys), and 19.6 lobsters per day per group (approximately four persons; less than 11 lobsters per day per group outside the Keys) (Bertelsen and Hunt 1991). More recently, 382,892 lobsters were estimated harvested during the 2008-09 special season by approximately 97,195 person days, or an average of 3.94 lobsters per person per day. These totals declined to 251,360 lobsters, 85,903 person days, and 2.93 lobsters per person per day for the 2009-10 special season. For the regular season, an estimated 747,150 lobsters were harvested during the 2009-10 season by 284,237 person days, for an average of 2.63 lobsters per person per day.

Gears Used

Recreational fishers without an SRCL are not allowed to use traps to capture lobster. In the 1980s and prior to the SRCL, those using traps usually fished between five to twelve traps, but some fished as many as 25 traps (Johnson 1987). Bully nets and diving (breath-hold, SCUBA, or hookah) are the only legal recreational fishing methods. Divers must permanently and conspicuously display a 'divers down flag' placard on the vessel and affix the Commercial Dive Permit to the diagonal stripe with 10-inch numbers visible from the air and 4-inch numbers visible from the water. Harvest from artificial habitat is prohibited. Divers must possess a carapace measuring device and measure lobster in the water. The use of bleach or chemical solutions or simultaneous possession of spiny lobster and any plastic container capable of ejecting liquid is prohibited. Most recreational diving occurs in the Florida Keys and in moderately shallow waters.

A survey of recreational divers in the mid 1970s found that 95% of the free divers dove no deeper than 30 feet, while 81% of those who used SCUBA gear dove no deeper than 40 feet. None of the sampled divers reported diving deeper than 80 feet (SAFMC and GFMC 1982: p. 8-16). Some spiny lobsters were caught on shallow flats by recreational fishers using bully nets, but they represented only a small portion of the recreational catch.

Hookah fishing involves diving from a boat for lobster using an air compressor that supplies air for the diver through a long hose. See Figure 3.1.2.4. Multiple divers can be connected to the same compressor. The use of a hookah system has become increasingly popular because one can use it without becoming certified in scuba diving. Anyone can purchase a hookah system, although hookah diving shares many of the same risks as scuba diving such as decompression sickness and air embolism. Novice divers can stay under for longer periods of time than scuba divers, although there is always the risk of the hose breaking or dislodging from the compressor.

According to the FWC (2006a), the large proportion of recreational divers is highly active only at the start of the fishing season when the lobsters are most abundant. As the recreational lobster fishing season continues, the number of dive trips and number of lobsters recreational divers land declines rapidly. Also, there are many divers with a license are not active during the lobster fishing season.

Some divers, generally those from outside southern Florida, will use charter or party boats. Charter boats typically are hired by diving clubs while party boats operate out of dive shops along the Florida Keys (SAFMC & GFMC 1982: p. 8-8). These boats can hold from 30 to 50 divers and have commercial lobster licenses. In Florida, patrons aboard a fishing charter are not required to possess a recreational saltwater fishing permit because they are covered under the fishing license of the charter boat.

Figure 3.1.2.4. Hookah Diving Gear.
Source: www.bigbluetech.net/big-blue-tech-news/wp-content/uploads/2009/08/hookah_80175d.jpg.

Those who use bully nets perch on bows of boats at night, shine bright lights into the shallows and use a long-handled net to bag spiny lobsters that move out into the open (Cocking 2009). Recreational fishers are restricted to diving and bully/hoop netting. Spears, wire snares, hooks or any gear/device that could penetrate, puncture or crush the shell of a lobster is prohibited. Divers typically use a "tickle stick" to coerce lobsters from their dens into a hand-held net.

3.1.3 Other spiny lobster species

The spotted spiny lobster and smoothtail spiny lobster are found mostly inshore, generally in 15-20 feet of water and are considered obligate reef dwellers (Sharp et al. 1997). Further, individuals are relatively small. For these reasons, commercial fishers in the Florida Keys generally do not target these species in U.S. federal waters (W. Kelley, personal communications). A "luxury" fishery exists in Bermuda and parts of the Caribbean for the spotted spiny lobster (Evans and Lockwood 1995). The smoothtail spiny lobster supports a fishery in Brazil concurrent with a Caribbean spiny lobster fishery; this species is considered to be of minor importance elsewhere (FAO 2007).

Federal regulations prohibit the possession of egg-bearing Caribbean spiny lobster and the removal of eggs, swimmerettes or pleopods; Florida regulations prohibit the same for any species of Family Palinuridae. No commercial or recreational landings data are available for either of these species, although some may be reported as Caribbean spiny lobster.

3.1.4 Slipper lobster species

The commercial fishery for slipper lobsters is mainly for the ridged slipper lobster, *Scyllarides nodifer*, but landings data are by family only and not by species (Table 3.1.4.1). The following information is taken from Sharp et al. (2007) and Spanier and Lavalli (2006). The slipper lobster fishery is basically a trawl fishery by shrimpers, who harvest slipper lobsters as bycatch. In the Florida Keys, they are harvested by divers for the aquarium trade and are also bycatch in spiny lobster traps. The vast majority of landings are along the Florida west coast. A targeted fishery developed during the 1980s by trawlers during the off-season for shrimp (spring and summer). This is also the spawning season for slipper lobsters, and their migration into shallower water at this time likely contributed to their catchability. In 1987, Florida implemented regulations prohibiting the harvest of egg-bearing female or the removal of eggs by stripping or clipping the pleopods. Around this time, landings declined dramatically. Landings increased somewhat during the 1990's, then declined again and remained low since 1999. The number of shrimp trips also declined beginning in 1999 (Sharp et al. 2007).

Table 3.1.4.1. Commercial effort, landings, and CPUE (pounds/trip) of slipper lobsters in the Gulf and South Atlantic.

Year	Trips	Pounds (x1000)	Lbs/trip
86/87	535	28,097	53
87/88	487	19,952	41
88/89	558	40,736	73
89/90	334	14,793	44
90/91	465	27,282	59
91/92	653	48,728	75
92/93	584	48,708	83
93/94	655	60,230	92
94/95	411	33,531	82
95/96	362	26,843	74
96/97	437	43,565	100
97/98	335	30,872	92
98/99	225	13,139	58
99/00	146	7,196	49
00/01	145	8,766	60
01/02	179	8,582	48
02/03	130	9,951	77
03/04	132	17,012	129
04/05	72	5,000	69
05/06	63	4,291	68
06/07	56	6,060	108
07/08	23	6,443	280
08/09	22	1,889	86
04/05-08/09 Average	47	5.0	24
99/00-08/09 Average	97	7.5	41.2

Source: SEFSC, FTT (19Mar10) data

The majority of the commercial landings for both the Spanish and ridged slipper lobsters, occur in federal waters off the Gulf coast (Figure 2.1.1). The gear types used to harvest these species by trips were 56% by trawl, 23% by diving, and 19% by traps, which was fairly consistent over the 10-year period. Low landings of slipper lobsters were also documented in federal South Atlantic waters and Florida state waters for the combined coasts. In the Florida Keys, slipper lobster species are bycatch in traps for Caribbean spiny lobster (Sharp et al. 2007).

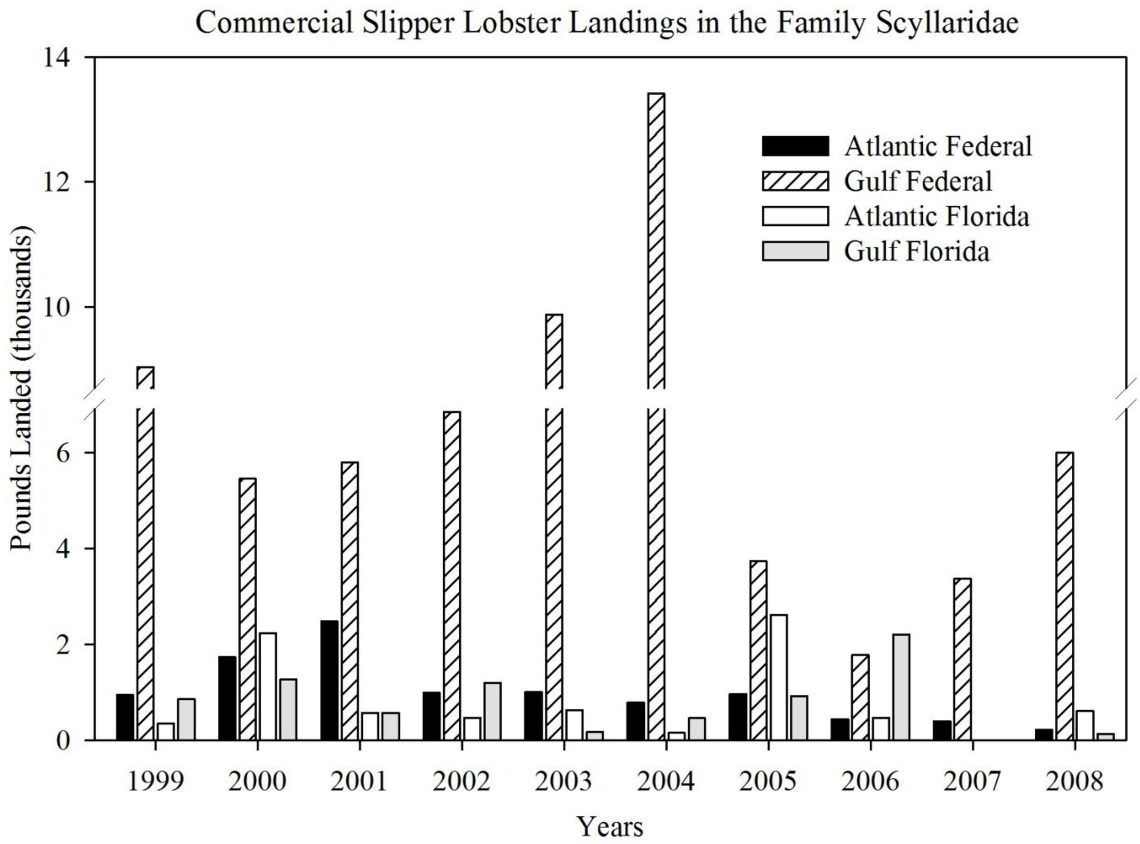

Figure 2.1.1. Commercial landings for the family Scyllaridae from 1999 through 2008 by coast in federal and state of Florida waters.
Source: Florida FWC, Marine Fisheries Information System 2009.
Note: This data is based on the trip ticket program. There is only one space is available for waters fished. Fishers could fish in both state and federal waters within one day, based on the season and other fishing behaviors. This figure should be viewed with some caution, because there could be additional unaccounted variability, due to the way the data is recorded and analyzed.

The Gulf States also had some information on slipper lobster landings. Alabama reported total commercial landings of 10,000 pounds or less whole animal weight of slipper lobsters during the 1999-2008 period. Landings records indicate that these species were incidentally caught from shrimp trawls fishing in federal waters off the west coast of Florida (C. Denson, Alabama Marine Resources Division, Alabama Department of Conservation and Natural Resources, personal communication). There were no reported landings for Mississippi, Louisiana, and Texas for slipper lobster species (Source: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html).

From the South Atlantic states, Georgia had no reported commercial landings of slipper lobster species in either state or federal waters for the years 1999-2008 (J. Califf, Commercial Fisheries Statistics Coordinator, Coastal Resources Division, Georgia Department of Natural Resources, personal communication). In South Carolina, there were no recorded landings of slipper lobster species in state or federal waters (G. Steele, Biological Statistician, South Carolina Department of Natural Resources, personal communication). In the state waters of North Carolina there were no recorded landings of slipper lobsters; however, during the years 1999, 2000, 2002, and 2005 commercial landings for slipper or spiny lobster were not recorded by the North Carolina Division of Marine Fisheries (A. Bianchi, Trip Ticket Coordinator, North Carolina Division of Marine Fisheries, personal communication).

Little information exists on harvest of slipper lobsters by the recreational sector. MRFSS does not survey lobster, and the State of Florida recreational survey does not collect information on any species except the Caribbean spiny lobster. A creel survey of spiny lobster fishermen indicated they did not target slipper lobsters (Sharp, et al 2007). These species are both cryptic and nocturnal, rendering them difficult to find by recreational divers. For this reason, they are unlikely to support a large recreational fishery.

Federal regulations prohibit the possession of a slipper lobster, defined as *Scyllarides nodifer* only, with eggs or from which the eggs, swimmerettes, or pleopods have been removed; Florida regulations prohibit the same for all species of Family Scyllaridae. Poisons and explosives may not be used to take slipper lobster in the EEZ.

3.2 Physical Environment

Note: This is taken directly from the Final Import Amendment 4/8. Given the large to near total dependence on recruitment from the Caribbean, it is appropriate to include the Caribbean area in the description of the physical environment.

> "The Caribbean Sea is an interior sea formed by a series of basins lying to the east of Central America and separated from the North American Basin of the Atlantic by an island arc 2,500 nautical miles long which joins the Florida Peninsula to the north coast of Venezuela. This arc is demarcated by the Greater Antilles (Cuba, Jamaica, Hispaniola, and Puerto Rico) and the Lesser Antilles (the Virgin Islands, Guadeloupe, Martinique, St. Lucia, Barbados, and Trinidad).
>
> Contained between the 10th and 30th degrees of north latitude, this interior sea has an elliptical form. The long northwest-southeast axis is 2,200 nautical miles and the short axis is 900 nautical miles. The total area of the Caribbean Basin is 4,320,000 km^2, divided into two unequal parts: 1) the Gulf of Mexico (1,700,000 km^2) and 2) the Caribbean Sea (2,600,000 km^2); separated by the Yucatan Peninsula and Cuba between which flows the Yucatan Channel (60 nautical miles wide and 2000 m deep).
>
> The Gulf of Mexico is a simple depression including an extended peripheral continental shelf representing more than one-third of the surface area of the Gulf, and a central basin whose maximum depth is 3800 m. The continental shelf is rich in oil-bearing strata. The Gulf of Mexico opens on the North American Basin by the single opening of the Straits of Florida, between the tip of Florida, the north coast of Cuba, and the Bahamas Archipelago. The width of the channel is 30-50 nautical miles and its greatest depth is 800 m.
>
> As a seismic and volcanic region, the Caribbean has a much more complex topography and has numerous openings into the North American Basin. The Jamaican Ridge, running from Cape Gracias a Dios to Jamaica and Hispaniola,

divides the Caribbean into two sections-one in the northwest, the other southeast, communicating across a 1500 m sill which is 20 nautical miles wide at 100m. The northwest basin is itself divided in two by the Cayman Ridge, which from the southwest point of Cuba runs toward, without reaching it, the Gulf of Honduras. Between the Gulf of Mexico and the Cayman Ridge lies the Yucatan Basin, of which the central part is 4700 m deep. At its western extremity it communicates freely at depth of more than 5000 m with the second basin, the Cayman Basin. In the eastern part of the Cayman Basin, between the southwest point of Cuba and against the Cayman Ridge lies a narrow trench 7680 m deep.

The southeast basin, more extensive than the northwest, is in turn subdivided into three by two ridges (Beata and the Aves), having a mostly north-south orientation, parallel to the general direction of the Lesser Antilles. Between the Jamaica and Beata Ridges lies the Colombian Basin, more than 4000 m deep. Between the Beata and Aves Ridges is the Venezuelan Basin which has depths between 4000 and 5000 m; and the Grenada Basin, with a depth of more than 3000 m, is held between the Aves Ridge and the chain of the Lesser Antilles. Because the Beata Ridge does not reach the north coast of Colombia, the Colombian and Venezuelan Basins exchange freely at depths of 1600 m. The main exchanges between the Caribbean and the North American Basin are: 1) the Windward Passage between the southeast of Cuba and the northwest part of Haiti, with a depth of 1650 m and a width of 12 nautical miles; and 2) the Anegada Passage, prolonged by the Virgin Islands Passage, with a depth of 1800 m and a length of 8 nautical miles, enabling the Atlantic to communicate with the Venezuelan Basin.

The channels between the islands of the Lesser Antilles are all of the order of a depth of 1000 m. Outside of the Greater Antilles chain, to the north of Puerto Rico and Hispaniola, lies the Puerto Rico trough, which has a maximum depth of 8648 m. This maximum depth is found no more than 200 km from a peak in Hispaniola, which reaches 3175 m for a relief of about 11,823 m in less than 200 km.

The Caribbean Basin is entirely in the tropical Atlantic. The mean annual temperature is near 25° C and seasonal variations are small. The winds, the eastern sector predominating, are tied to the trade wind system of the Northern Hemisphere. In the Gulf of Mexico in winter there is a rather marked northern component. Precipitation is 500 mm annually in the east and southeast Caribbean, 500-1000 mm annually over the Gulf of Mexico, and 2000 mm annually in the southwest part of the Caribbean (Tchernia 1980)."

The physical habitat in the South Atlantic Council's area of jurisdiction is described in the Fishery Ecosystem Plan (SAFMC 2009) and is incorporated by reference herein. Habitats and Speices in included in Volume II.

3.3 Biological Environment

3.3.1 Lobster

Family Palinuridae (Figure 3.3.1.1)

Figure 3.3.1.1. From left to right the following species are: Caribbean spiny lobster, smoothtail spiny lobster, spotted spiny lobster.
Source: Photograph from Florida FWC website.

Caribbean spiny lobster
Panulirus argus, is widely distributed throughout the western Atlantic Ocean as far north as North Carolina to as far south as Brazil including Bermuda, the Bahamas, Caribbean, and Central America (Herrnkind 1980; Figure 3.3.1.2). Analyses of DNA indicate a single stock structure for the Caribbean spiny lobster throughout its range (Lipcius and Cobb 1994; Silberman and Walsh 1994; Hunt et al. 2009). This species inhabits shallow waters, occasionally as deep as 295 ft (90 m), possibly even deeper. Caribbean spiny lobster can be found among rocks, on reefs, in grass beds or in any habitat that provides protection. The species is gregarious and migratory. Maximum total body length recorded is 18 inches (45 cm), but the average total body length for this species is 8 inches (20 cm; FAO Fisheries Synopsis 1991).

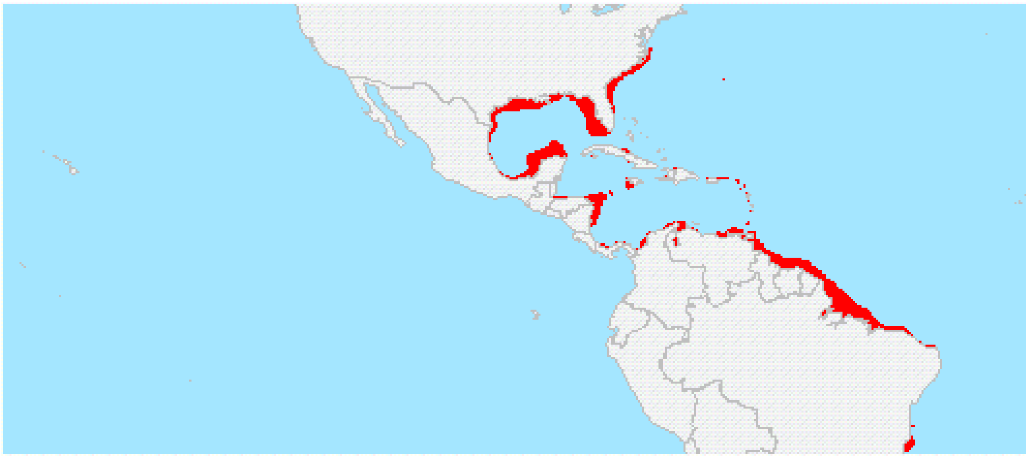

Figure 3.3.1.2. Distribution of Caribbean spiny lobster.
Source: FAO Fisheries Synopsis 1991; Joint CFMC-GMFMC-SAFMC Amendment 8, 2008.

Distribution and dispersal of Caribbean spiny lobster is determined by the long planktonic larval phase, called the puerulus, during which time the infant lobsters are carried by the currents until they become large enough to settle to the bottom (Davis and Dodrill 1989). As the lobsters begin metamorphosis from puerulus to the juvenile form, the ability to swim increases and they move into shallow, near shore environments to grow and develop.

Young benthic stages of Caribbean spiny lobster will typically inhabit branched clumps of red algae (*Laurencia sp*.), mangrove roots, seagrass banks, or sponges where they feed on invertebrates found within the microhabitat. In contrast to the social behavior of their older counterparts, the juvenile lobsters are solitary and show aggressive behavior to ensure they remain solitary. The inhabitation of macroalgae by the juvenile lobsters provides protection to the vulnerable individuals from predators while providing easy access to food sources (Marx and Hernkind 1985).

Individuals two to four years show nomadic behavior, emigrating out of the shallows and moving to deeper, offshore reef environments. Once in the adult phase, Caribbean spiny lobsters are thigmotactic and tend to enter social living arrangements aggregating in enclosed dens. Shelter environments may include natural holes in a reef, rocky outcrops, or artificially created environments (Lipcius and Cobb 1994).

Given the wide distribution of this species from Bermuda down to Brazil, it is hard to determine a definitive stock structure for this species. There are a multitude of currents and other factors that influence the movement of water throughout their range. The long duration that lobsters spend in the larval stage, traveling by the currents severely impairs the ability of scientists to determine a stock structure. Because Florida is "downstream" from most other spawning populations, Florida waters would be expected to receive recruits from many other areas (Hunt et al. 2009).

Silberman et al. (1994) and Hunt et al. (2009) concluded Caribbean spiny lobster is a single stock from Brazil to Bermuda, and throughout the Caribbean. Members of the stock assessment panel also suggested that very little self-recruitment occurs in Florida.

Studies have shown that the presence of local gyres or loop currents in certain locations could influence the retention of locally spawned larvae. In addition, benthic structures such as coral reef may disturb the flow of water and lead to the settlement of larvae in a particular location (Lee et. al. 1994).

The general anatomy of Caribbean spiny lobster conforms to the typical decapod body plan consisting of five cephalic and eight thoracic segments fused together to form the cephalothorax (Figure 3.3.1.3). The carapace, a hard shield-like structure, protects this portion of the body and is often the part of the lobster measured and used as a standard to determine organism length. All the segments bear paired appendages that serve in locomotion, sensory, or both (Phillips et al. 1980). From the head of the lobster, the appendages are ordered starting with the first antennae, second antennae, mandibles, first maxillae, and second maxillae. There are five pairs of walking legs called pereiopods (walking legs) and a six-segmented tail. The antennae function primarily to obtain sensory information by chemoreception, as do the dactyls of the walking legs and the mouthparts involved in handling food. Lobsters have great visual ability, achieved through the use of their paired, lateral compound eyes. In addition, highly distributed superficial hairs detect water movements (Ache and Macmillan 1980).

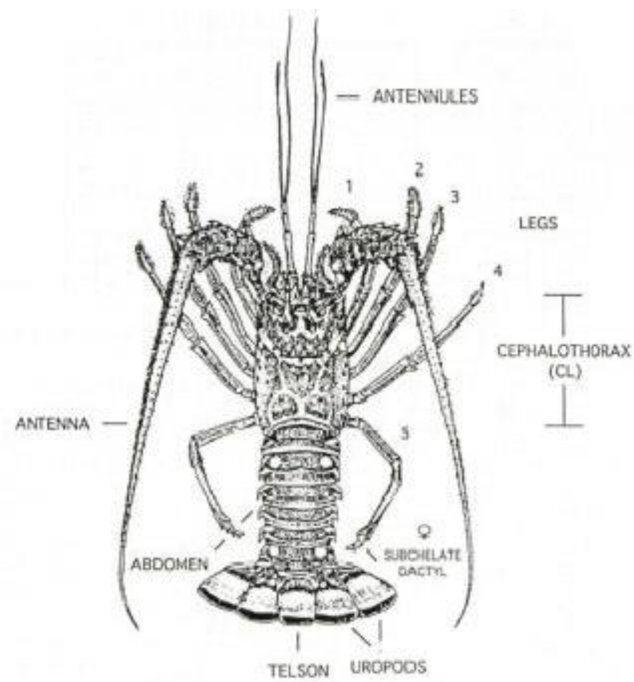

Figure 3.3.1.3. Morphology of Caribbean spiny lobster, *Panulirus argus*.
Source: Lipcius and Cobb (1994).

Gills are the main organs used by lobsters for respiration. The rate of oxygen consumption in *P. argus* is dependent upon the temperature, the degree of crowding within the den, feeding and size of the lobster; oxygen consumption is not determined by the concentration of the oxygen in the water as some studies show that oxygen uptake remained the same in both hypoxic and aerated water (Phillips et al. 1980).

Food Habits

After Caribbean spiny lobster settle from the planktonic phase to the benthic habitat they enter seagrass and macroalgae nursery habitat. Their diet consists of small gastropod mollusks, isopods, amphipods and ostracods, most of which can be found in or within close proximity to the lobster's algal shelter. Studies suggest that as the abundance of food declines in and around their algae habitat, lobsters forage more frequently and thus have more frequent contact with conspecifics. Aggressive behavior in the juvenile lobsters, which at this time live solitarily, has been observed as a means of enforcing territoriality. The consequence of increased aggressive interactions as well as a declining food source is thought to induce the nomadic emigration from the algal nursery environment to off shore reef environments (Marx and Herrnkind, 1985).

During the adult and juvenile phases, the Caribbean spiny lobster will rest in shelters during daylight hours and emerge in the evening to forage for food. Adult lobsters are key predators in many benthic habitats with their diets consisting of slow-moving or stationary bottom-dwelling invertebrates including sea urchins, mussels, gastropods, clams and snails (Lipcius and Cobb 1994). Juvenile lobsters also forage at night and will eat a similar diet of invertebrates, only smaller individual prey. During feeding, prey organisms are seized and maneuvered using the anterior periopods or maxillipeds, while the mandibles carry out mechanical digestion and are capable of crushing hard mollusk shell (Herrnkind et. al. 1975). Little is known about the dietary requirements of the larval phase, plankton sized lobsters.

Larger animals such as sharks and finfish frequently prey upon adult Caribbean spiny lobsters. Studies indicate that Caribbean spiny lobsters are highly selective of the dens they choose to live in and the location of these crevices. Their evening movements away from and subsequent return to their dens illustrates the spatial orientation they have to their immediate habitats (Herrnkind, 1980).

Reproduction

Reproduction in the Caribbean spiny lobster occurs almost exclusively in the deep reef environment once mature individuals have made the permanent transition from the shallow seagrass nursery to the ocean coral reef system. Spawning season is in the spring and summer; however, autumnal reproduction has been known to occur in some situations (Kanciruk and Herrnkind 1976). The gestation period for eggs is about a month. Eggs are orange when they are fresh and brown when they are close to hatching. Studies have found that the initiation of spawning is related to water temperature with an optimal water temperature for mating of 24 degrees centigrade (Lyons et. al. 1981).

Reproductive fecundity is dependent upon the size of the individual as well as the geographic area in which the lobster lives. Reproductive efficiency for a given size in a given area can be determined using the relationship between fecundity and carapace length. A study conducted in South Florida found that differences exist between the fecundity/carapace length relationships of individuals living in the Dry Tortugas from individuals living in the Upper and Middle Florida Keys. Based on data provided from each location, an Index of Reproductive Potential was calculated using the model developed by Kanciruk and Herrnkind (1976):

Index = (A x B x C)/D
Where:

A = number of females in size class/total females
B = propensity of size class to carry eggs
C = egg carrying capacity of size class female
D = constant (31.27) – present to set the 76-80 mm size class index to 100 as the standard.

Choice of mate is determined by the female as well as inter-male aggression, where larger males will prevent a smaller male from courting a female (Lipcius and Cobb1994). Females mate only once during a season, while males can fertilize multiple females. During mating, the male will flick his antennules over the anterior of the female and scrape at her with the third walking legs. The male follows the female around continually trying to lift the female up and embrace her. This pattern continues until the female acquiesces and they each stand on their walking legs while the male deposits the spermatophore mass on the female sternum (Atema and Cobb 1980). Females bearing eggs will usually live in solitary dens and infrequently forage for food (Lyons, et. al. 1981). Large adult females will produce more broods, as well as spawn eggs earlier in the reproductive period than younger females since younger individuals molt earlier in the reproductive period.

Growth and Molting

The life cycle of the Caribbean spiny lobster provides larvae with the potential to travel long distances for periods ranging from a few months to almost two years (Figure 3.3.1.4). During this time, the larval lobsters remain near the surface of the water. Maximum potential dispersal distances differ from one region to another and are primarily dependent on the currents in the area. A gyre in an area where lobster eggs have hatched may keep the larva in the same geographic area, however most of the time the larva are transported out of the area, sometimes hundreds of miles (Lee et. al. 1994). Once the planktonic lobsters reach about 1.4 inches (35 mm) they are large enough to settle down as post larval pueruli in shallow benthic environments to grow. Growth in juveniles is rapid with most reaching a carapace length of 2.4-2.8 inches (60-70 mm) within about two years (Hernkind 1980). Once the lobsters reach about 2.8 inches (70 mm) and begin to sexually mature, the young Caribbean spiny lobster emigrate from the nursery to deeper offshore reef environments.

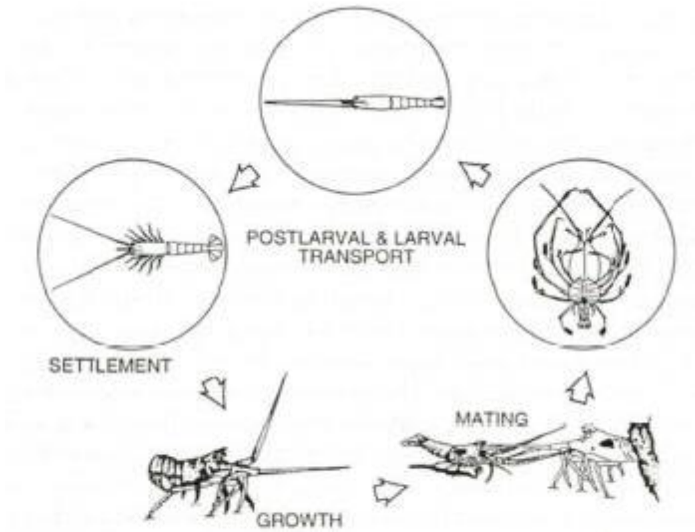

Figure 3.3.1.4. The Life Cycle of the Caribbean spiny lobster *Panulirus argus*.
Source: Lipcius and Cobb (1994).

Physical growth of lobsters is achieved through molting (Figure 3.3.1.4). A thorough understanding of the molt cycle of the Caribbean spiny lobster is an important component to the management of this fishery because the catchability and captive behavior of crustaceans is directly related to the animal's proximity to molting. The molt cycle begins with the inter-molt period, the time when a new cuticle is being created, tissue growth is rapid and the lobster actively forages. This period of time culminates in ecdysis, which is shedding the old cuticle or molting (Lipcius and Hernkind 1982).

Molting occurs primarily at night. Possible reasons for nocturnal ecdysis include decreasing the risk of cannibalism by other members of this gregarious species, and decreasing diurnal predation risks. The first action to occur during molting is the rupture of the thoracoabdominal membrane followed by a rising of the dorsal part of the cephalothorax; this action frees the eyes, bases of antennae and antennules. A series of peristaltic contractions causes the removal of the abdomen from the old cuticle, while writhing motions free the cephalothorax and attached structures. A few final wriggles and contractions terminating in a tail flip completely segregates the lobster from its old cuticle. Once molted, the lobster seeks immediate shelter, as they are especially vulnerable until their new cuticle becomes hardened (Lipcius and Hernkind 1982). For adult lobsters, molts average about two and a half times each year. The entire molting event takes approximately ten minutes. The new exoskeleton will take about 12 days from the start of the molt to harden such that it cannot be dented; however the shell is not completely formed until the 28th day (Williams 1984).

Studies found that feeding rates significantly increase in the time preceding a molt to accommodate the increasing metabolic needs associated with new cuticle formation. About a week before ecdysis, daily food intake for the Caribbean spiny lobster decreases rapidly, in correlation with a reduction in demanding activities such as locomotion and foraging. In the few days before and the time during ecdysis, feeding ceases altogether and the lobster becomes socially reclusive. Within a week of the molting event Caribbean spiny lobster will display maximal feeding, foraging and locomotor activity rates to accommodate for the active tissue growth that occurs (Lipcius and Hernkind 1982). The dramatic swings in feeding and foraging behavior associated with the molting cycle influences the success of fishermen when capturing this species. The highest catchability of spiny lobster is expected immediately following molting because lobsters are actively foraging at this time and are therefore more likely to accept bait. Conversely, the lowest catchability of spiny lobster is expected before molting when foraging decreases and the lobster becomes less mobile (Lipcius and Hernkind 1982).

Growth and Mortality Rates

Despite the wide body of literature on this species, limited information is available on the growth and aging of the Caribbean spiny lobster due in part to the molting habits of lobsters interfering with tagging efforts. Consequently, length data, which is substantially easier and less costly to collect, has been the dominant source of information used to estimate growth in Caribbean spiny lobster. The limited quantitative information that exists on growth for this species at various locations has been compiled in a doctoral thesis by Jaime Manuel Gonzalez-Cano (1991) and was graphed below using the von Bertalanffy growth model.

$$L = Linf\ [1-e(-k(t-to))]$$

Where:
L = length of the organism at time t
Linf = asymptotic average length achieved
K = growth rate with units 1/time
T_o = time when the length of the organism would be zero

As with any fished population, especially one with poor aging information, natural mortality rates for Caribbean spiny lobster populations have been difficult to isolate from fished rates of mortality.

Locomotion and Migration

The Caribbean spiny lobster achieves locomotion by using the five pairs of walking legs attached to the cephalothorax and can swim (backward) for brief periods using its tail for propulsion (Lipcius and Cobb 1994). Caribbean spiny lobster patterns of movement fall into the following categories: homing, nomadism and migration. Throughout most of their life, Caribbean spiny lobster is a shelter dweller during the day and forages at night. Evening movements within the home range are directed; lobsters are aware of their location and can find the way back to the den of origin even if detours are caused by predators or divers. Nomadism is the movement that occurs in juvenile lobsters away from the nursery habitat and to the offshore reefs. Migration is the direct movement of an entire population or sub-population over a long distance for a given period of time (Herrnkind 1980).

Mass movements (2-60 individuals) of Caribbean spiny lobsters occur annually throughout the geographic range of the species and are dependent on latitude and climactic factors. Observed locations for the migration include Bermuda in October, the Bahamas and Florida in late October and early November, and the Yucatan and Belize in December (Herrnkind 1985). This mass migratory behavior is thought to have evolved in response to deteriorating conditions that resulted from the periods of glaciations that occurred over the past several 100,000 years. Thus, the migration and queuing behavior became specialized by the natural selection on individuals of the harsh winters during periods of glaciations. Gonads during the migration in the fall are inactive, as they don't begin to mature until the late winter (Herrnkind 1985).

The first autumn storm in the tropics usually brings a severe drop in water temperature of about five degrees centigrade, as well as high northerly winds of up to 40 km/h and large sea swells. The shallow regions that the lobsters exploit during the summer months become turbid and cold, initiating the diurnal migration of thousands of lobsters to evade these conditions. The Caribbean spiny lobster is highly susceptible to severe winter cooling and will exhibit reduced feeding and locomotion at temperatures 54-57 ºF (12-14 ºC); molting individuals usually perish under these conditions. According to Herrnkind (1985), the behavioral changes observed in Caribbean spiny lobster as well as the known biological information about the species lends credence to the idea that individuals migrate to evade the stresses of the cold and turbidity in the winter.

Caribbean spiny lobster initiate the migratory behavior by queuing, the single file formation of migrating individuals initiated by visual or tactile stimuli. Queuing is maintained by establishing contact between the antennules of one individual and anterior walking legs of another. Biologically, the queuing behavior is an important hydrodynamic drag reduction technique for the migration of individuals over long distances (Bill and Herrnkind 1976). Studies done by tagging individuals found that during the migration, individuals tended to move distances of 19-31 statute miles (30-50 km; Herrnkind 1985).

Migratory movement lasts for variable periods of time and is believed to be dependent on the total number of migratory lobsters. One study in the Bahamas in 1971 found the migration to take six hours while another study in the same location in 1969 found the migration to take five days. It is thought that the more lobsters present, the longer the migration will last in order to avoid overcrowding of shelters at their final destination (Kanciruk and Herrnkind 1978). Once individuals reach sheltered habitats located in deeper water, such as a deep reef site, the migratory queuing behavior ends and the lobsters disperse.

<u>Other Species in the Family Palinuridae</u>

Spotted spiny lobster, *Panulirus guttatus*, range includes the western Atlantic, Bermuda, Bahamas, South Florida, Belize, Panama, and Venezuela, as well as the Caribbean from Cuba to Trinidad, Curacao, and Bonaire (Figure 3.3.1.5). This species prefers shallow water and inhabits rocky areas, mainly in crevices. Maximum total body length recorded is 8 in (20 cm), but the average total body length for this species is 6 in (15 cm; FAO Fisheries Synopsis 1991). This species is occasionally caught in traps, typically set for other species, such as the Caribbean spiny lobster (FAO Fisheries Synopsis 1991).

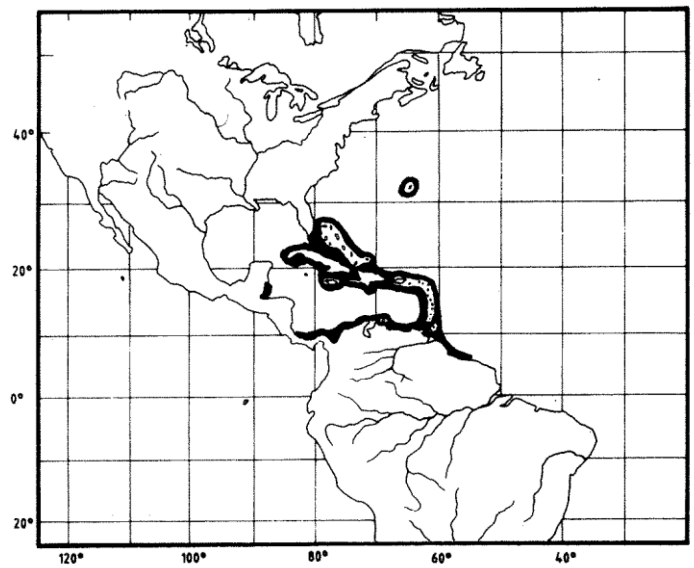

Figure 3.3.1.5. Distribution of spotted spiny lobster, *Panulirus guttatus*.
Source: FAO Fisheries Synopsis (1991).

Smoothtail spiny lobster, *Panulirus laevicauda,* range includes the western Atlantic, Bermuda, South Florida, down into Brazil, as well as Central America, and the Caribbean (Figure 3.3.1.6). This species is found in coastal waters, as deep as 164 ft (50 m) and prefers rock or coral reef substrate as habitat. Maximum total body length recorded is 12 inches (31 cm), but the average total body length for this species is 8 in (20 cm). Sometimes smoothtail spiny lobsters are taken together with Caribbean spiny lobster. The largest yield for this species is in Brazil (FAO Fisheries Synopsis 1991).

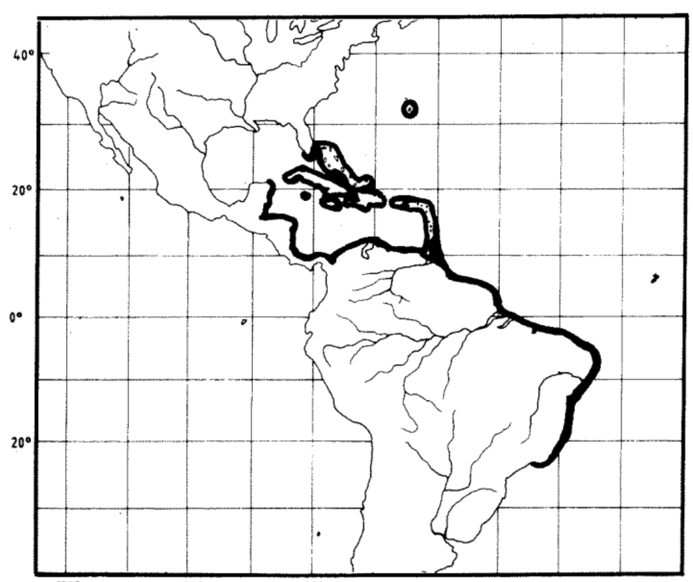

Figure 3.3.1.6. Distribution of smoothtail spiny lobster, *Panulirus laevicauda*.
Source: FAO Fisheries Synopsis (1991).

Family Scyllaridae

Spanish slipper lobsters, *Scyllarides aequinoctialis*, are distributed in the western Atlantic Ocean, as far north as South Carolina down to Brazil including Bermuda, the Gulf of Mexico, and the Caribbean (Figure 3.3.1.7). This species depth distribution ranges from 2 to 591 ft (0.6 to 180 m), usually between 2 to 210 ft (0.6 and 64 m). This species preferred habitat is sand or rocks, often on high-relief coral reefs in crevices (FAO Fisheries Synopsis 1991; Sharp et al. 2007). The animals are sluggish and nocturnal and feed on algae and detritus. They bury themselves in the sand. Maximum total body length recorded is 12 inches (31 cm), but average carapace length is 5 inches (12 cm; FAO Fisheries Synopsis 1991; Sharp et al. 2007).

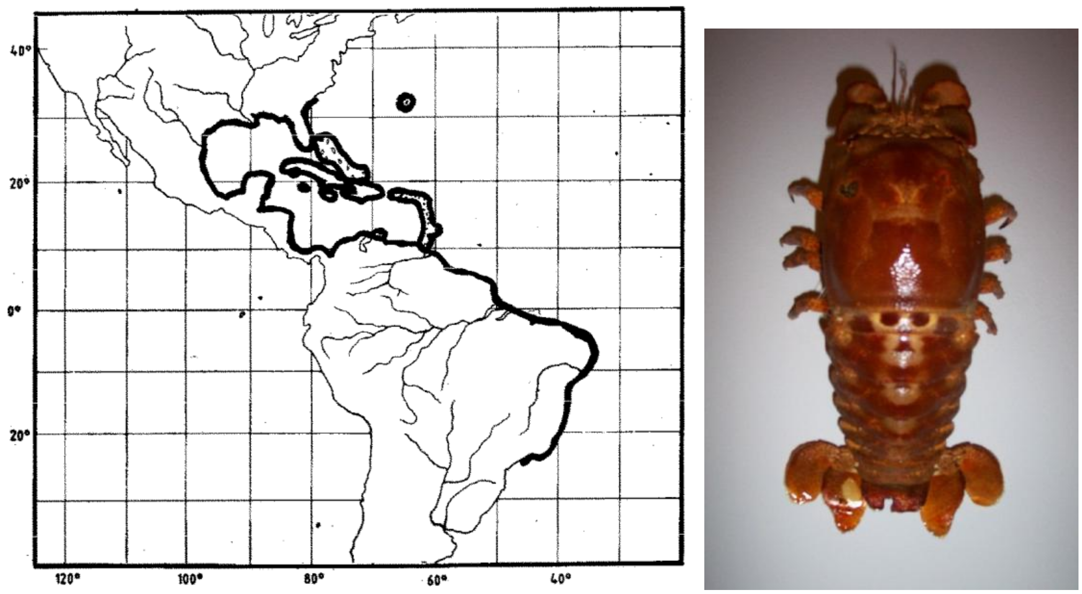

Figure 3.3.1.7. Distribution and photograph of Spanish slipper lobster, *Scyllarides aequinoctialis*.

Ridged slipper lobster, *Scyllarides nodifer*, are distributed throughout the western Atlantic Ocean, south of Cape Lookout, North Carolina, Bermuda, and the entire Gulf of Mexico (Figure 3.3.1.8). This species is typically found in the Florida Keys and Dry Tortugas (FAO Fisheries Synopsis 1991). Ridged slipper lobster depth distribution ranges between 6.5 to 299 ft (2 and 91 m) and prefer sandy substrate, sometimes mixed with mud, shell, or corals. They are often found on low-relief coral reefs and bury themselves in sediments during daylight hours (Sharp et al. 2007). Maximum total body length recorded is 14 in (35 cm), but average carapace length is 4.3 in (11 cm; FAO Fisheries Synopsis 1991; Sharp et al. 2007).

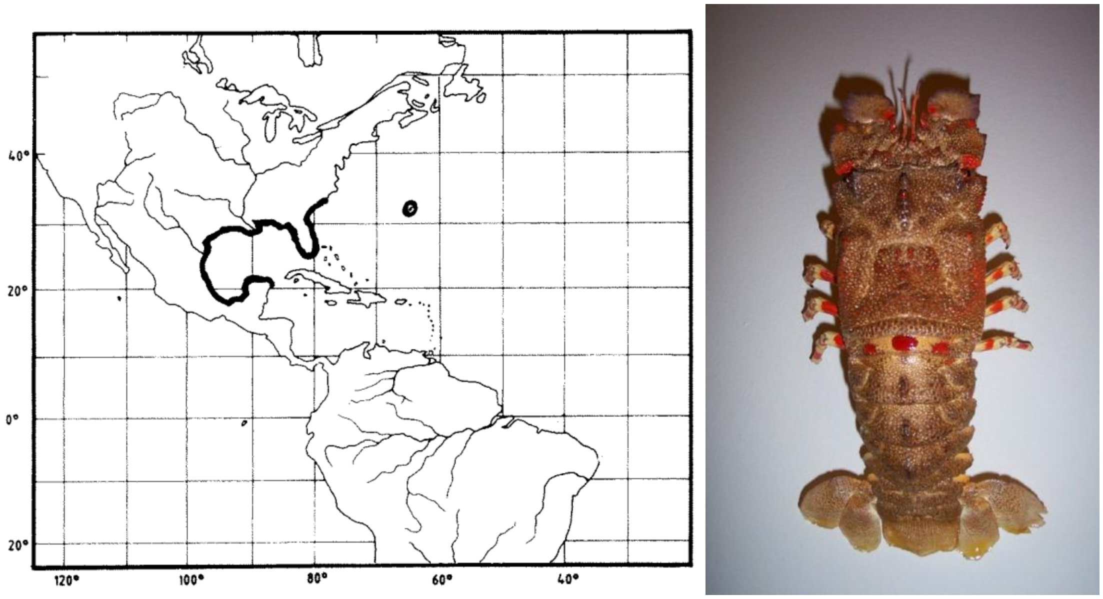

Figure 3.3.1.8. Distribution and photograph of ridged slipper lobster.
Source: FAO Fisheries Synopsis (1991); Photograph by J. Hunt (2009).

3.3.2 Protected Species

There are 32 different species of marine mammals that may occur in the EEZ of the Gulf of Mexico, South Atlantic, and Caribbean. All 32 species are protected under the Marine Mammals Protection Act (MMPA) and six are also listed as endangered under the Endangered Species Act (ESA) (i.e., sperm, sei, fin, blue, humpback and North Atlantic right whales). There are no known interactions between spiny lobster fisheries and marine mammals. Other species protected under the ESA occurring in the Gulf of Mexico, South Atlantic, and Caribbean include five species of sea turtle (green, hawksbill, Kemp's ridley, leatherback, and loggerhead); the smalltooth sawfish, and two *Acropora* coral species (elkhorn [*Acropora palmata*] and staghorn [*A. cervicornis*]). A discussion of these species is below. Designated critical habitat for the North Atlantic right whale also occurs within the South Atlantic region.

ESA-Listed Sea Turtles

The following sections are a brief overview of the general life history characteristics of the sea turtles found in the Gulf of Mexico and South Atlantic region. Several volumes exist that cover more thoroughly the biology and ecology of these species (i.e., Lutz and Musick (eds.) 1997, Lutz et al. (eds.) 2002).

Green sea turtle hatchlings are thought to occupy pelagic areas of the open ocean and are often associated with *Sargassum* rafts (Carr 1987, Walker 1994). Pelagic stage green sea turtles are thought to be carnivorous. Stomach samples of these animals found ctenophores and pelagic snails (Frick 1976, Hughes 1974). At approximately 20 to 25 cm carapace length, juveniles migrate from pelagic habitats to benthic foraging areas (Bjorndal 1997). As juveniles move into benthic foraging areas a diet shift towards herbivory occurs. They consume primarily seagrasses and algae, but are also know to consume jellyfish, salps, and sponges (Bjornal 1980, 1997; Paredes 1969; Mortimer 1981, 1982). The diving abilities of all sea turtles species vary by their life stages. The maximum diving range of green sea turtles is estimated at 110 m (360 ft) (Frick 1976), but they are most frequently making dives of less than 20 m (65 ft.) (Walker 1994). The time of these dives also varies by life stage. The maximum dive length is estimated at 66 minutes with most dives lasting from 9 to 23 minutes (Walker 1994).

The hawksbill's pelagic stage lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm in straight carapace length (Meylan 1988, Meylan and Donnelly 1999). The pelagic stage is followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Little is known about the diet of pelagic stage hawksbills. Adult foraging typically occurs over coral reefs, although other hard-bottom communities and mangrove-fringed areas are occupied occasionally. Hawksbills show fidelity to their foraging areas over several years (van Dam and Diéz 1998). The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Gravid females have been noted ingesting coralline substrate (Meylan 1984) and calcerous algae (Anderes Alvarez and Uchida 1994), which are believed to be possible sources of calcium to aid in eggshell production. The maximum diving depths of these animals are not known, but the maximum length of dives is estimated at 73.5 minutes. More routinely dives last about 56 minutes (Hughes 1974).

Kemp's ridley hatchlings are also pelagic during the early stages of life and feed in surface waters (Carr 1987, Ogren 1989). Once the juveniles reach approximately 20 cm carapace length they move to relatively shallow (less than 50m) benthic foraging habitat over unconsolidated substrates (Márquez-M. 1994). They have also been observed transiting long distances between foraging habitats (Ogren 1989). Kemp's ridleys feeding in these nearshore areas primarily prey on crabs, though they are also known to ingest mollusks, fish, marine vegetation, and shrimp (Shaver 1991). The fish and shrimp Kemp's ridleys ingest are not thought to be a primary prey item but instead may be scavenged opportunistically from bycatch discards or from discarded bait (Shaver 1991). Given their predilection for shallower water, Kemp's ridleys most routinely make dives of 50 m or less (Soma 1985; Byles 1988). Their maximum diving range is unknown. Depending on the life stage a Kemp's ridleys may be able to stay submerged anywhere from 167 minutes to 300 minutes, though dives of 12.7 minutes to 16.7 minutes are much more common (Soma 1985; Mendonca and Pritchard 1986; Byles 1988). Kemp's ridleys may also spend as much as 96% of their time underwater (Soma 1985; Byles 1988).

Leatherbacks are the most pelagic of all ESA-listed sea turtles and spend most of their time in the open ocean. However, they will enter coastal waters and are seen over the continental shelf on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates. Unlike other sea turtles, leatherbacks' diets do not shift during their life cycles. Because leatherbacks' ability to capture and eat jellyfish is not constrained by size or age, they continue to feed on these species regardless of life stage (Bjorndal 1997). Leatherbacks are the deepest diving of all sea turtles. It is estimated that these species can dive in excess of 1000 m (Eckert et al. 1989) but more frequently dive to depths of 50 m to 84 m (Eckert et al. 1986). Dive times range from a maximum of 37 minutes to more routines dives of 4 to 14.5 minutes (Standora et al. 1984, Eckert et al. 1986, Eckert et al. 1989, Keinath and Musick 1993). Leatherbacks may spend 74% to 91% of their time submerged (Standora et al. 1984).

Loggerhead hatchlings forage in the open ocean and are often associated with Sargassum rafts (Hughes 1974, Carr 1987, Walker 1994, Bolten and Balazs 1995). The pelagic stage of these sea turtles are known to eat a wide range of things including salps, jellyfish, amphipods, crabs, syngnathid fish, squid, and pelagic snails (Brongersma 1972). Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic (Witzell 2002). Here they forage over hard- and soft-bottom habitats (Carr 1986). Benthic foraging loggerheads eat a variety of invertebrates with crabs and mollusks being an important prey source (Burke et al. 1993). Estimates of the maximum diving depths of loggerheads ranges from 692-764ft (211 to 233 m; Thayer et al. 1984; Limpus and Nichols 1988). The lengths of loggerhead dives are frequently between 17 and 30 minutes (Thayer et al. 1984; Limpus and Nichols 1988; Limpus and Nichols 1994; Lanyan et al. 1989) and they may spend anywhere from 80 to 94% of their time submerged (Limpus and Nichols 1994; Lanyan et al. 1989).

ESA-Listed Marine Fish

The historical range of the smalltooth sawfish in the U.S. ranged from New York to the Mexico border. Their current range is poorly understood but believed to have contracted from these historical areas. In the South Atlantic region, they are most commonly found in Florida, primarily off the Florida Keys (Simpfendorfer and Wiley 2004). Only two smalltooth sawfish have been recorded north of Florida since 1963 (the first was captured off of North Carolina in 1999 (Schwartz 2003) and the other off Georgia 2002 [Burgess unpublished data]). Historical accounts and recent encounter data suggest that immature individuals are most common in shallow coastal waters less than 25 m (Bigelow and Schroeder 1953, Adams and Wilson 1995), while mature animals occur in waters in excess of 100 meters (Simpfendorfer pers comm. 2006). Smalltooth sawfish feed primarily on fish. Mullet, jacks, and ladyfish are believed to be their primary food resources (Simpfendorfer 2001). Smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs) by disturbing bottom sediment with their saw (Norman and Fraser 1937, Bigelow and Schroeder 1953).

ESA-Listed Marine Invertebrates

Elkhorn (*Acropora palmata*)(Figure X) and staghorn (*A. cervicornis*) (Figure 3.3.2.1) coral were listed as threatened under the ESA on May 9, 2006. The Atlantic *Acropora* Status Review (*Acropora* Biological Review Team 2005) presents a summary of published literature and other currently available scientific information regarding the biology and status of both these species.

Elkhorn and staghorn corals are two of the major reef-building corals in the wider Caribbean. In the Gulf of Mexico, South Atlantic, and Caribbean they are found most commonly in the Florida Keys and U.S. Virgin Islands, though colonies exist in Puerto Rico and Flower Gardens National Marine Sanctuary in the Gulf of Mexico. The depth range for these species ranges from <1 m to 60 m. The optimal depth range for elkhorn is considered to be 1 to 5 m depth (Goreau and Wells 1967), while staghorn corals are found slightly deeper, 5 to 15 m (Goreau and Goreau 1973).

All Atlantic *Acropora* species (including elkhorn and staghorn coral) are considered to be environmentally sensitive, requiring relatively clear, well-circulated water (Jaap et al. 1989). Optimal water temperatures for elkhorn and staghorn coral range from 25° to 29°C (Ghiold and Smith 1990, Williams and Bunkley-Williams 1990). Both species are almost entirely dependent upon sunlight for nourishment, contrasting the massive, boulder-shaped species in the region (Porter 1976, Lewis 1977) that are more dependent on zooplankton. Thus, Atlantic *Acropora* species are much more susceptible to increases in water turbidity than some other coral species.

Fertilization and development of elkhorn and staghorn corals is exclusively external. Embryonic development culminates with the development of planktonic larvae called planulae (Bak et al. 1977, Sammarco 1980, Rylaarsdam 1983). Unlike most other coral larvae, elkhorn and staghorn planulae appear to prefer to settle on upper, exposed surfaces, rather than in dark or cryptic ones (Szmant and Miller 2006), at least in a laboratory setting. Studies of elkhorn and staghorn corals indicated that larger colonies of both species[5] had higher fertility rates than smaller colonies (Soong and Lang 1992).

A B

Figure 3.3.2.1 *Acropora* species. A. Elkhorn Coral (*Acropora palmata*). B. Staghorn Coral (*A. cervicornis*).
Photo Credit: W. Jaap

[5] As measured by surface area of the live colony

3.4 Economic Environment

3.4.1 Commercial Fishery

Commercial fishing for Caribbean spiny lobster (*Panulirus argus*) in Florida has been affected by sharply lower prices in the last two years and by landings that have been the lowest since the early 1960s (Figure 3.4.1.1, Table 3.4.1.1; Vondruska 2010a). Ex-vessel prices decreased sharply to $3.30 / lb (ww) in 09/10, compared with the 22-year high of $7.94 /lb for 2 years earlier. Based on 5-year averages for 87/88-91/92 and 05/06-09/10, fishing effort is now much lower than it was (Table 3.4.1.1; Figure 3.4.2.2):

1) The number of vessels declined from 2,175 to 781 per year.
2) The number of trips declined from 39,086 to 15,568 per year.
3) The number of hours fished declined from 493,211 to 234,292 per year (Vondruska, 2010a, Table 2).
4) The number of traps fished on all trips declined from 8.65 to 4.24 million (including duplication, because individual traps are usually fished on more than one trip, unless lost or damaged) (estimates as explained in Vondruska, 2010a, Table 3, column 9).
5) Vessel-based estimates for the number of "traps that could be fished" declined from 704,580 to 368,106 traps (excluding duplication attributable to the use of individual traps on multiple trips). The number of traps that could be fished is a proxy for the number of traps licensed to fish for spiny lobster. The number peaked in 91/92 at 814,864 traps (estimates as explained in Vondruska, 2010a, Table 3, column 4).

Economic conditions would have been worse without long-term reductions in fishing effort and consequent increases vessel and trip productivity. Average vessel and trip landings have exhibited arguably flat to upward trends since the early-1990s (Figure 3.4.1.3; Table 3.4.1.1).

Initially, the number of trap certificates was reduced in steps, from 944,000 in 1992 to 543,000 by 1999. Given a decade or so of fisher experience with the program, Shivlani, Ehrhardt, Murray and Kirkley (2004) conducted a survey of fishers and analyzed the economic and social conditions at the fisher level and fisher attitudes about the program. Today, reductions in the total number of certificates occur routinely if certificates are transferred and/or revert to the state because the owner does pay requisite annual fees for three years. Besides the Trap Certificate Program, other factors have affected commercial fishing for spiny lobster in Florida, such as gentrification, state and local regulations on the storage of traps, and availability and access to docks and dealers.

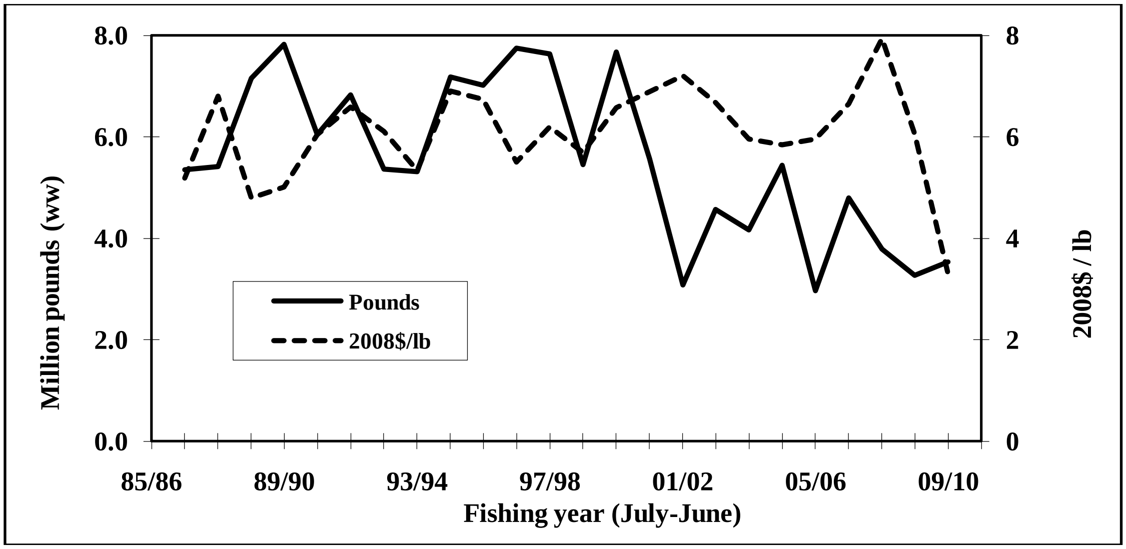

Figure 3.4.1.1 Commercial fishing for Caribbean spiny lobster, Florida landings & ex-vessel prices.

Source: FTT data as of 19Mar10, Vondruska 2010a.

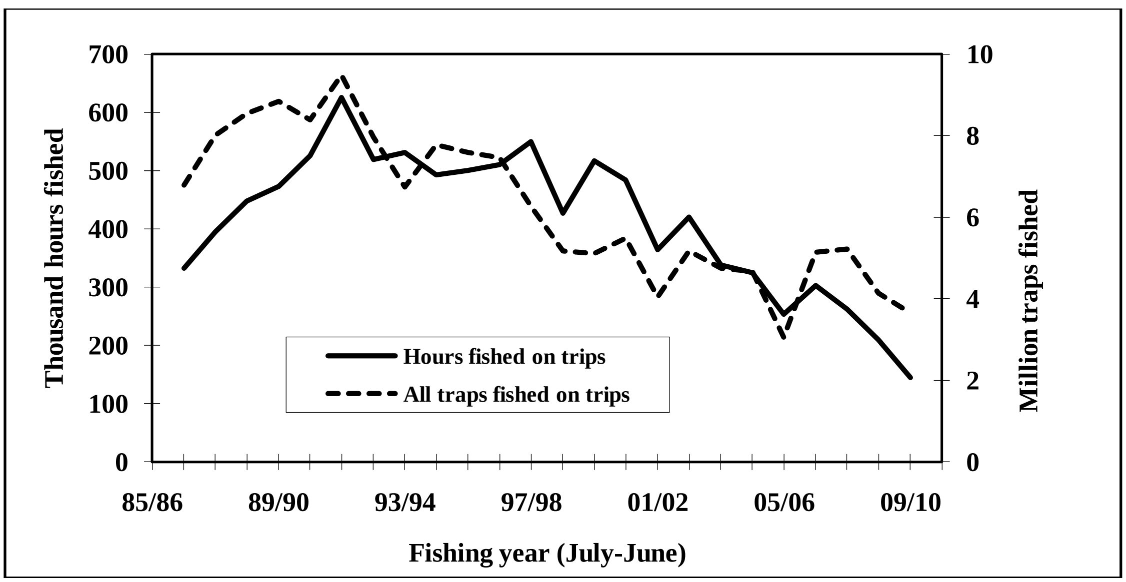

Figure 3.4.1.2 Commercial fishing for Caribbean spiny lobster in Florida, hours & traps fished.

Source: FTT data as of 19Mar10, Vondruska 2010a.

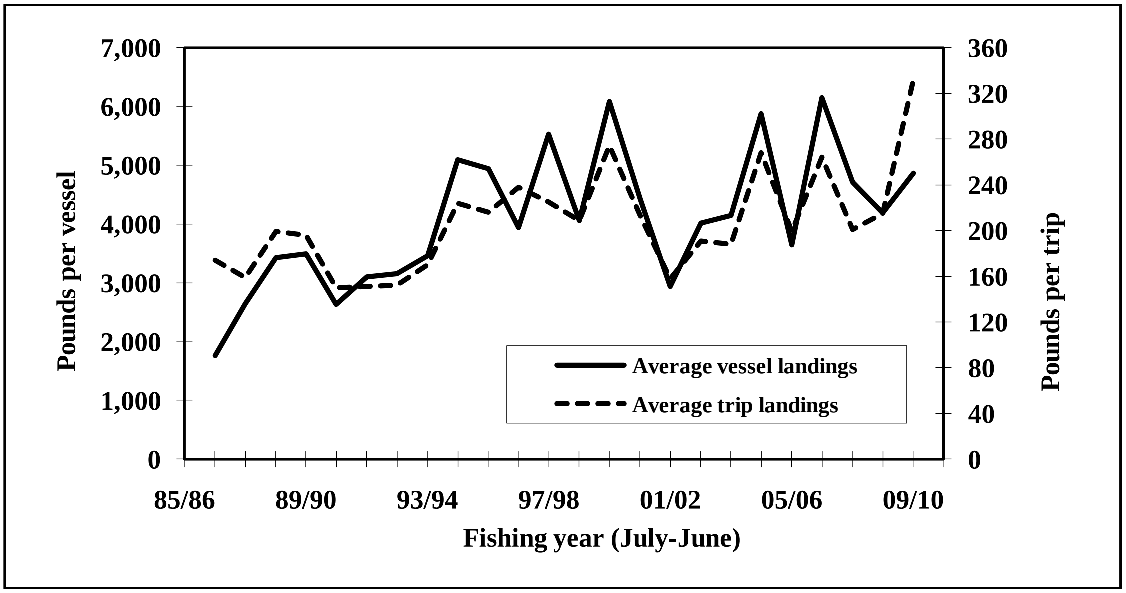

Figure 3.4.1.3 Commercial fishing for Caribbean spiny lobster in Florida, vessel and trip landings.
Source: FTT data as of 19Mar10, Vondruska 2010a.

Table 3.4.1.1. Florida commercial fishing for Caribbean spiny lobster.

Fishing year (July-June)	Landings (ww), Caribbean spiny lobster						
	Thousand pounds	Thousand 2008$	2008$ /lb	Vessels	Lbs / vessel	Trips	Lbs / trip
86/87	5,351	$27,786	$5.19		1,762	30,696	174
87/88	5,417	$36,833	$6.80	2,045	2,649	34,005	159
88/89	7,154	$34,327	$4.80	2,086	3,430	36,021	199
89/90	7,830	$39,229	$5.01	2,244	3,489	39,935	196
90/91	6,044	$36,523	$6.04	2,300	2,628	40,194	150
91/92	6,834	$45,018	$6.59	2,200	3,106	45,276	151
92/93	5,367	$32,804	$6.11	1,702	3,153	35,387	152
93/94	5,309	$28,362	$5.34	1,536	3,457	31,283	170
94/95	7,181	$49,553	$6.90	1,411	5,090	32,093	224
95/96	7,017	$47,295	$6.74	1,419	4,945	32,546	216
96/97	7,748	$42,675	$5.51	1,968	3,937	32,591	238
97/98	7,641	$47,373	$6.20	1,382	5,529	33,906	225
98/99	5,448	$30,980	$5.69	1,342	4,060	26,012	209
99/00	7,669	$50,402	$6.57	1,260	6,086	27,947	274
00/01	5,570	$38,391	$6.89	1,259	4,424	26,111	213
01/02	3,081	$22,186	$7.20	1,047	2,943	19,528	158
02/03	4,574	$30,529	$6.68	1,140	4,012	23,960	191
03/04	4,161	$24,773	$5.95	1,003	4,149	22,088	188
04/05	5,445	$31,799	$5.84	926	5,880	20,295	268
05/06	2,964	$17,666	$5.96	814	3,642	14,901	199
06/07	4,799	$31,913	$6.65	780	6,152	18,184	264
07/08	3,782	$30,025	$7.94	803	4,710	18,858	201
08/09	3,271	$19,836	$6.06	780	4,194	15,238	215
09/10	3,541	$11,695	$3.30	727	4,870	10,660	332
5-yr aver							
87/88-91/92	6,656	$38,386	$5.85	2,175	3,060	39,086	171
05/06-09/10	3,671	$22,227	$5.98	781	4,714	15,568	242
FTT data (19Mar10), based on Vondruska 2010a.							

Economic Impacts
Descriptions of the commercial fishery for spiny lobster are contained in Vondruska (2010a), Vondruska (2010b), and CFMC (2008) and are incorporated herein by reference. Select summary statistics for the commercial fishery are provided in Table 3.4.1.2, and estimates of economic impacts (economic activity) are provided in Table 3.4.1.3.

Estimates of the average annual economic activity (impacts) associated with the commercial spiny lobster fishery were derived using the model developed for and applied in NMFS (2009x) and are provided in Table 3.4.1.3. Business activity for the commercial sector is characterized in the form of full-time equivalent (FTE) jobs, income impacts (wages, salaries, and self-employed income), and output (sales) impacts (gross business sales). Income impacts should not be added to output (sales) impacts because this would result in double counting.

As noted in Table 3.4.1.3, the annual period refers to the fishing year, as appropriate to the management of the species. The estimates of economic activity include the direct effects (effects in the sector where an expenditure is actually made), indirect effects (effects in sectors providing goods and services to directly affected sectors), and induced effects (effects induced by the personal consumption expenditures of employees in the direct and indirectly affected sectors). Estimates are provided for the economic activity associated with the ex-vessel revenues from spiny lobster as well as the revenues from all species harvested by these same vessels. The estimates of ex-vessel value are replicated from Table 3.4.1.2.

Table 3.4.1.2. Five-year[1] average performance statistics for the commercial sector of the Caribbean spiny lobster fishery.

	Vessels	Total Lobster Ex-vessel Value[2] (millions)	Total All Species Ex-vessel Value[2] (millions)	Average Ex-vessel Value per Vessel
2005-2010 Average	781	$22,227	$23,399	$29,960

[1]Fishing-year (2005/2006, 2006/2007,…, 2009/20010).
[2]2008 dollars.
Source: Florida Trip Ticket System and NMFS SEFSC Accumulated Landings System.

Table 3.4.1.3. Average annual economic activity associated with the spiny lobster fisheries.

Species	Average Ex-vessel Value[1] (millions)	Total Jobs	Harvester Jobs	Output (Sales) Impacts (millions)	Income Impacts (millions)
Spiny Lobster	$22.23	4,223	580	$293,188	$125,382
- All Species[2]	$23.40	4,445	611	$308,647	$131,993

[1]2008 dollars.
[2]Ex-vessel revenues and economic activity associated with the harvests of all species harvested by vessels that harvested spiny lobster.

Permits

Information on the number of permits will be provided in a subsequent version of this amendment.

Table 3.4.1.4. Number of permits associated with the spiny lobster fishery.

3.4.2 Recreational Fishery

Number and Description of Recreational Fishers

Prior to 1991, the number of recreational spiny lobster fishers was unknown. That changed with the requirement of the Florida Crawfish Stamp (permit) that began with the 1991-92 season, which was purchased as an additional endorsement to the state's recreational saltwater fishing license. The permit provided the Florida Fish and Wildlife Institute (formerly the Florida Marine Research Institute) with a mechanism by which they could monitor the fishery, specifically, the use of two annual mail surveys sent to persons with a lobster license/permit (FWC 2005). The surveys were and are used to estimate the number and landings of lobsters harvested by recreational fishers who take lobsters during the Special Two-Day Sport Season and from opening day to the first Monday in September of the regular recreational fishing season. The survey of recreational fishers who harvest during the regular fishing season focuses on the first month of the season because the majority of recreational fishing effort occurs during the first month of the season (Sharp *et al*., 2005). As the season progresses, recreational fishers have to move with the migration of the lobsters from shallower to deeper waters. Eventually, the waters are too deep for non-trap fishing (GFMC and SAFMC 1982).

In July 1991, 48,760 permits were issued before the two-day sport season that occurred the last weekend in July, and one month later, another 41,785 permits were issued (Tormalin 1991). In total over 120,000 individuals purchased a permit for the 1991-92 fishing season. The mail surveys of permit holders showed that significant numbers of them did not fish. Bertelsen and Hunt (1991) estimated that 38% of the recreational lobster permit holders participated in both the sport and regular seasons in 1990-91. Approximately 60% of permit holders residing in Monroe County fished, while only approximately 3% of holders from the east coast and 1-2% from the Panhandle and west coast fished (Bertelsen and Hunt 1991). It was estimated that approximately 50,000 people fished for lobsters during the opening month of the 1991-92 fishing season.

The first survey of recreational fishers revealed the average fisher was from the late 20s to early 40s years of age and had completed college (GFMC and SAFMC 1993). Twenty-five percent were novices with less than three years fishing experience, while 33% were highly experienced with over 12 years of experience.

One end-of-the-season mail survey was conducted at the conclusion of the 1994 season to obtain an estimate of fishing effort and landings during the lobster fishing season after the first month (Sharp *et al*. 2005). The data from the survey confirmed the belief that recreational fishing effort is predominantly limited to the sport season and first month of the regular season.

From the 1990-91 to 1994-95 seasons, an average of 110,000 persons have purchased a crawfish permit. The Florida Marine Research Institute (FMRI) included a socioeconomic component in its 1992 recreational lobster survey. Recreational fishers were asked how much they would be willing to pay to avoid a decrease in the bag limits and how much they would be willing to pay to have an increase in the bag limits. The least they were willing to pay to avoid the bag limits was $0.94 per lobster (in 1992 dollars) and to increase the bag limits was $0.37 per lobster (in 1992 dollars).

Sharp et al. (2005) estimate that 51,510 permit holders fished during the 1994 two-day sport season and 63,225 fished during the first month of the 1994-95 fishing season. The average fishing group-size during the two-day sport season and first month of the regular season was four people, but, during the sport season, group size was larger in the Florida Keys than in other areas.

The number of crawfish permits rose from about 110,000 in 1993 to almost 140,000 in 1997, and fluctuated around 130,000 from 1998 to 2005 (FWC 2006a). Mail surveys of recreational lobster license holders indicate that most fish for lobsters only a few days in any particular season, with 30% fishing for 1 to 2 days, 59% for up to 4 days, and 95% fishing for 10 days or less. Approximately, 110,000 recreational divers harvest from 20 to 25% of the combined commercial and recreational catch of spiny lobsters each fishing year (FWC 2006b).

From 1993 to 2002 fishing effort ranged from 60,000 to 112,000 person-days during the two-day sport season and from 261,000 to 514,000 person-days during the regular season (Sharp *et al*. 2005). While there was no discernable trend for the two-day sport season, there was a decreasing trend in fishing effort during the regular season, especially from 1999 to 2002.

Presently, the cost of a resident saltwater fishing license is $17.00, which is valid for one year but does not include lobster fishing privileges ($79 for a five-year permit), and the cost of a resident lobster (crawfish) permit is $5.00 ($25.00 for a five-year permit; see http://myfwc.com/license/licpermit_swfishing.htm). The recreational lobster permit is required of all fishers 16 years and older, but not Florida residents who are more than 65 years old.

Special Recreational Crawfish Licensed Fishers

In 1993, the Florida legislature created the Special Recreational Crawfish License (SRCL), which was implemented with the 1994-95 fishing season. The SRCL was designed for recreational fishers who possessed an SPL but did not qualify for a Restricted Species Endorsement. In the 1994-95 fishing season there were 492 SRCL holders, and approximately 380 of them reported that they fished during the first month of the regular season. During the 2008-09 season there were less than 200.

The number of special recreational crawfish licensed fishers has declined. See Figure 3.4.2.3. Beginning with the 2012-2013 fishing season and every season thereafter, no special recreational crawfish license will be issued or renewed by the FWC (Florida Administrative Code 68B-24.0035). Hence, there will be no SRCL fishers after the 2011-12 fishing season. The SRCL bag limits for the 2010-11 and 2011-12 fishing seasons are 15 and 10 lobsters per person per day, respectively.

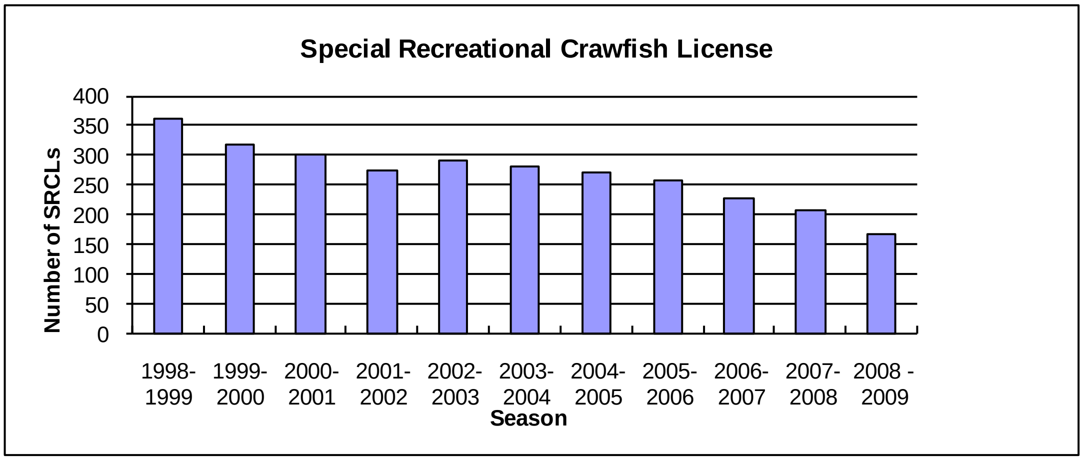

Figure 3.4.2.3. Number of Special Recreational Crawfish Licenses, 1998-99 to 2008-09 Seasons.

Approximately 17% of the SRCL fishers have been from Dade County, followed by approximately 15% from Palm Beach, 13% from Nassau, 12% from Broward, and approximately 8% from Monroe Counties. See Table 3.4.2.1.

Table 3.4.2.1. Average Percent of SRCL Fishers by County, 1998-99 to 2008-09 Fishing Seasons.

County	Ave. Percent of All SRCL Fishers
Dade	16.80
Palm Beach	14.52
Broward	11.69
Brevard	2.86
Charlotte	1.17
Citrus	0.39
Clay	0.36
Collier	2.22
Duval	1.57
Escambia	0.39
Franklin	0.10
Gulf	0.33
Hernando	0.56
Hillsborough	3.95
Indian River	1.31
Jefferson	0.15
Lee	6.22
Levy	0.12
Manatee	1.18
Martin	2.80
Monroe	8.31
Nassau	13.00

Pasco	1.71
Pinellas	5.48
St. Johns	0.39
Sarasota	0.23
St. Lucie	3.13
Volusia	2.77
Inland/Out of State	9.18

Source: FFWC, Marine Fisheries Information System.

Economic Impacts

The recreational spiny lobster fishery is very important to Monroe County. In 2001, additional socio-economic questions were added on to the annual survey. Almost 230 thousand (229,395) person-days of recreational lobster fishing occurred that year in Monroe County. Of those person-days, approximately 75% (171,127) were during the regular season, and the remaining 58,268 person-days (25 percent) were during the two-day sport season. Approximately 79% of those person-days (180,123) were attributed to visitors of Monroe County and the remaining 21% (49,272 person-days) to residents. See Table 3.4.2.4.

Visitors spend substantially more per person-day than residents of Monroe County, and visitors spend slightly more during the two-day sport season than regular season. See Table 3.4.2.4. Sharp *et al.* (2005) estimate approximately $24 million was spent on recreational lobster fishing in the Florida Keys from the opening of the recreational season through the first Monday in September in 2001. Fishers who resided outside the Keys accounted for about $22 million (92%) of the total monies spent on recreational lobster fishing in the Keys.

Table 3.4.2.4. Average Expenditures per Person-Day in 2001.

Season	Person Days		Ave. Exp. Per Person-Day		Total Expenditures (2001 Dollars)		
	Resident	Visitor	Resident	Visitor	Resident	Visitor	Total
Two-Day	12,306	45,962	$33.99	$129.41	418,281	5,947,942	6,366,223
Regular	36,966	134,161	$42.83	$122.35	1,583,254	16,414,598	17,997,852
Total	49,272	180,123	$40.61	$124.15	2,000,936	22,362,270	24,363,206

Source: Sharp et al. 2005.

3.5 Social Environment

The demographic description of the social environment is presented primarily at the county level for south Florida counties and will include a brief discussion of the communities within in those counties that are most reliant upon spiny lobster, both commercially and recreationally. The focus on south Florida is due to the nature of the fishery which is prosecuted primarily in Miami-Dade and Monroe Counties. Utilizing demographic data at the county level will allow for updated statistics from the Census Bureau which produces estimates for geographies (counties; minor civil divisions; census designated places, etc.) that are larger than 20,000 prior to the decennial census.[6] Estimates for smaller geographies are not available at this time. Because employment opportunities often occur within a wider geographic boundary than just the community level, a discussion of various demographics within the county is appropriate and will be used to address environmental justice concerns. A more detailed description of environmental justice concerns will be at the end of this section. The county descriptions will correspond with recent research that was also conducted at the county level concerning social vulnerability and is described below.

The county-level description will focus primarily on the demographic character while fishing activity at the community level will be described where needed. Here a brief discussion of coastal growth and development that seems to affect many coastal communities, especially those with either or both commercial and recreational working waterfronts that might be reflected in those demographic statistics. This is especially true for Monroe County which has very limited land area and has seen a steady rise in land values. Recent research on the Key's communities (Shivalani 2010) has described the problem of increasing land values and disappearance of working waterfronts, especially for communities like Key West. The rapid disappearance of these types of waterfronts has important implications as the disruption of various types of fishing-related businesses and employment affect fisheries overall. The process of "gentrification," which tends to push those of a lower socio-economic class out of traditional communities as property values and taxes rise has become common along coastal areas of the U.S. and around the world. Working waterfronts tend to be displaced with development that is often stated as the "highest and best" use of waterfront property, but often is not associated with water-dependent occupations. However, with the continued removal of these types of businesses over time the local economy becomes less diverse and more reliant on the service sector and recreational tourism. As home values increase, people within lower socio-economic strata find it difficult to live within these communities and eventually must move. Consequently they spend more time and expense commuting to work, if jobs continue to be available. Newer residents often have no association with the water-dependent employment and may see that type of work and its associated infrastructure as unappealing. They often do not see the linkage between those occupations and the aesthetics of the community that produced the initial appeal for many migrants. The demographic trends within counties can provide some indication as to whether these types of coastal change may be occurring if an unusually high rate of growth or change in

[6] American Community Survey estimates are based on data collected over a three year time period. The estimates represent the average characteristics of population and housing between January 2006 and December 2008 and do not represent a single point in time. Because these data are collected over three years, they include estimates for geographic areas with populations of 20,000 or more.

the demographic character of the population is present. A rise in education levels, property values, fewer owner occupied properties and an increase in the median age can at times indicate a growing process of gentrification.

Although the most recent estimates of census data have been used here, many of the statistics related to the economic condition of counties or communities do not capture the recent downturn in the economy which may have significant impacts on current employment opportunities and business operations. Therefore, in the descriptions of both counties and communities, it should be understood that in terms of unemployment, the current conditions could be worse than indicated by the estimates used here. To be consistent, census data are used for the various demographic characteristics and as noted earlier are limited to the most recent estimates which are an average for 2006 - 2008. Other aspects of trade and market forces as a result of the economic downturn could also affect the business operations of vessels, dealers, wholesalers and retail seafood businesses for the commercial sector and charter services and other support services for the recreational fishery. These may not be reflected in the demographic profile provided here.

Marine Related Employment

Other county level tables provide summaries of marine related employment within the coastal counties of South Florida. These estimates provide the number of sole proprietors (# Prop) and the number of employed persons (# Emp) for various sectors associated with employment in the marine environment. These categories were chosen because the occupations that are represented within each sector often include fishing related activities or fishing related support activities. For instance, the sector entitled Scenic Water includes charter fishermen within the estimate. The sector Shipping includes various shipping containers that would be used by fish houses and others to handle seafood. While these estimates do not encompass all employment related to fishing and its support activities, it does provide some estimate of the amount of activity associated with employment related to both recreational and commercial fishing.

Social Vulnerability

In the map below, the counties in South Florida are shown with fishing communities identified in each. Each county has also been geocoded with regard to social vulnerability as measured by Social Vulnerability Index (SoVI). Those counties most vulnerable are shaded with light and darker red tones while those least vulnerable are shaded in lighter and darker blue tones. The yellow shading represents medium vulnerability. The Index was created by the Hazards Research Lab at the University of South Carolina (Cutter et al. 2003) to understand how places that are susceptible to coastal hazards might also exhibit vulnerabilities to social change or disruptions. These vulnerabilities may come in the form of high unemployment, high poverty rates, low education and other demographic characteristics. In fact, the SoVI is an index that consists of 32 different variables combined into one comprehensive index to measure social vulnerability. Although the SoVI was created to understand social vulnerability to coastal environmental hazards, it can also be interpreted as a general measure of vulnerability to other social disruptions, such as adverse regulatory change or manmade hazards. This does not mean that there will be adverse effects, only that there may be a potential for adverse effects under the right circumstances. Fishing communities in these vulnerable counties may have more difficulty adjusting to regulatory changes if those impacts affect employment or other critical social capital. At present, a social vulnerability index is being created for fishing communities in the Southeast region with more timely data (the SoVI uses 2000 census data). Until that index is completed, the SoVI will substitute at the county level for a measure of vulnerability for those communities that are within the boundaries of a particular coastal county. This concept is closely tied to environmental justice and the thresholds associated with that are addressed below.

Fishing Communities

The communities displayed in Figure 3.5.1 below represent a categorization of communities based upon their overall value of local commercial landings divided by the overall value of commercial landings. These data were assembled from the accumulated landings system which includes all species from both state and federal waters landed in 2008. All communities were ranked on this "regional quotient" and divided by those who were above the mean and those below. Those above the mean were then divided into thirds with the top tier classified as Primarily Involved in fishing; the second tier classified as Secondarily Involved; and the third classified as being Tangentially Involved. The communities included within the map were only those communities that were categorized as primarily or secondarily involved. This breakdown of fisheries involvement is similar to the how communities were categorized in the community profiling of South Atlantic fishing communities (Jepson et al. 2005). However, the categorization within the community profiles included other aspects associated with fishing such as infrastructure and other measures to determine a community's status with regard to reliance upon fishing. While these communities represent all fishing, communities those that are more involved in the spiny lobster fishery are represented in more depth within their respective county description.

A further breakdown of community landings is provided for those communities which have substantial landings of spiny lobster as evidenced by their local quotient (lq) which is the amount of landings and value out of the total landings for the community. This provides an indication of how reliant a community may be on a particular species.

Although it is difficult to place recreational landings within a community, a table is provided below with recreational fishing communities that have been identified by their ranking on a number of criteria including number of charter permits per thousand population and recreational fishing infrastructure as listed under the MRIP survey identified within each community. Because the recreational lobster fishery is such an important part of the Florida Keys economy, most every Keys community might be considered a recreational fishing community. This list of recreational fishing communities is not exhaustive and should be considered a guide to where substantial recreational fishing activity may take place.

Southern Florida Counties

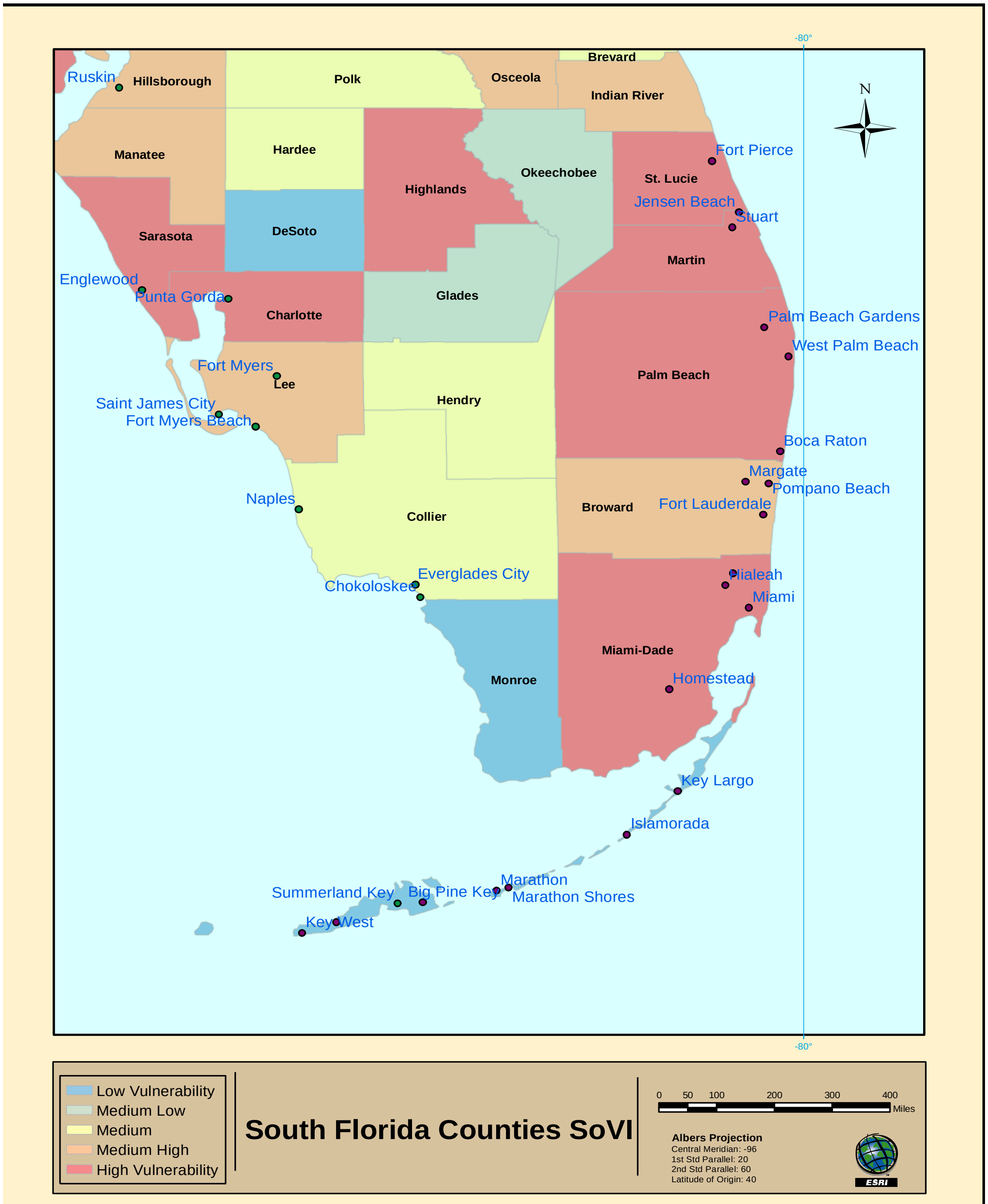

Figure 3.5.1. The Social Vulnerability Index applied to South Florida Counties.
Source: http://webra.cas.sc.edu/hvri/products/sovi.aspx#.

Table 3.5.1. Marine Related Employment for 2007 in South Florida Coastal Counties.
Source: Census Bureau 2010

Florida County	Broward		Miami-Dade		Monroe		Palm Beach		Collier	
Sector	# Prop	# Emp	# Prop	# Emp	# Prop	# Emp	# Prop	# Emp	# Prop	# Emp
Boat Dealers	253	.	108	.	23	.	108	.	26	
Seafood Dealers	.	406	.	.	.	112	.	46		38
Seafood Harvesters	228	.	396	.	934	.	287	.	176	
Seafood Retail	28	291	79	.	7	7	18	57		14
Marinas	.	707	34	.	.	191	10	887		204
Processors	0	142	.	.	0	.	.	176		
Scenic Water	.	313	.	.	.	315	.	94		97
Ship Boat Builders	.	776	.	.	.	17	.	100		
Shipping Support	.	1557	.	.	.	67	.	756		7
Shipping		995	.	.	.	35		69		5

Gulf Counties

Of those commuities in the Gulf with landings of spiny lobster, Key West leads with over 50% of the pounds and close to 50% of the value of total Gulf landings or regional quota (rq) (Figure 3.5.2). Marathon is second with over 30% of both landings and value in the Gulf.

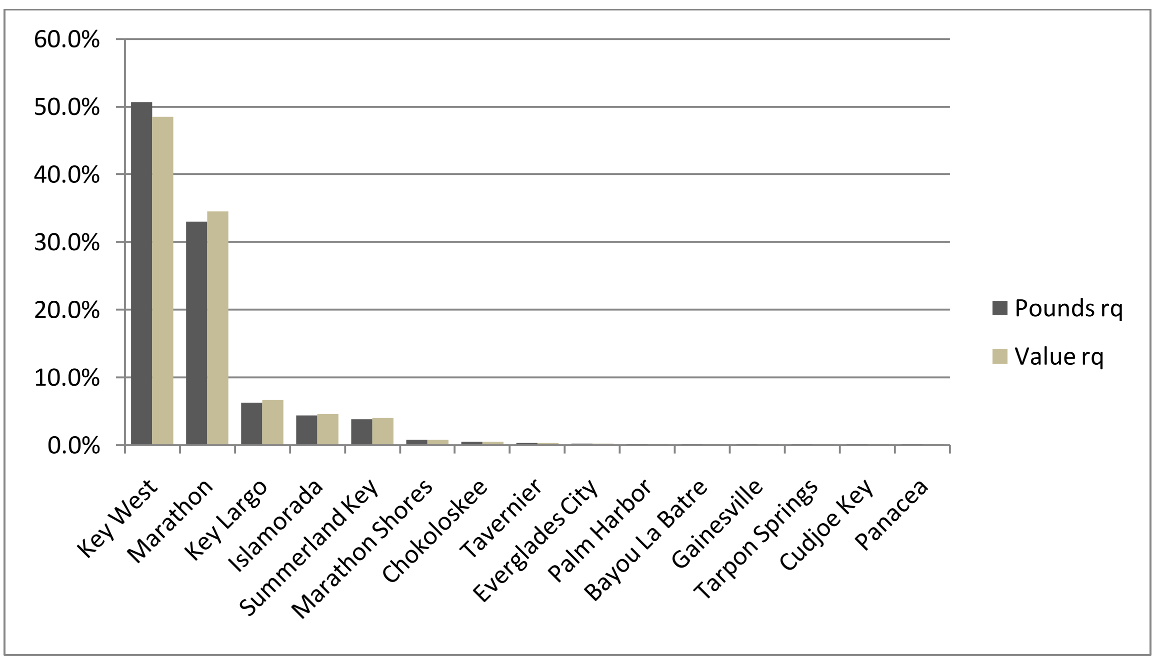

Figure 3.5.2. Proportion of spiny lobster commercial landings and value by total spiny lobster landings and value for Gulf Coast Communities.
Source: ALS 2008.

The next four communities have less than 10% each and are: Key Largo, Islamorada, Summerland Key and Marathon Shores. Chokoloskee and Everglades City in Collier County are the two highest landing communities, both with less than 1% of the Gulf total. These communities are featured under their respective county descriptions.

Monroe County

Monroe County had a total population of 79,589 in 2000 that is estimated to have fallen to 74,397 by 2007. The majority of residents were identified a White (92.0%) in 2000 and was estimated to have dropped slightly to 90.4% in 2007. The Hispanic population has grown from 16.0 % in 2000 to 18.0% in 2007. Florida as a state had an estimated 77.8% White population and Hispanics made up 20.5% of its total population. The White alone population for the state was estimated to be 60.7% in 2007. The median age for residents of Monroe County was estimated to have been 47.2 which is slightly higher than it was in 2000 when it was 43.0. The median age for the State of Florida was 38.7 in 2000 and was estimated to have increased to 40.1 by 2007 so Monroe County's median age is considerably older than the state as a whole. There was an estimated 2.8 % of the population in the civilian force that was estimated to be unemployed in Monroe County, which was quite a bit lower than the State's unemployment rate of 6.4%. The percentage of persons below the poverty level was estimated at 10.1% which was below the 12.6% for the state as a whole during 2007. Monroe County had a slightly higher owner occupied housing rate than the state with slightly over 71.2% of owner occupied housing to the State's 70.3% estimated for 2007 (U.S. Census Bureau).

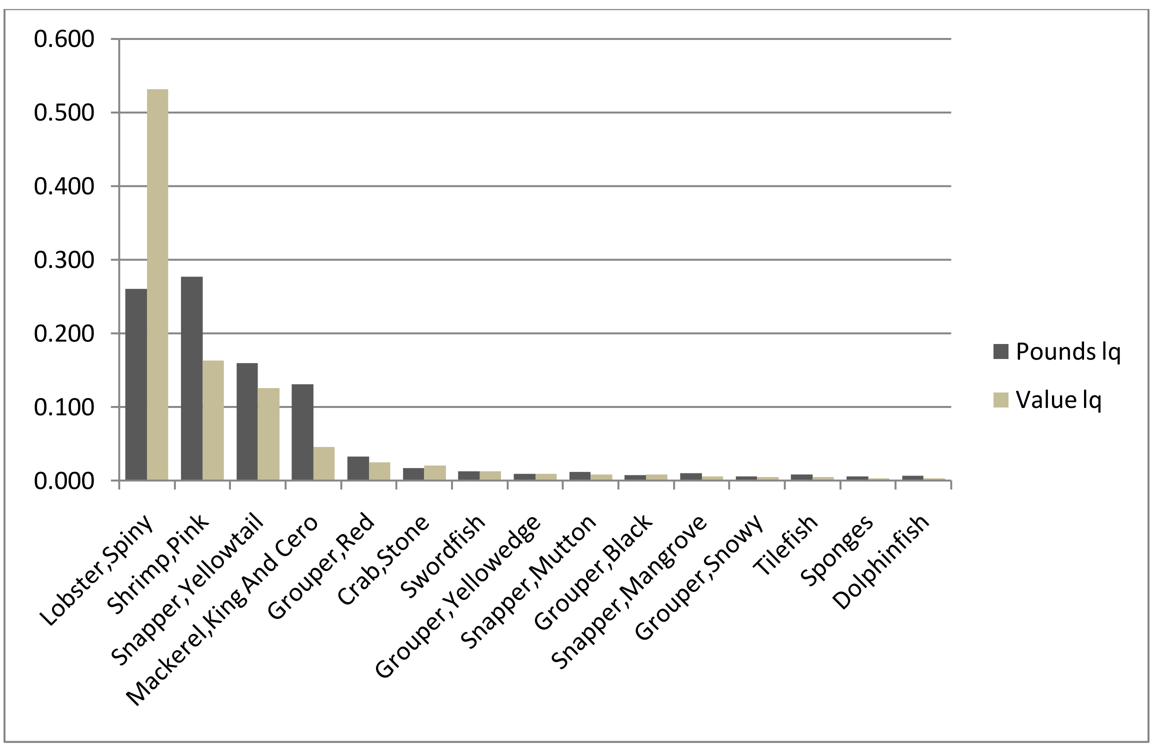

Figure 3.5.3. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Key West, Florida.
Source: ALS 2008.

Of the Monroe County communities, Key West is by far the leader in spiny lobster landings as shown in Figure 3.5.3. Spiny lobster landings have by far more value than any other fishery or component fishery making up over 50% of total landings value for the community. Pink shrimp is second in value, but first in terms of pounds landed within the community.

The community of Marathon has a significant amount of local quotient value derived from spiny lobster with over 60% of total landings value coming from spiny lobster and 40% of landings in 2008 as shown in Figure 3.5.4. Stone crab landing are almost equal to lobster, but value is far greater for spiny lobster.

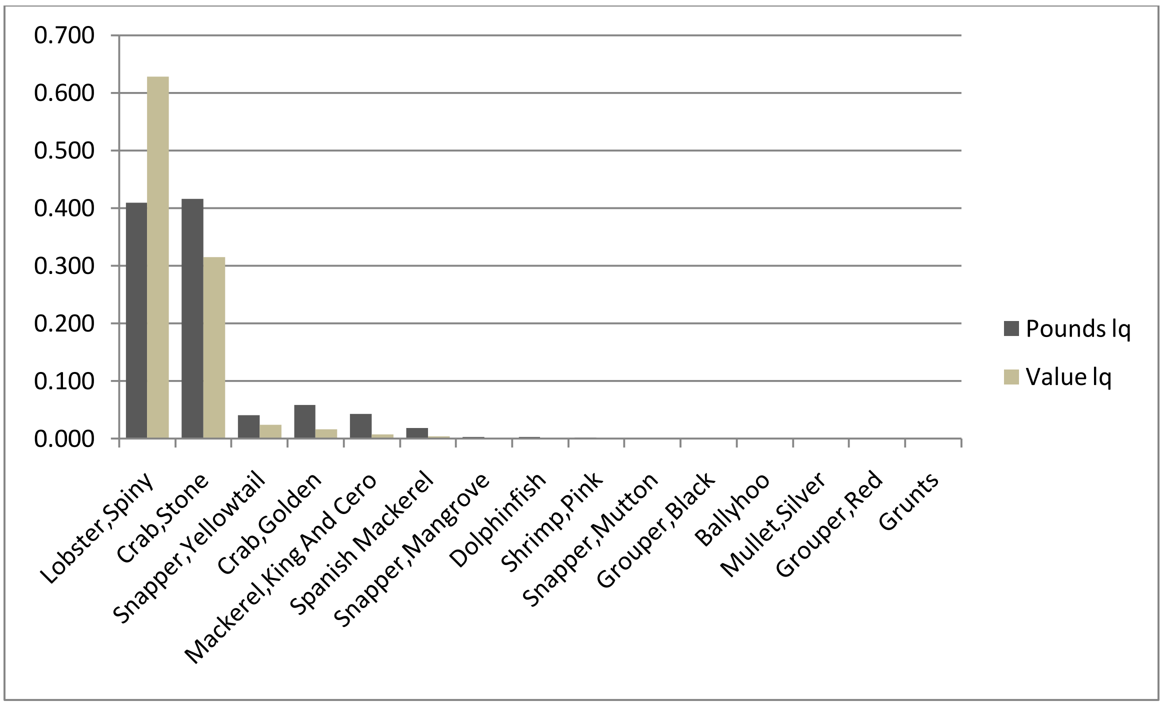

Figure 3.5.4. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Marathon, Florida.
Source: ALS 2008.

The community of Key Largo also recieves considerable value from spiny lobster with over 50% of the value from all landings coming from that species which comprises less than 20% of all landings as shown in Figure 3.5.5.

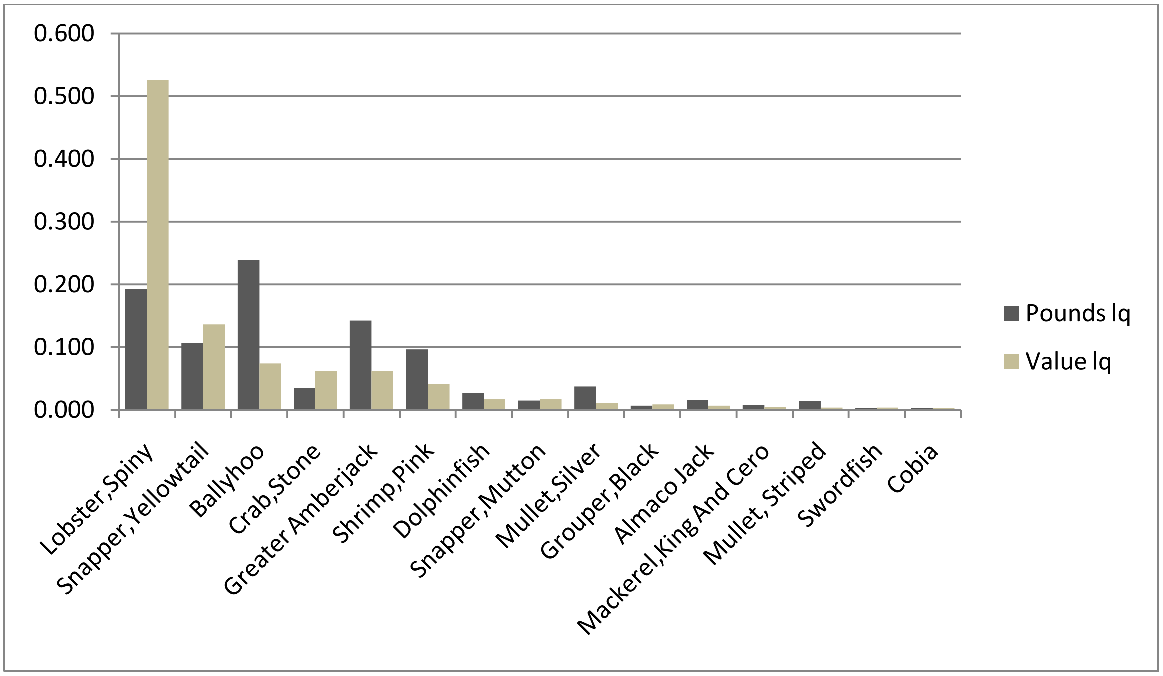

Figure 3.5.5. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Key Largo, Florida.
Source: ALS 2008.

Islamorada also derives over 50% of all value from spiny lobster landings while constituting only 20% of total landings for the community as shown in Figure 3.5.6.

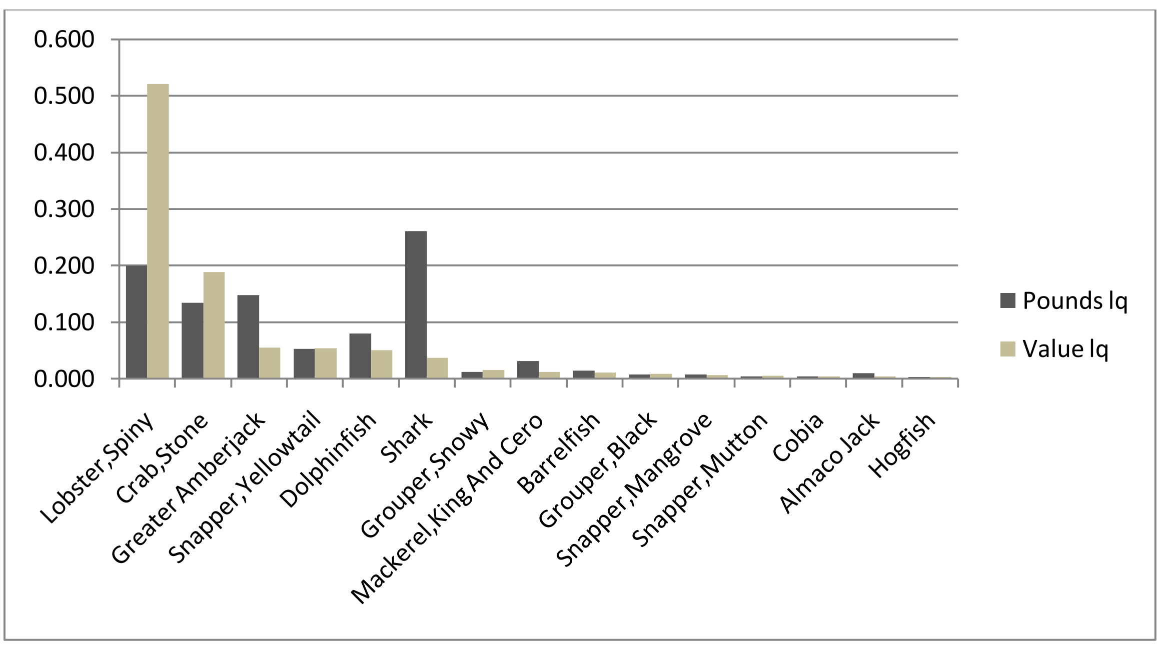

Figure 3.5.6. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Islamorada, Florida.
Source: ALS 2008.

Summerland Key, also in Monroe County, has substantial landings and value from spiny lobster. As depicted in Figure 3.5.7, spiny lobster accounts for over 60% of all landed value for the community and 40% of all landings. The next closest species is yellowtail snapper with just 10% of value and just under 20% of landings.

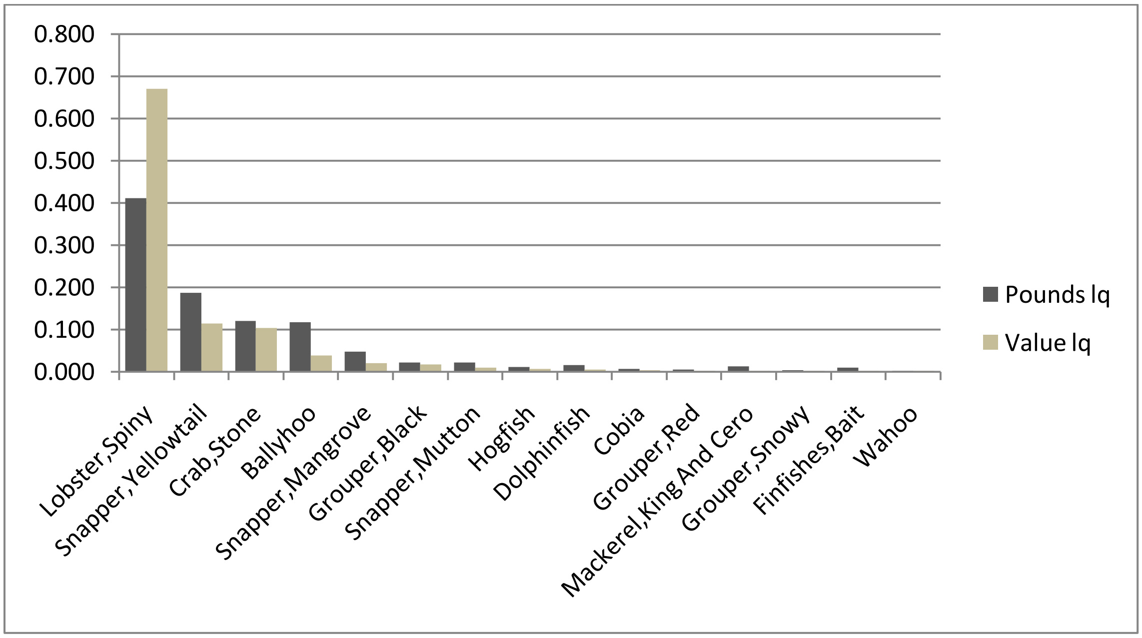

Figure 3.5.7. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Summerland Key, Florida.
Source: ALS 2008.

Collier County

Collier County had a total population of 251,377 in 2000 that is estimated to have grown to 315,839 by 2007. The majority of residents (87.2%) were identified a White in 2007 and the Hispanic population was 25.1% in 2007, while Florida as a state had an estimated 77.8% White population and Hispanics made up 20.5% of its total population. The median age for residents of Collier County was estimated to have been 44.3 while the median age for the State of Florida was 40.1 by 2007 so Collier County's median age is higher than the state as a whole. There was an estimated 5.3 % of the population in the civilian force that was estimated to be unemployed in Collier County, which was slightly below the State's unemployment rate of 6.4%. The percentage of persons below the poverty level was estimated at 10.2% which was below the 12.6% for the state as a whole during 2007. Collier County had a higher owner occupied housing rate than the state with over 76.3% of owner occupied housing to the State's 70.3% estimated for 2007 (U.S. Census Bureau)

Of the communities in Collier County that have spiny lobster landings are Chokoloskee and Everglades City (Figures 3.5.8 and 3.5.9). Neither community derives substantial landings or value from spiny lobster, yet it is third in value for both communities. Landings and value in both communities is dominated by stone crab.

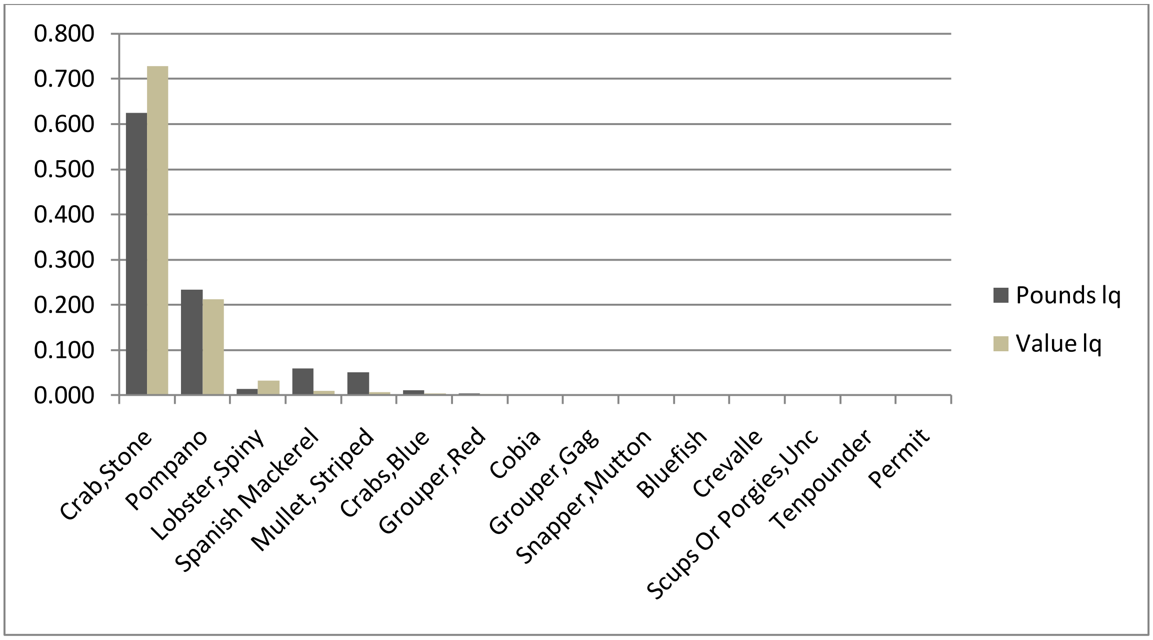

Figure 3.5.8. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Everglades City, Florida.
Source: ALS 2008.

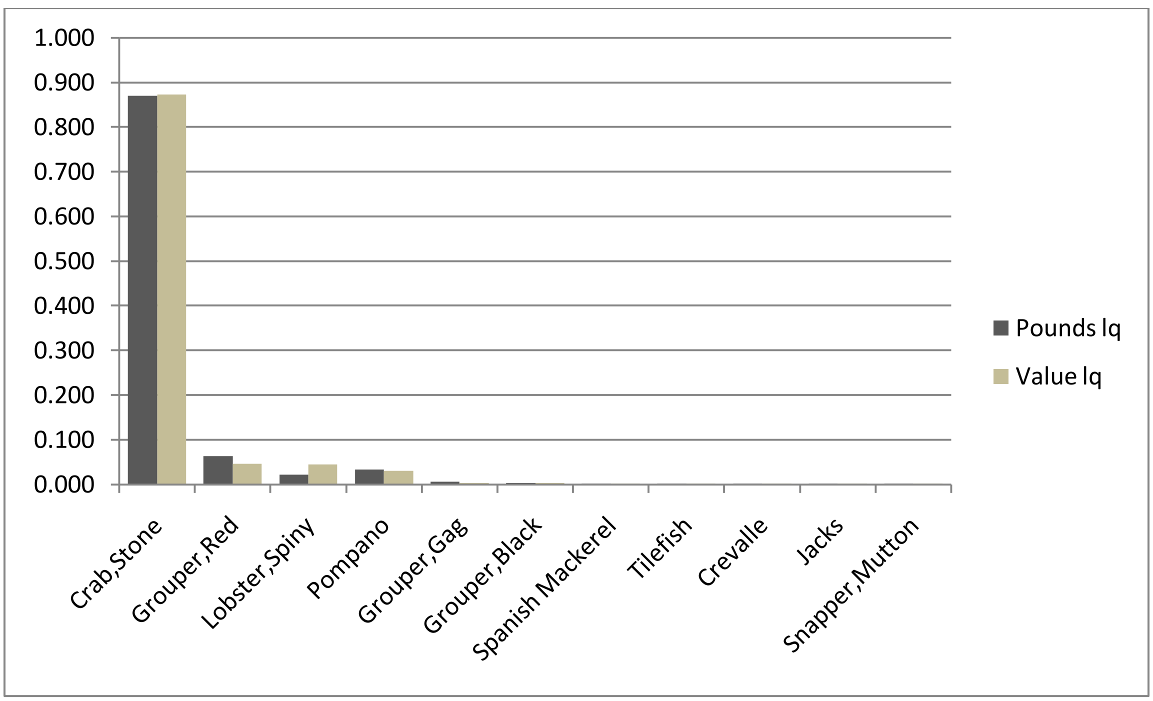

Figure 3.5.9. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Chokoloskee, Florida.
Source: ALS 2008.

South Atlantic

Of those commuities in the South Atlantic with landings of spiny lobster, Miami has by far the most with over 75% of the pounds and value of total South Alantic landings (the Keys communities were included in the Gulf landings) (Figure 3.5.10). The next four communities have less than 10% each and are: Fort Lauderdale, North Miami, Palm Beach Gardens and Hialeah. These five communities are featured under their respective county descriptions.

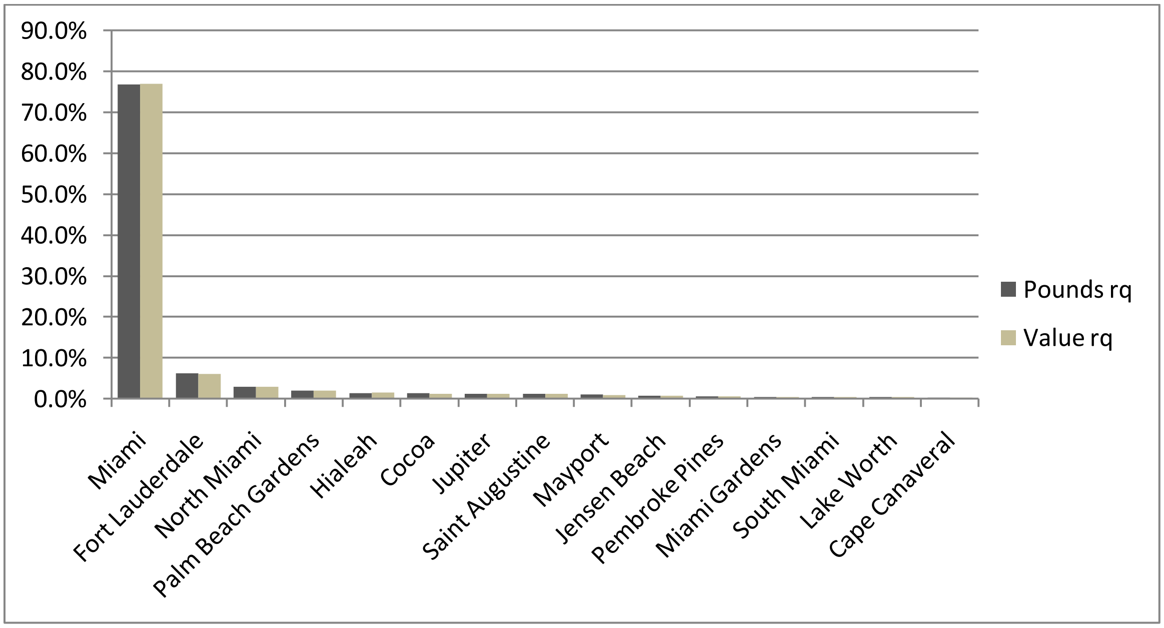

Figure 3.5.10. Proportion (rq) of spiny lobster commercial landings and value by total spiny lobster landings and value for South Atlantic communities.
Source: ALS 2008.

Palm Beach County

Palm Beach County had a total population of 1,131,191 in 2000 that is estimated to have grown to 1,754,846 by 2007. The majority of residents (75.6%) were identified a White in 2007 and the Hispanic population was 17.3% in 2007, while Florida as a state had an estimated 77.8% White population and Hispanics made up 20.5% of its total population. The median age for residents of Palm Beach County was estimated to have been 43.0 while the median age for the State of Florida was 40.1 by 2007 so Palm Beach County's median age is higher than the state as a whole. There was an estimated 6.3 % of the population in the civilian force that was estimated to be unemployed in Palm Beach County, which was almost the same as the State's unemployment rate of 6.4%. The percentage of persons below the poverty level was estimated at 11.5% which was below the 12.6% for the state as a whole during 2007. Palm Beach County had a higher owner occupied housing rate than the state with over 74.3% of owner occupied housing to the State's 70.3% estimated for 2007 (U.S. Census Bureau).

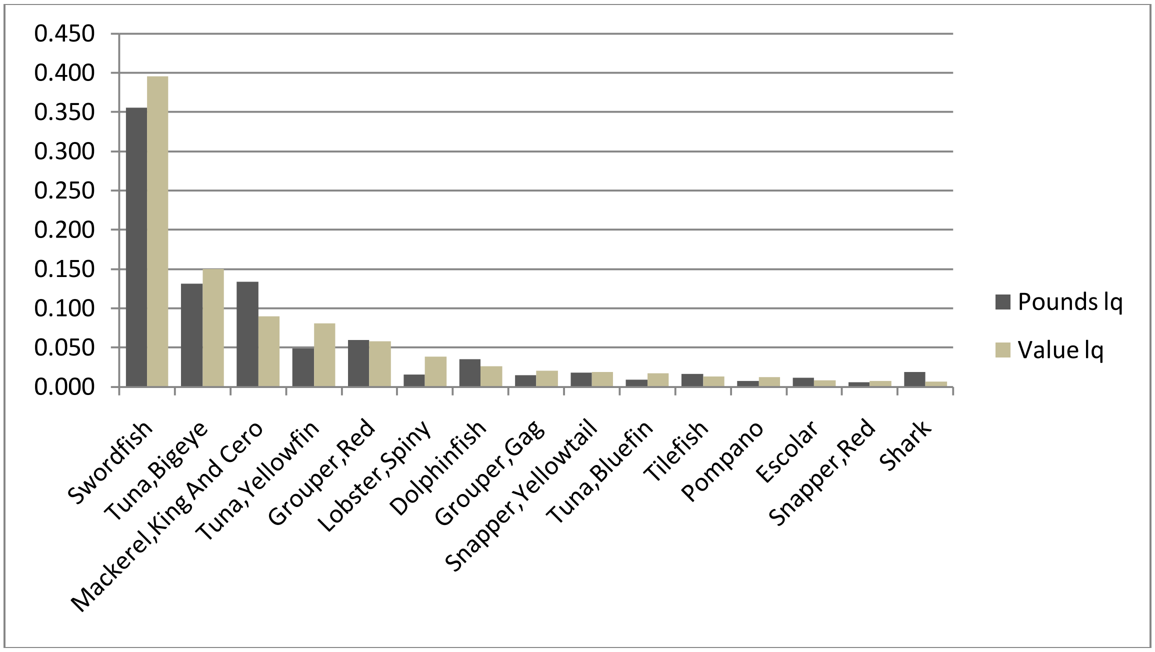

Figure 3.5.11. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Palm Beach Gardens, Florida.
Source: ALS 2008.

Value of spiny lobster for Palm Beach Gardens is just below 5% of total landings and around 2% of landings overall. Five other species rank ahead of spiny lobster in terms of value, with swordfish by far the most valuable for the community as depicted in Figure 3.5.11.

Miami-Dade County

Miami-Dade County had a total population of 2,253,779 in 2000 that is estimated to have grown to 2,387,170 by 2007. The majority of residents were identified a White (74.4%) in 2007 and the Hispanic population was 61.7%, the largest in the state. Florida as a state had an estimated 77.8% White population and Hispanics made up 20.5% of its total population. The median age for residents of Miami-Dade County was estimated to have been 38.7 while the median age for the State of Florida was 40.1.7 by 2007 so Miami-Dade County's median age is slightly younger than the state as a whole. There was an estimated 5.9 % of the population in the civilian force that was estimated to be unemployed in Miami-Dade County, which was somewhat lower than the State's unemployment rate of 6.4%. The percentage of persons below the poverty level was estimated at 16.1% which was above the 12.6% for the state as a whole during 2007. Miami-Dade County had a lower owner occupied housing rate than the state with over 60.1% of owner occupied housing to the State's 70.3% estimated for 2007 (U.S. Census Bureau).

Spiny lobster is by far the most valuable species landed in Miami with over 60% of the value of total landings and just over 30% of landings as depicted in Figure 3.5.12.

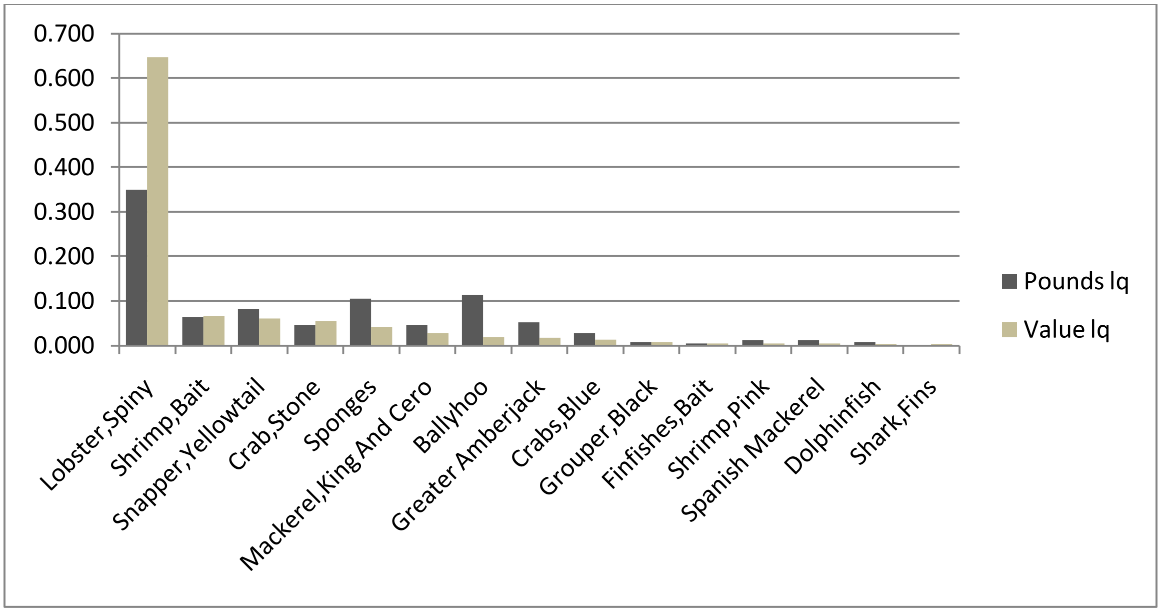

Figure 3.5.12. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Miami, Florida.
Source: ALS 2008.

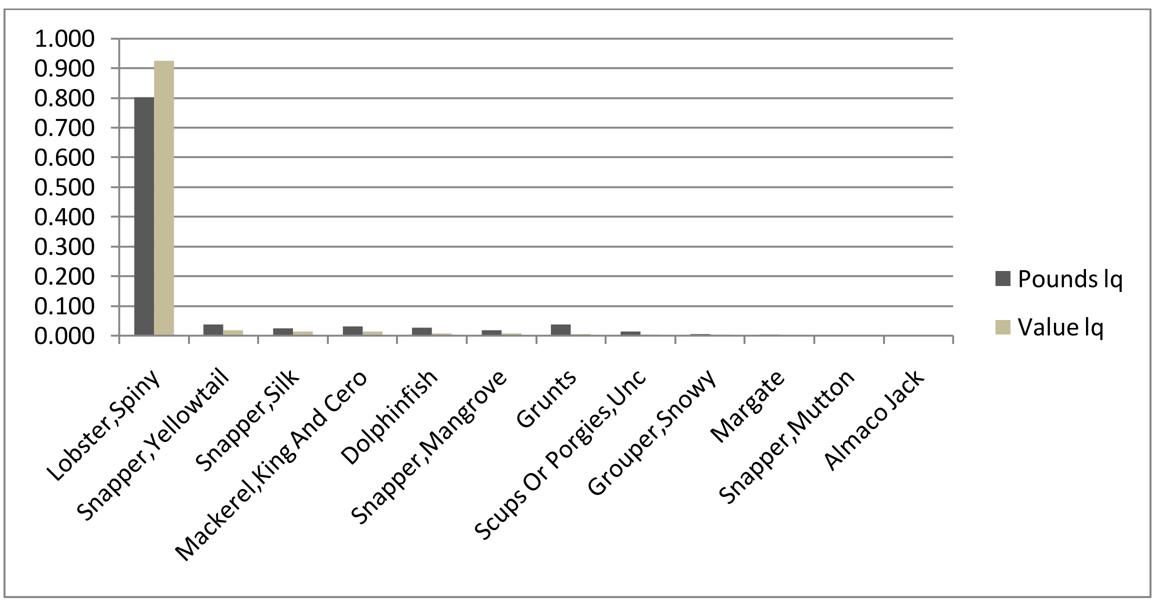

Figure 3.5.13. Proportion (lq) of landings and value for top fifteen species out of total landings and value for North Miami, Florida.
Source: ALS 2008.

North Miami landings and value are completely dominated by spiny lobster with over 90% of the value and 80% of total landings attributed to that species (Figure 3.5.13). All other species make up less than 3% each.

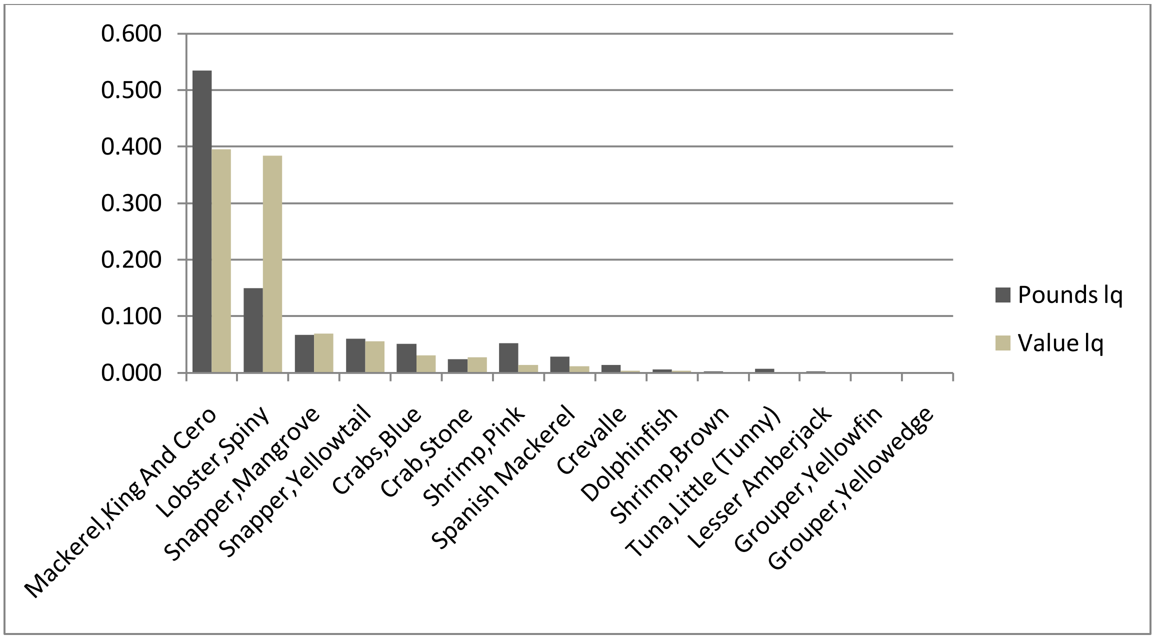

Figure 3.5.14. Proportion (lq) of landings and value for top fifteen species out of total landings and value for Hialeah, Florida.
Source: ALS 2008.

Hialeah derives almost 40% of value from all landings in spiny lobster while it makes up only 15% of landings (Figure 3.5.14). In contrast, king mackerel makes up over 50% of landings and only slightly less than 40% of value.

Recreational Fishing

As mentioned earlier, recreational fishing for spiny lobster is an important fishery for the Keys and surrounding counties. Table 3.5.2 lists recreational fishing communities along Florida's Atlantic coast, including the Keys.

Table 3.5.2. Recreational Fishing Commuinties along Florida's East Coast.

Community	**State**
Islamorada	FL
Cudjoe Key	FL
Key West	FL
Tavernier	FL
Little Torch Key	FL
Ponce Inlet	FL
Marathon	FL
Sugarloaf Key	FL
Palm Beach Shores	FL
Big Pine Key	FL
Saint Augustine	FL
Key Largo	FL
Summerland Key	FL
Sebastian	FL
Cape Canaveral	FL

The ranking is based upon serveral criteria as mentioned earlier which include the number of charter permits per thousand population and the number of recreational fishing infratstructure attributed to the community as listed under the MRIP survey. As seen in Table 3.5.2, the Keys communities rank high in terms of reliance upon recreational fishing.

In Figure 3.5.15 the distribution of recreational spiny lobster permits is presented and suggests a wide dispersion around the state which may indicate the Keys communities draw a considerable number of recreatoinal fishers from the entire state to fish spiny lobster during the season. By far the largest concentration of permits are in the lower east coast zip code areas and the Keys. In deed, Sharp et al. (2005) find that recent trends in recreational landings have increased although overall effort may have decreased. This is a significant finding as there has been a slight effort shift away from the commercial fishery to the recreational. What drives this shift in effort is unknown, but may be due to regulatory changes and other outside factors as suggested by Shivlani (2009).

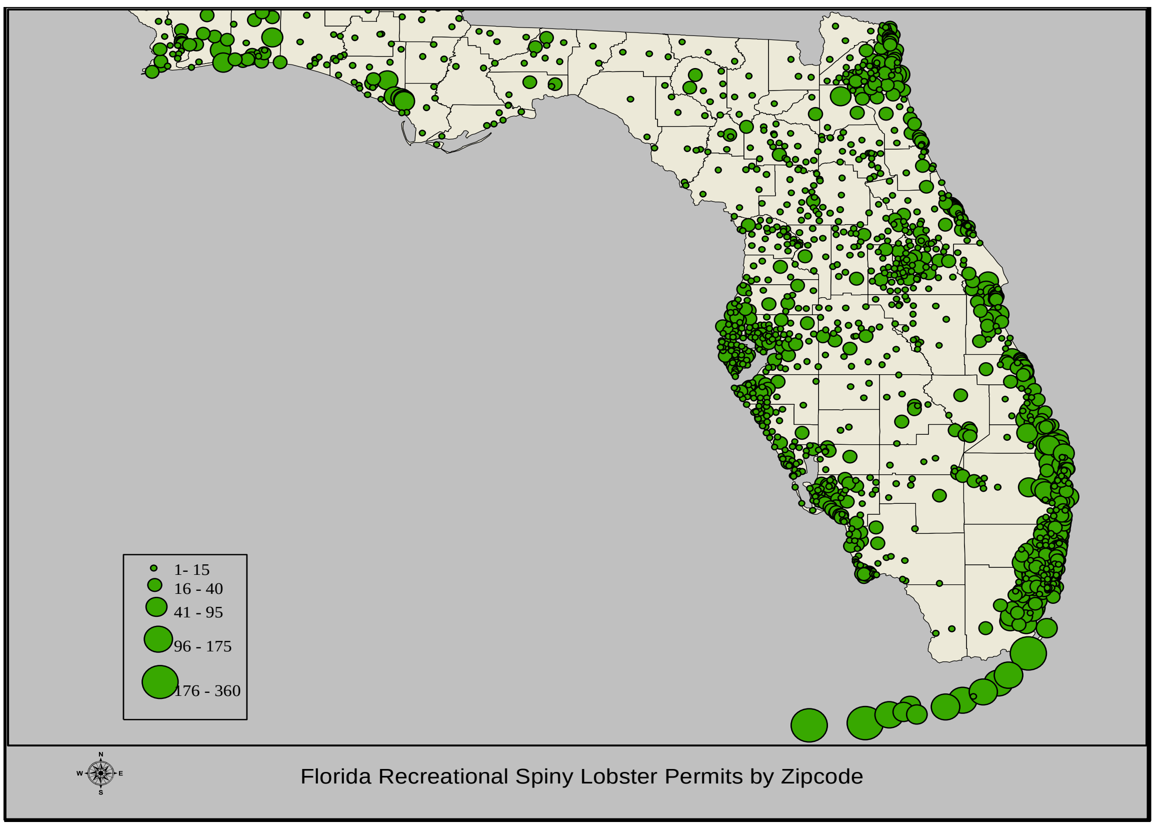

Figure 3.5.15. Florida Recreatoinal Spiny Lobster Permits for 2010 by Zipcode of Permit Holder.
Source: Florida Fish and Wildlife 2010.

3.5.1 Environmental Justice

As mentioned, environmental justice is related to the idea of social vulnerability; however, there are no thresholds with regard to social vulnerability. Environmental Justice is addressed through Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations and requires federal agencies conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence. Impacts of commercial and recreational fishing on subsistence fishing are a concern in fisheries management; however, there are no such implications from the action proposed in this amendment.

Although it is anticipated that the impacts of this amendment may affect communities with environmental justice concerns, because the impacts should not discriminate against any group, this action should not trigger any environmental justice concerns. In reviewing the thresholds for minorities among the coastal counties involved, Miami-Dade and Broward in Florida exceed the threshold for minorities, while with regard to poverty, Miami-Dade Counties exceeds the poverty threshold. Again, as illustrated by the SoVI, environmental justice is closely tied to social vulnerability index as most of the counties that do not meet these thresholds are also considered medium high or highly vulnerable. It is anticipated that the impacts from the following management actions may impact minorities and the poor, but not through discriminatory application of these regulations. However, it is also noted that while Monroe County does not exceed any of the EJ thresholds, nor is it classified as being vulnerable in terms of social vulnerability, there are processes that affect working waterfronts and therefore commercial and charter fishermen through the process of gentrification. While the regulatory actions within this amendment in and of themselves may not precipitate social change or disruptions, in combination with these and other outside factors, working waterfronts may be negatively affected.

3.6 Administrative Environment

3.6.1 Federal Fishery Management

Federal fishery management is conducted under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.), originally enacted in 1976. The Magnuson-Stevens Act claims sovereign rights and exclusive fishery management authority over most fishery resources within the EEZ, an area extending 200 nautical miles from the seaward boundary of each of the coastal states, and authority over US anadromous species and continental shelf resources that occur beyond the EEZ.

Responsibility for federal fishery management decision-making is divided between the Secretary of Commerce (Secretary) and eight regional fishery management councils that represent the expertise and interests of constituent states. Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary is responsible for promulgating regulations to implement proposed plans and amendments after ensuring management measures are consistent with the Magnuson-Stevens Act and with other applicable laws summarized in Section 10. In most cases, the Secretary has delegated this authority to NOAA Fisheries Service.

The Councils are responsible for fishery resources in federal waters of their respective regions. These waters extend to 200 nautical miles offshore from the nine-mile seaward boundary of the states of Florida Texas and the territory of Puerto Rico, and the three-mile seaward boundary of the Atlantic side of Florida and the states of Alabama, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and the territory of the USVI.

The Councils consist of voting members: public members appointed by the Secretary; one each from the fishery agencies of the state or territory, and one from NOAA Fisheries Service. The public is also involved in the fishery management process through participation on advisory panels and through council meetings that, with few exceptions for discussing personnel matters and litigation, are open to the public. The regulatory process is also in accordance with the Administrative Procedures Act, in the form of "notice and comment" rulemaking, which provides extensive opportunity for public scrutiny and comment, and requires consideration of and response to those comments.

Regulations contained within FMPs are enforced through actions of the NOAA's Office for Law Enforcement, the U.S. Coast Guard, and various state authorities. To better coordinate enforcement activities, federal and state enforcement agencies have developed cooperative agreements to enforce the Magnuson-Stevens Act.

3.6.2 State Fishery Management

The purpose of state representation at the council level is to ensure state participation in federal fishery management decision-making and to promote the development of compatible regulations in state and federal waters. The state governments have the authority to manage their respective state fisheries. Each of the states exercises legislative and regulatory authority over their states' natural resources through discrete administrative units. Although each agency is the primary administrative body with respect to the states' natural resources, all states cooperate with numerous state and federal regulatory agencies when managing marine resources.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Action 1: Other species in the Spiny Lobster FMP

4.1.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

Alternative 1 would not meet the National Standard 1 guidelines and have have the same impacts to the physical or biological environments as currently exist.

Alternative 2 would set ACLs and AMs for each species. This alternative would be expected to have positive impacts on the physical and biological environments if catch is constrained below current levels. However, setting an appropriate ACL for the smoothtail and spotted spiny lobster (**Option a** and **b**) would be difficult, because no historical landings are available for these species. The two species of slipper lobsters, Spanish and ridged (**Option c** and **d**) have commercial landings information, but are considered species landed as bycatch in the shrimp trawl and the Caribbean lobster trap fishery. Positive physical, ecological, and biological impacts may result from better monitoring and record keeping of the resource, and implementing accountability measures, when and if the ACLs are exceeded.

If **Alternative 3** was selected as preferred, the impacts would be the same as currently, unless new data collection programs are developed. Leaving the species in the fishery management plan may offer the benefit of collecting data if the future that could be used in the development of conservation and management measures, and positive impacts to the physical and biological environments would be expected at a later date. However, no data collection programs are currently in place for any of these species.

Alternative 4 would remove any or all of the other lobster species from the fishery management plan. If other agencies, such as the individual states, took over management, positive physical and biological impacts could occur. However, the two spiny lobster species (**Option a** and **b**) have no landings information available, so management by any agency would be just as difficult. The two species of slipper lobster (**Option c** and **d**) currently have some federal regulations. If the two slipper lobsters were removed from the fishery management plan and another agency took over management, positive impacts to the physical and biological environments would be expected because the Florida regulations concerning the taking of egg-bearing females, or stripping or removing eggs, are more conservative than federal regulations. If another agency did not take over management of other lobster species, and overfishing or detriment to the resource occurred without our knowledge, negative physical and biological impacts would be expected. Because of the lack of landings data on the other species of spiny and slipper lobster presently in the Spiny Lobster FMP, completing a stock assessment would probably not be possible, even for the ridged slipper lobster (Sharp et al. 2007).

4.1.2 Direct and Indirect Effect on the Economic Environment

Alternative 1 would not result in any change in the species contained in the management unit, species retained for data collection, or species listed as ecosystem components. As a result, all status quo management conditions and related operation of the fishery, and associated economic benefits, would remain unchanged. If any or all of the species considered by this action require more detailed and management protection, however, as would occur under **Alternative 2**, **Alternative 1** would prevent such protection from occurring, increasing the likelihood of current or future resource decline, with associated reduction in economic benefits.

Data on commercial fishing for scyllarid (*Scyllaridae* family) lobsters are collected and managed inseparably, and these data are summarized for Florida in Section 2.1, Table 4.1.2.1 and Table 4.1.2.2. Sharp, Hunt and Teehan (2007) describe ecology for the two species and commercial fishing for scyllarid lobsters; they indicate that landings of scyllarid lobsters peaked in 1985 and have been much lower since then. Apparently, fishing was affected by regulatory changes for commercial fishing for shrimp (the authors are quoted below under **Alternative 1**). Today, the landings are well below those of 1985, and much lower than in the mid-1990s. They averaged 4,737 pounds per year in the last 5 years, a period which is assumed to represent **Alternative 1** (the status quo) (Table 4.1.2.2). The ex-vessel value (paid to fishermen by first buyers), $24,232 in 2008$, is a small part of the total for trip gross, $304,989, approximately two thirds of which is for shrimp (Table 4.1.2.1). At $5.12 a pound, the ex-vessel prices are a bit lower than for Caribbean spiny lobster. Although annual landing of scyllarid lobsters declined markedly in the past 20 years, average trip landings were relatively stable: 100 pounds per trip for the last 5 years, 70 pounds per trip in the preceding 5 years, and 78 pounds per trip for the last 21 years (weighted averages, as explained in the footnote for Table 4.1.2.2).

The vessels landing scyllarid lobsters in Florida in the last 5 years averaged $13,260 per vessel in annual gross revenue for all species landed, including $9,391 for shrimp, while the 47 trips averaged $6,489 in trip gross, including $4,596 for shrimp (Table 4.1.2.1). Shrimp trawls accounted for 75% of the ex-vessel value of landings of scyllarid lobsters, followed by lobster traps (10%), and diving (7.9%), referring to data in 2008$ for 96/97-09/10.

Given the significance of fuel in trip costs when using shrimp trawls at greater depths for scyllarid lobsters, commercial fishing for scyllarid lobsters as well as shrimp could have been significantly affected by increasing fuel prices in 2004-2008. Diesel fuel rose gradually in 2004-2006. Diesel fuel rose sharply in 2007-2008, peaked in July 2008, and declined by half in late 2008 to levels of late 2006. Note: An the index producer-level prices for diesel fuel averaged 100.5 in 2003, peaked at 431.9 in July 2008 and fell to 168.0 in December 2008 (U.S. Bureau of Labor Statistics, producer price index for no. 2 diesel fuel, 1982 base of 100).

Table 4.1.2.1 Florida commercial fishing for scyllarid lobsters.

Period	Vessels	Trips	Pounds	2008$	2008$ /lb	Trip gross, 2008$	Shrimp in trip gross, 2008$	Vessel gross, 2008$
Trips landing > = 1 lb of slipper lobster.								
89/90-93/94	192	538	39,948	$152,479	$3.82	$2,503,041	$2,095,000	$2,503,041
04/05/08/09	23	47	4,737	$24,232	$5.12	$304,989	$216,000	$304,989
Avg. per-vessel, 04/05/08/09			206	$1,054		$13,260	$9,391	$13,260
Avg. per-trip, 04/05/08/09			101	$516		$6,489	$4,596	$6,489
Trips landing > = 1 lb of slipper lobster and slipper lobster is the top species in trip value.								
89/90-93/94	78	137	27,000	$106,000	$3.93	$120,604		$120,604
04/05/08/09	8.6	15.8	3,476	$18,546	$5.34	$19,606		$19,606
Avg. per-vessel, 04/05/08/09			404	$2,157		$2,280		$2,280
Avg. per-trip, 04/05/08/09			220	$1,174		$1,241		$1,241
NMFS, SEFSC, FTT (19Mar10), data and methods as for spiny lobster in Vondruska 2010a. Multi-year averages for trips and vessels were computed from unrounded data. All data are for trips with landings of at least one pound of slipper (scyllarid) lobster for July-June fishing years. In ranking species by dollar value on individual trips, all shrimp are counted as one species, and the same is true for groupers, snappers other than yellowtail snapper, tuna, and stone crab.								

Table 4.1.2.2 Florida commercial fishing for scyllarid lobsters.

Fishing year	Slipper (scyllarid) lobster				Trip gross, all species landed	Value of shrimp in trip gross	Average landings of scyllarid lobster per trip
	Vessels	Trips	Lbs	2008$	2008$	2008$	Lbs / trip
	1	2	3	4	5	6	7
86/87	145	535	28,097	$139,737	$3,164,506	$2,847,000	53
87/88	131	487	19,952	$77,776	$3,368,151	$3,094,000	41
88/89	198	558	40,736	$127,040	$3,462,936	$3,145,000	73
89/90	149	334	14,793	$46,590	$1,911,348	$1,699,000	44
90/91	187	465	27,282	$100,244	$2,005,785	$1,757,000	59
91/92	213	653	48,728	$190,484	$2,041,960	$1,586,000	75
92/93	193	584	48,708	$201,406	$2,909,027	$2,326,000	83
93/94	220	655	60,230	$223,671	$3,647,087	$3,107,000	92
94/95	130	411	33,531	$117,551	$2,425,114	$1,789,000	82
95/96	148	362	26,843	$109,467	$1,741,169	$1,258,000	74
96/97	193	437	43,565	$194,740	$2,755,427	$2,467,000	100
97/98	122	335	30,872	$131,100	$2,589,996	$2,287,000	92
98/99	101	225	13,139	$56,937	$967,323	$662,000	58
99/00	71	146	7,196	$33,469	$1,300,163	$839,000	49
00/01	88	145	8,766	$49,169	$1,321,361	$983,000	60
01/02	81	179	8,582	$51,109	$1,767,823	$1,245,000	48
02/03	59	130	9,951	$58,195	$857,261	$637,000	77
03/04	58	132	17,012	$98,764	$671,789	$429,000	129
04/05	36	72	5,000	$23,537	$532,271	$430,000	69
05/06	30	63	4,291	$22,078	$496,995	$411,000	68
06/07	26	56	6,060	$30,933	$185,422	$26,000	108
07/08	10	23	6,443	$36,865	$159,716	$116,000	280
08/09	14	22	1,889	$7,747	$150,541	$97,000	86
Averages for rows, excepting last column which uses weighted average (see footnote)							
99/00-08/09	47	97	7,519	$41,187	$744,334	$521,300	78
99/00-03/04	71	146	10,301	$58,141	$1,183,679	$826,600	70
04/05-08/09	23	47	4,737	$24,232	$304,989	$216,000	100
NMFS, SEFSC, FTT (19Mar10) data, as used for spiny lobster in Vondruska 2010a. All shrimp are counted as one species. Data are for trips with landings of at least one pound of scyllarid lobsters for July-June fishing years. Because of the declining number of trips, weighted averages for pounds per trip are shown in the last column, rather than averages for data in the last column: 78 lbs / trip for 99/00-08/09 (78 lbs / trip = 7,519 lbs / 97 trips), 70 lbs / trip for 99/00-03/04 (70 lbs / trip = 10,301 lbs / 146 trips), and 100 lbs / trip for 04/05-08/09 (100 lbs / trip = 4,737 lbs / 47 trips).							

During the past 20 years or so, scyllarid lobsters landed in Florida were caught at greater depths, approximately 80-110 ft, compared with 30-45 ft for Caribbean spiny lobster and 40-70 ft for shrimp. The median monthly time away from port (days at sea) for trips for scyllarid lobsters was more variable than for shrimp (shrimp, approximately 8 hours), more seasonal, and, typically, much higher, often, 70 hours to 200 hours and more per trip. The depth of capture and time away from port for trips with landings of scyllarid lobsters in Florida are consistent with results of a two-year study of populations of several species of lobster, including *S. nodifer* (depth, 30 meters) (Sharp et al. 2007, p. 235). Apparently, *S. nodifer* reside in dens during the day and may feed on unconsolidated bottoms at night. The authors indicate that in the early 1980s, shrimp fishermen had directed fishing effort toward *S. nodifer* on the west coast of Florida in the spring and summer, and that such effort subsided from the late 1980s onward, apparently in part because of regulations for shrimp fishing (*Ibidem*, quoting p. 237):

> A part-time fishery developed for *S. nodifer* in the Gulf of Mexico during the 1980s (Moe 1991), and landings increased rapidly during the early part of the decade (Figure 11.3 shows landings by coast and by year). Hardwick & Cline (1990) noted that shrimpers operating along the west coast of the state directed fishing effort toward *S. nodifer* during the spring and summer in their "off-season." They provided a detailed description of one such fishing operation and noted that fishers modified their shrimp trawls to withstand the habitat in which they had frequently including *S. nodifer*, and then concentrated their fishing effort in those specific areas.
>
> …
>
> Landings of scyllarid lobsters along the west coast peaked in 1985, and then decreased rapidly during the next several years. While landings again progressively increased during the 1990s, they never approached those of the peak landings years (Figure 11.3). The reduction in landings may be related to regulatory changes implemented during 1987 that prohibited both the possession of ovigerous *S. nodifer* and the removal of eggs by clipping their pleopods. Additionally, since 1990, the state has required turtle-excluding devices (TEDS) on shrimp trawls that may have also reduced the efficiency with which the gear captures lobsters. Annual scyllarid lobster landings statewide have remained below 5 [metric] tons since 1999 as a decline in the Gulf of Mexico shrimp fishery has resulted in fewer fishing trips targeting shrimp (Figure 11.6 shows the decline in the number of shrimping trips by year).

Although it is an *ex post* indicator that may differ in interpretation from an *ex ante* indicator of targeting behavior, the top species in dollar value can be determined after trips are landed and tallied. For 16 trips (33% of the 47 trips) on average per year in the last 5 years, scyllarid lobsters were the top species in dollar value, and these 16 trips accounted for most of the pounds of scyllarid lobsters landed (Table 4.1.2.1). These 16 trips had much lower averages for trip gross, $1,241 (including $1,174 for scyllarid lobster), than all 47 trips with landings of scyllarid lobsters, $6,489, including $516 for scyllarid lobsters).

An average of 1,408 vessels per year landed shrimp (all species combine) in Florida in the last 5 years, and they averaged $40,326 in vessel gross for all species landed (Table 4.1.2.3). The average vessel gross is much higher than that for the 47 vessels that landed scyllarid lobsters,

$13,260 in vessel gross, and the percentage for scyllarid lobsters is much lower, 0.006% compared with 37% (Tables 4.1.2.1 - 4.1.2.3).

Table 4.1.2.3 Florida commercial fishing for shrimp.

	Shrimp				Trip gross, all species landed	Value of scyllarid lobster in trip gross	
	Vessels	Trips	Lbs	2008$	2008$	2008$	Percentage
Fishing year			Data in thousands				
Column -->	1	2	3	4	5	6	7
86/87	2,144	40,316	29,171	$109,272	$125,366	$40.768	0.033%
87/88	2,650	38,767	28,488	$97,403	$119,327	$54.766	0.046%
88/89	3,180	43,068	29,798	$115,503	$142,178	$40.630	0.029%
89/90	3,177	42,566	31,317	$99,686	$121,194	$23.559	0.019%
90/91	2,873	41,573	25,321	$85,951	$104,551	$45.200	0.043%
91/92	2,551	38,507	20,549	$64,980	$77,105	$56.105	0.073%
92/93	2,476	37,928	25,964	$80,580	$91,126	$86.594	0.095%
93/94	2,492	39,032	26,967	$81,685	$91,298	$102.960	0.113%
94/95	2,622	44,332	32,545	$111,432	$120,716	$33.285	0.028%
95/96	2,436	40,136	39,409	$105,724	$112,957	$41.921	0.037%
96/97	3,757	47,104	50,130	$128,161	$136,869	$101.130	0.074%
97/98	2,559	45,781	30,792	$106,640	$113,889	$53.699	0.047%
98/99	2,321	42,211	30,806	$105,007	$111,782	$18.087	0.016%
99/00	2,270	42,333	27,659	$103,390	$111,396	$14.741	0.013%
00/01	1,967	37,877	26,306	$89,330	$94,483	$15.421	0.016%
01/02	2,033	37,534	29,214	$88,857	$94,816	$27.499	0.029%
02/03	1,681	32,572	22,209	$63,285	$68,824	$33.315	0.048%
03/04	1,595	30,511	25,808	$64,905	$71,096	$64.572	0.091%

04/05	1,538	29,150	29,738	$68,276	$72,499	$7.245	0.010%
05/06	1,433	27,626	23,337	$57,181	$61,046	$3.462	0.006%
06/07	1,329	26,342	19,518	$46,883	$51,902	$2.986	0.006%
07/08	1,327	28,314	16,031	$40,000	$45,864	$0.492	0.001%
08/09	1,411	29,322	19,958	$47,101	$52,582	$4.406	0.008%
Averages							
99/00-08/09	1,658	32,158	23,978	$66,921	$72,451	$17.414	0.023%
99/00-03/04	1,909	36,165	26,239	$81,953	$88,123	$31.110	0.040%
04/05-08/09	1,408	28,151	21,716	$51,888	$56,779	$3.718	0.006%
Data for trips with landings of at least one pound of shrimp (all species of shrimp) for July-June fishing years. NMFS, SEFSC, FTT (19Mar10) data; methods and data as used for spiny lobster in Vondruska 2010a.							

Alternative 2 would set annual catch limits and accountability measures using historical landings for Spanish slipper lobster (*Scyllarides aequinoctialis*), after adding to the Fishery Management Unit, and for ridged slipper lobster (*S. nodifer*), currently in the Fishery Management Unit. If the either or both of the species are considered to require more detailed and management protection, this would occur under **Alternative 2**, whereas **Alternative 1, Alternative 3 and Alternative 4** would prevent such protection from occurring, increasing the likelihood of current or future resource decline, with associated reduction in economic benefits. Respecting Alternative 2, it is noted that Section 1.1 mentions four criteria for possible use in deciding whether a species should be included in a fishery management unit under the Magnuson Stevens Act, and Section 2.1 provides information relevant to these criteria for scyllarid lobsters. The scyllarid lobsters meet two criteria for being included in a fishery management unit because they are sold by commercial fishermen and because they are arguably a target species, as discussed above (Tables 4.2.1.1 - 4.2.1.1.3).

If current or future resource decline were to occur under **Alternatives 1, 3 or 4,** but not under **Alternative 2**, the reduction in economic benefits could be as much as depicted in Table 4.1.2.1**.** Stating it the other way around, the economic benefit for **Alternative 2** is represented by the ex-vessel value of $24,232 in 2008$ for scyllarid lobsters, which could be reduced to zero under **Alternatives 1, 3 or 4.**

There are some caveats. If current or future resource decline were to occur under **Alternatives 1, 3, or 4,** but not under **Alternative 2**, the loss under **Alternatives 1, 3, or 4** refers to scyllarid lobster only. This assumes that the vessel owners (operators) could pursue other fishing opportunities and not be driven out commercial fishing. Because shrimp accounts for a relatively large proportion of their gross revenue on average (Table 4.1.2.1), it would seem such opportunities may exist for the vessel owners (operators) to the extent that they meet the limited-access requirements for fishing for shrimp, and/or other species in state and federal waters, including the possession of valid licenses and permits. An average of 1,408 vessels per year landed shrimp (all species combined) in Florida in the last 5 years. They averaged $40,326 in vessel gross for all species landed (Table 4.1.2.3). The median vessel gross was approximately $6,700 per vessel, meaning that half of the vessels had a lower gross and half had a higher gross. Because they had annual average vessel gross for all species landed of $13,260 (Table 4.1.2.1), the vessels with landings of scyllarid lobster came in below the average vessel gross for vessels with landings of shrimp but they came in above the median (annual averages only in Table 4.1.2.3).

Alternative 3 would list species as ecosystem component species:

> **Gulf Preferred Option a:** smoothtail spiny lobster**,** *Panulirus laevicauda*
> **Gulf Preferred Option b:** spotted spiny lobster, *Panulirus guttatus*
> **Option c:** Spanish slipper lobster, *Scyllarides aequinoctialis*
> **Option d:** ridged slipper lobster, *Scyllarides nodifer*.

Among the options for **Alternative 3**, data on commercial fishing are not available for any of the four species separately. Sharp et al. (2007) describe the ecology for some of these species, and describe commercial fishing for *Scyllaridae* family (scyllarid) lobsters as a whole, meaning the last two species combined. Data on commercial fishing in Florida for scyllarid lobsters are managed by NMFS, SEFSC, and summarized in Section 2.1, with additional information Tables 4.1.2.1 - 4.1.2.2.

If any or all of the species considered by this action require more detailed and management protection than would occur under **Alternative 1** or **Alternative 2 (**for scyllarid lobsters only), then **Alternative 3** would prevent such protection from occurring, increasing the likelihood of current or future resource decline, with associated reduction in economic benefits. Should such resource decline occur under **Alternative 3**, **Option c and Option d** together, it is estimated that the ex-vessel value of landings of scyllarid lobsters could decline by as much as $24,232 per year (Table 4.1.2.1). That is, this amount represents the estimated economic impact of **Alternative 3, Option c and Option d** together, when compared with **Alternative 1**. The economic impact of **Alternative 3, Option a, or Alternativ3, Option b**, is not known, but assumed to be less.

Alternative 4 would remove species from the Joint Spiny Lobster FMP:

> **Option a:** smoothtail spiny lobster**,** *Panulirus laevicauda*
> **Option b:** spotted spiny lobster, *Panulirus guttatus*
> **Gulf Preferred Option c:** Spanish slipper lobster, *Scyllarides aequinoctialis*
> **Gulf Preferred Option d:** ridged slipper lobster, *Scyllarides nodifer***.**

See discussion under **Alternative 3**. It assumed that the economic impacts of **Alternatives 3-4** are essentially the same.

4.1.3 Direct and Indirect Effect on the Social Environment

The effects on the social environment from removing or not removing other species from the fishery management plan would likely accrue from the implementation of new ACLs and AMs on those species. The no action **Alternative 1** would have little impact on the social environment, yet may not be feasible if these species remain in the FMP as National Standard 1 will not be met. Setting ACLs and AMs in **Alternative 2** would likely have an impact on the social environment depending upon the thresholds selected and the measures that were implemented to account for any overages. Listing species as ecosystem components as in **Alternative 3** or removing species from the FMP as in **Alternative 4** would likely have few social impacts unless one or more of the **Options a-d** were not selected. Leaving any species in the FMP would require ACLs and AMs be set. Because landing information on these species is imprecise, setting an ACL and subsequent AMs would be problematic and could cause some social disruption and changes in fishing behavior if thresholds were set too low. These species tend to be by-catch in other fisheries which makes monitoring difficult. While removing them from the FMP may preclude any monitoring of status of these species, continuing to manage them with ACLs and AMs may be costly or impractical.

4.1.4 Direct and Indirect Effect on the Administrative Environment

Alternative 1 would not meet the requirements of the Magnuson-Stevens Act, and could leave NOAA Fisheries Service and the Councils subject to litigation, which would result in a significant administrative burden. Specifying an ACL alone (**Alternative 2**) would not increase the administrative burden over the status-quo. However, the monitoring and documentation needed to track the ACL could result in a need for additional cost and personnel resources because a monitoring mechanism is not already in place. After the ACL is specified, the administrative burden associated with monitoring and enforcement, implementing management measures, and accountability measures would increase. **Alternative 3** would designate species as ecosystem component species which would eliminate the administrative burden associated with establishing ACLs and AMs for those species. **Alternative 4** would remove species from the FMP, resulting in less administrative burden with regards to establishing ACLs and AMs. However, removing these species from the FMP may make developing management measures for these species more difficult if the need arises.

4.1.5 Council Conclusions

Need to add

4.2 Action 2: Modify the Current Definitions of Maximum Sustainable Yield, Optimum Yield, Overfishing Threshold, and Overfished Threshold for Caribbean Spiny Lobster

4.2.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

This action explores various alternatives for establishing biological reference points: MSY, OY, overfishing threshold, and overfished threshold. **Alternatives 2** and **3** under all actions are expected to have positive impacts to the physical and biological environments. **Alternative 1,** no action under all actions could have negative impacts to the physical and biological/ecological environment, due to the biological reference points being inconsistent between the two Councils. In addition to that issue, the Gulf Council's current definitions for the biological reference points use transitional SPR, which is more appropriate for stocks that are overfished. The best case scenario suggests that when transitional SPR is used, proxies should be estimated on an annual basis (MRAG Americas 2001). Caribbean spiny lobster were not overfished or undergoing overfishing based on the SEDAR 8 (2005) benchmark assessment, therefore static SPR for yield projections are suggested as a better proxy to use based on the current information available about the stock. The South Atlantic Council currently uses static SPR as a proxy and **Alternative 2**, under **Actions 3.3.1, 3.3.2 and 3.3.3,** would modify the Gulf Council's definition to static SPR. **Alternative 2** under **Action 3.3.4** would modify the overfished threshold to the current Gulf Council definition 15% transitional SPR, but use static SPR instead. This would make the overfished definitions consistent between the Councils and used static SPR which is better proxy for yield projects, because it uses equilibrium changes in recruitment and mortality. Consistency between Councils when establishing biological reference points would be more beneficial for the physical and biological environments. Using the same proxies reduces confusion for assessments and provides guidance for analysts. Further, based on the information available on Caribbean spiny lobster, static SPR is a more appropriate proxy to use. Transitional SPR proxies should be estimated on an annual basis and are not beneficial for long term yield projections (MRAG Americas 2001). **Alternative 3** under all actions would modify the current definitions to the biological reference points established during the SEDAR and joint Scientific and Statistical Committee process. **Alternative 3** would be based on the best available science and reviewed by experts; therefore, this alternative if selected as preferred could provide the best benefits to the physical and biological environments. The biological reference points would be consistent between Councils and based on the most recent data.

4.2.2 Direct and Indirect Effect on the Economic Environment

Defining the MSY, OY and MSST of a species does not alter the current harvest or use of the resource. Specification of these measures merely establishes benchmarks for fishery and resource evaluation from which additional management actions for the species would be based, should comparison of the fishery and resource with the benchmarks indicate that management adjustments are necessary. The impacts of these management adjustments will be evaluated at the time they are proposed. As benchmarks, these parameters would not limit how, when, where, or with what frequency participants in the fishery engage the resource. This includes participants who directly utilize the resource (principally, commercial vessels, for-hire operations, and recreational anglers), as well as participants associated with peripheral and support industries.

All entities could continue normal and customary activities under any of the alternative specifications. Participation rates and harvest levels could continue unchanged.

Since there would be no direct effects on resource harvest or use, there would be no direct effects on fishery participants, associated industries or communities. Direct effects only accrue to actions that alter harvest or other use of the resource. Specifying MSY, OY, and MSST, however, establishes the platform for future management, specifically from the perspective of bounding allowable harvest levels. The relationship between and implications of the harvests levels implied by the MSY and OY alternatives relative to the status quo are discussed in Section 4.4.2.2 (formerly Section 4.2.2.2).

Fishery management decisions influence public perception of responsible government control and oversight. These perceptions in turn influence public behavior. This behavior may be positive, such as cooperative participation in the management process, public hearings, and data collection initiatives, or negative, such as non-cooperation with data initiatives, legal action, or pursuit of political relief from management action. Positive behavior supports the efficient use of both the natural resource and the economic and human capital resources dedicated to the management process. Negative behavior harms the integrity of the information on which management decisions are based, induces inefficient use of management resources, and may prevent or delay efficient use of the natural resource. The specific benefits and costs of these behaviors cannot be calculated. Although disagreement with the exact specifications contained in the MSY and OY alternatives may occur, any of the alternatives satisfy the technical guidelines and would establish the required platform from which future action can be taken and, thus, should generally induce satisfaction with the management of the resource. However, the alternatives vary in implications for total allowable harvest and constituents who favor more liberal harvests would likely prefer the alternatives in the decreasing order of the potential harvest implied by the alternative specifications, while those who favor more conservative harvests would likely hold the opposing preferences. The net effect of the behavioral responses from these opposing constituent groups cannot be determined.

Administrative costs of fishery management accrue to the time and labor involved in developing new regulations, permitting systems, or other management actions. To the extent that each of the MSY and OY alternatives provides fishery scientists and managers with specific objective and measurable criteria to use in assessing the status and performance of the fishery, the impacts of the various alternatives on administrative costs are indistinguishable. However, the more conservative (lower) the equivalent allowable harvest level, the greater the potential for harvest overages, necessitating additional management action, with associated administrative costs.

In addition to the trigger to subsequent management that MSY and OY may provide, the MSST identifies the stock level below which a resource is determined overfished. Should the evaluation of the resource relative to the benchmark result in said designation, harvest and/or effort controls are mandated as part of a recovery plan. These harvest and effort controls would directly impact the individuals, social networks, and associated industries associated with the resource or fishery, inducing short-term adverse economic impacts until the resource is rebuilt and less restrictive management is allowable.

4.2.3 Direct and Indirect Effect on the Social Environment

MSY, OY, Overfishing Threshold and Overfished Threshold for Caribbean spiny lobster are primarily biological thresholds that may impact the social environment depending upon where the threshold is set. These thresholds are determined through the assessments by several scientific panels and are entirely determined on the biology of the spiny lobster. Therefore, the effect on the social environment would depend upon the level determined for each threshold and how it relates to current landings by both commercial and recreational sectors. The setting of these thresholds becomes even more critical if sector allocation is chosen and at what level each sector allocation is set. Certainly if these thresholds are set below current landing levels, there will be changes to the social environement and setting sector allocation will become controversial.

4.2.4 Direct and Indirect Effect on the Administrative Environment

There could be additional administrative burdens, if these biological reference points are not modified for consistency. Changing these biological reference points is required under the requirements of the Magnuson-Stevens Act, and if not done, could leave NOAA Fisheries Service and the Councils subject to litigation, which would result in a significant administrative burden.

4.2.5 Council Conclusions

Need to add

4.3 Action 3: Establish Sector Allocations for Caribbean Spiny Lobster in State and Federal Waters from North Carolina through Texas

4.3.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

The Florida Fish and Wildlife Conservation Commission (FWC) invited representatives of stakeholder groups participating in Florida's Lobster Fishery to serve as members of the Spiny Lobster Ad Hoc Advisory Board (Advisory Board). The Advisory Board was made up of five commercial trappers, three commercial divers, three recreational fishers, two wholesale dealers, two environmental groups, and one FWC representative on the board.

The Advisory Board was designed to bring together a group of stakeholder representatives from around the state who represent the diversity of the lobster fishery community and included commercial lobster trappers, commercial lobster divers, recreational lobster fishers, a special recreational license holder, wholesale lobster dealers, an environmental group, and a representative from the FWC. The goal was to provide constructive comments and guidance to the FWC in the form of proposed refinements to the management of Florida's spiny lobster fishery. Over a period of sixteen months the Advisory Board met approximately eight times for approximately two days each to focus on reviewing and discussing lobster fishery issues and proposals for refinements to Florida's spiny lobster fishery.

The Advisory Board examined landings records for all sectors of the spiny lobster fishery from fishing seasons 1993/94 through 2003/2004. These data have been updated and are included in detail in Table 4.3.1. The Advisory Board ignored landings from unknown and other gear categories. The Advisory Board alternatives were developed by splitting the landings into four sectors (commercial trap, commercial diving, commercial bully nets, and recreational. During that time, the allocation of the lobster harvest among the different sectors changed. During the initial years of trap reductions, annual landings were generally higher than they had been in a decade. Landings by commercial divers increased, but because landings were so high, the progressive shift in the landings allocation toward that group appeared subtle. However, a period of lower landings beginning with the 2000/01 season underscored this shift toward the commercial dive fishery and the recreational fishery as well. Regulations limiting harvest of commercial divers were enacted beginning with the 2003/04 season. The effects of these rules can be seen by comparing allocations in the 2002/03 and 2003/04 seasons. Landings were essentially the same in both seasons, but the harvest share of commercial divers was reduced because of trip limits and banning harvest from artificial habitat. It appears that in high landing years, trappers have a larger harvest share because lobsters are available to be captured later in the season when there is little diving activity. Harvest from casitas is most effective early in the season. (Note: Harvest by casitas was prohibited during 2003). In low landings years, these early landings make up a larger harvest share than in high landings years. There is a need to understand current allocations in the spiny lobster fishery, how those allocations have shifted over time, and how rule changes have likely impacted allocation. The Councils have collapsed the commercial suballocations into one commercial allocation for the alternatives being considered.

Table 4.3.1. Florida statewide spiny lobster landings by fishing year.

Fishing Season	Com. Trap	%Com. Trap	Com. Dive	%Com. Dive	Com. Bully	%Com. Bully	Com. Other	Com. Unknown	Com. Total	% Com.	Rec. Total	% Rec.	Com. & Rec. Total
1991/92	3,370,669	49.3%	92,587	1.4%	2,715	0.0%	5,537	3,364,507	6,836,015	79.0%	1,815,791	21.0%	8,651,806
1992/93	3,934,923	73.3%	148,752	2.8%	1,855	0.0%	6,044	1,276,614	5,368,188	79.9%	1,352,443	20.1%	6,720,631
1993/94	4,982,625	93.8%	169,545	3.2%	5,967	0.1%	8,423	143,230	5,309,790	73.8%	1,883,114	26.2%	7,192,904
1994/95	6,808,250	94.8%	253,961	3.5%	18,892	0.3%	4,924	95,614	7,181,641	79.0%	1,905,995	21.0%	9,087,636
1995/96	6,637,721	94.6%	307,717	4.4%	18,333	0.3%	2,784	50,579	7,017,134	78.4%	1,930,718	21.6%	8,947,852
1996/97	7,318,618	94.5%	337,971	4.4%	28,206	0.4%	3,292	56,017	7,744,104	80.1%	1,922,596	19.9%	9,666,700
1997/98	7,147,561	93.6%	397,068	5.2%	25,494	0.3%	13,473	56,581	7,640,177	76.8%	2,304,186	23.2%	9,944,363
1998/99	5,037,323	92.5%	352,283	6.5%	11,582	0.2%	3,627	42,718	5,447,533	80.7%	1,302,677	19.3%	6,750,210
1999/00	6,995,609	91.2%	588,461	7.7%	16,765	0.2%	8,192	60,180	7,669,207	75.7%	2,461,981	24.3%	10,131,188
2000/01	4,856,259	87.2%	635,394	11.4%	12,193	0.2%	5,308	59,553	5,568,707	74.1%	1,949,033	25.9%	7,517,740
2001/02	2,610,086	84.8%	447,484	14.5%	8,527	0.3%	12,854	312	3,079,263	71.1%	1,251,081	28.9%	4,330,343
2002/03	3,992,322	87.2%	559,839	12.2%	19,575	0.4%	4,948	708	4,577,392	75.9%	1,455,298	24.1%	6,032,690
2003/04	3,730,675	89.6%	406,694	9.8%	21,581	0.5%	1,560	1,079	4,161,589	74.7%	1,411,509	25.3%	5,573,097
2004/05	5,126,330	93.7%	311,502	5.7%	33,225	0.6%	565	1,372	5,472,994				
2005/06	2,679,606	90.4%	266,565	9.0%	14,593	0.5%	1,161	1,235	2,963,160	72.4%	1,131,014	27.6%	4,094,174
2006/07	4,516,784	94.1%	251,522	5.2%	27,875	0.6%	2,573	739	4,799,493	78.6%	1,304,511	21.4%	6,104,004
2007/08	3,467,956	91.8%	289,373	7.7%	18,919	0.5%	539	1,250	3,778,037	75.7%	1,215,069	24.3%	4,993,105
2008/09	3,005,813	91.9%	244,060	7.5%	17,034	0.5%	346	2,144	3,269,397	72.1%	1,263,509	27.9%	4,532,906
2009/10	4,149,324	95.5%	151,717	3.5%	39,104	0.9%	239	2,921	4,343,305	79.4%	1,126,714	20.6%	5,470,019

Source: Landings from Florida Fish & Wildlife Commission; current as of 6/24/10. The recreational numbers from 2000 onward reflect the retrospective analysis done to include additional recreational permit holders that were not incorporated into the original landings models. Total landings for the 2004/05 season are not shown because the recreational surveys were not conducted that season due to storms; previous estimates only included the 2-day season landings and substantially underestimated total recreational landings for that season.

So, why does increasing harvest from one sector have the effect of reducing the harvest of another sector? It is because the total lobster harvest each year is largely dependent upon the number of lobster available to be harvested that year and not by the amount of fishing effort expended to catch those lobsters, except in those unusual circumstances where effort is curtailed by extraordinary events such as hurricanes. Across the range of effort in the fishery since approximately 1975, landings and effort have not been related. Good fishing years have occurred with high and low effort, as have poor fishing years. For example, the best year on record for the commercial fishery was 1979 when nearly 7.9 million pounds were landed using ~600,000 traps. In contrast, 1983 was a poor fishing season with a harvest of 4.5 million pounds, again from ~600,000 traps. Similar observations can be made in recent years when landings estimates for all fishing groups were available. During 1999, the fishery (recreational and commercial) harvested 10.1 million pounds from 534,000 traps, 4,377 commercial fishing dive days, and 555,000 recreational fishing days. In contrast, the 2001 harvest of 4.3 million pounds was caught from the same number of traps, 4,538 commercial dive days, and 366,000 recreational fishing days. Furthermore, the size-structure of the lobsters landed by the fishery has remained constant since 1987 as has the average size. The average size has consistently been 3 ¼ inch carapace length (CL), just barely above the minimum legal size. This indicates that the fishery is heavily reliant on a single year class of lobsters each season – those that have just grown to legal size. Fluctuations in harvest are related to fluctuations in the numbers of new recruits to the fishery and not the number of traps, diver-days or recreational fishing days. Put another way, the size of the ‘lobster pie’ each year is determined by the number of lobsters attaining legal size. A change in fishing effort by any one sector simply alters that sector’s piece of the pie.

The Councils are using the alternatives and the administrative record developed by the FWC as the basis for developing allocation alternatives given that the majority of the harvest occurs off the State of Florida and given that the Councils have delegated much of the management to the State of Florida through a protocol established in Spiny Lobster Amendment 2 in 1989. The consensus recommendations of the Advisory Board, including all options evaluated, are presented in a document dated May 2007. The alternatives and rational is taken from the Facilitator’s Summary Report of the May 23-24, 2006 Meeting. These documents and other materials related to the Spiny Lobster Advisory Committee are available at: http://www.myfwc.com/RULESANDREGS/MarineFisheries_Workshops.htm

Allocating the ACL between the recreational and commercial sectors will have no direct effect on the Physical and Biological/Ecological Environments. The range of commercial allocations (74%-80%) is not sufficient to affect the number of lobster traps used so there would be no change in the impacts from lobster traps.

4.3.2 Direct and Indirect Effect on the Economic Environment

4.3.2.1 Economic Effects

It is assumed for purposes of analysis of economic impacts that sector allocations under Action 3 are as shown in Table 4.3.2.1. Although Action 3 applies to all southeastern coastal states (North Carolina through Texas), practically all of the landings of Caribbean spiny lobster occur in Florida. Furthermore, Florida landings occur largely in Monroe County (approximately 90% for commercial landings and 67% for recreational landings, percentage from Table 4.3.2.2). Therefore, any economic impacts of Action 3 would occur largely in Monroe County, and add to the cumulative economic impact on fishing in Monroe County of previous state, federal and local regulations.

Under **Alternative 1** (status quo), Action 3, the expected landings are 5.027 mp (ww), including 3.819 mp (76%) for the commercial sector and 1.208 mp (24%) for the recreational sector (Table 4.3.2.1). For **Alternatives 2-4**, total landings are an assumed 5.910 mp, and this is greater than total under **Alternative 1** (status quo), 5.027 mp. The resulting commercial allocations for **Alternatives 2-4** all exceed the **Alternative 1** (status quo) commercial landings, 3.819 mp. The recreational allocations for **Alternatives 3-4**, but not the allocation for **Alternative 2**, exceed the recreational landings for **Alternative 1**, 1.208 mp. This may imply further regulation of the recreational sector, depending on what the Councils and the State of Florida decide for Actions 3-5 as a whole.

Table 4.3.2.1. Caribbean spiny lobster landings in Florida and allocations by sector.

	Sector percentages		Sector and total landings, mp (ww)		
Alternative	Commercial	Recreational	Commercial	Recreational	Total
1	76%	24%	3.819	1.208	5.027
2	80%	20%	4.728	1.182	5.910
3	74%	26%	4.373	1.537	5.910
4	78%	22%	4.610	1.300	5.910

FTT data as of 31Aug10, personal communication, FWC. Pending the SEDAR for Caribbean spiny lobster, circa December 2010, it is assumed that the annual averages for 05/06-09/10 for recreational, commercial and total landing represent **Alternative 1** (status quo). The sector allocations for **Alternatives 2-4** are computed using an assumed total of 5.91 mp and the allocation percentages shown in this table.

It should be possible to reduce recreational landings via changes in season length for the 2-day season, changes in the length of the regular season, and/or changes in area-specific bag limits that are accompanied by outreach programs. The Florida Fish and Wildlife Conservation Commission (FWC) manages the detailed data necessary for assessing the efficacy of changes in bag limits and seasons on recreational landings in Florida.

It is noted that there are some caveats in the assessment of the economic impacts of **Alternatives 1-4**, Action 3, which have not been clarified to date. It is understood that paying passengers who fish from Florida licensed for-hire vessels need not purchase recreational fishing licenses and permits. If so, their landings and effort for Caribbean spiny lobster would not be obtained in the ongoing Florida FWC mail-in surveys. Apparently, a for-hire vessel may have a commercial lobster license that may allow it to combine harvests of paying passengers (Section 3.1.2), and to sell the lobsters. If so, this situation implies that Caribbean spiny lobster landed by for-hire vessels may either not be counted, or counted as commercial landings.

Recognizing possible controversy over alternative sector allocations, an ad hoc Spiny Lobster Advisory Board consisting of stakeholders is reported to have met several times in 2005-2006 at the request of the FWC to provide constructive comments and guidance (Section 2.3). After examining FWC data for years through the mid-2000s, large proportions of that Advisory Board would appear to have preferred what is now **Alternative 3**, or **Alternatives 2-3** averaged. Perhaps, their votes might be affected today by such things as (1) reduced OY, (2) requirements to specify ACLs and AMs, (3) worsened economic conditions, and (4) what is now a much longer period of relatively low landings for both sectors, as discussed in Section 4.3.2.2, next.

4.3.2.2 Commercial and Recreational Fishing for Caribbean Spiny Lobster in Florida

Shivlani (2009) provides information on the history, regulations, and natural, economic and social conditions of fishing in Monroe County, along with information on fishermen's attitudes and perceptions about regulations. For example, there have been (1) changes in county and state land use regulations, (2) changes in state and federal fishery regulations, and (3) the creation of marine sanctuaries and protected areas. In addition, fishing has been affected by (1) substantial economic development, gentrification and population growth, (2) increasing numbers of recreational boats and fishermen, and (3) hurricanes, fuel prices and adverse national economic conditions in the late-2000s. Despite some mitigating regulations, commercial fishing has been affected by sharply reduced access to scarce water front land, docking facilities, seafood dealers and land to store lobster traps. Access to once important commercial fishing grounds for Caribbean spiny lobster and other species is now precluded or substantially reduced, and economic development has increased the cost of living in Monroe County, while global economic conditions increased the cost of fuel, which are a substantial part of trip costs.

Commercial fishing effort for Caribbean spiny lobster (*Panulirus argus*) in Florida has been reduced substantially under the State's trap certificate reduction program. The number of vessel and trips with landings are far below what they were in the early 1990s, along with the number of hours fished and the estimate number of traps fished (Vondruska 2010a). Despite lower landings in the 2000s (Figure 4.3.3.1), trends in productivity continued to increase in terms of landings per trip and landings per vessel, albeit at a slower pace than in the past. Consequently, vessel gross revenue for all species landed averaged $29,960 in 05/06-09/10, compared with $19,921 in 87/88-91/92 (data in 2008$, Vondruska 2010a). Nevertheless, commercial fishermen are likely more mindful of the sharp drop in vessel average gross from a peak $43,297 in 07/08 to $16,829 in 09/10. The drop in ex-vessel prices, from $7.94 to $3.30 per pound, is associated worsened national economic conditions worldwide. Also, there were increasing fuel prices in calendar years 2004-2006, and sharply higher fuel prices in 2007-2008.

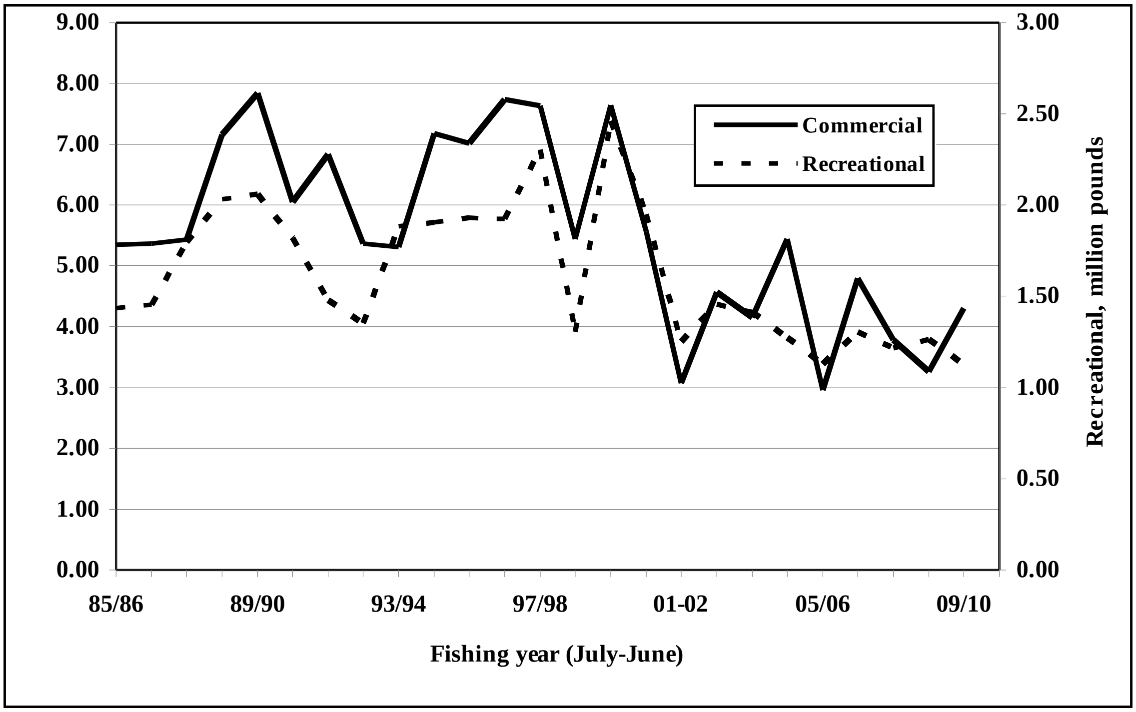

Figure 4.3.3.1. Florida commercial and recreational landings of spiny lobster (Table 4.3.3.2).

Recreational and commercial landings in Florida appear to have followed roughly similar cycles over the past 25 years, both dropping in the 2000s (Figure 4.3.3.1). The number of recreational fishermen was not known prior to 1991, when fishing occurred under open-access conditions with bag limits, gear restrictions and a closed season (Section 3.1.2). By way of perspective, the number of recreational fishing trips and participants in Florida for all species doubled during 1981-2008, but there was a mixture of year-to-year volatility, relative stability, and decline, including decline in the late 2000s, likely related to weakened conditions of the U.S. economy, hence reduced demand for recreational fishing (Shivlani, 2009, Figure 4).

For Caribbean spiny lobster, it is reported that recreational fishing effort was in the range of 60,000-112,000 person days in 1993-2002 for the "2-day season," and in the range of 261,000-514,000 person days during the regular season (Sharp, Bertelsen and Leeworthy, 2005; Section 3.1.2, under recreational landings and catch per unit effort). Estimates in SEDAR 08 indicate volatility in 78/79-03/04, including 6 years with more than 500,000 person days in 88/89-99//00, and approximately 350,000-370,000 person days in 01/02-03/04 (SEDAR-08, April 29, 2005, Table 3.2.1.2, p. 59; annual data may be updated in the SEDAR for spiny lobster, pending circa December 2010).

Table 4.3.3.1 Number of valid Florida recreational licenses for spiny lobster.

Fishing year	Annual & 5-year Crawfish Permits	Sportsman Gold (Annual)	Military Gold (Annual)	Lifetime Sportsman	Lifetime Saltwater
	1	2	3	4	5
95/96	112,627	0	0	1,772	654
96/97	120,651	0	0	1,838	824
97/98	139,553	0	0	939	1,012
98/99	130,812	0	0	1,096	1,237
99/00	135,146	0	0	1,253	1,493
00/01	137,219	0	0	1,417	1,735
01-02	128,256	0	0	1,597	2,000
02/03	123,003	8,370	0	1,826	2,319
03/04	136,163	15,007	0	2,097	2,626
04/05	130,358	17,874	0	2,352	2,962
05/06	136,888	20,075	6,556	2,708	3,320
06/07	143,362	21,643	7,425	3,049	3,784
07/08	146,988	20,597	8,849	3,158	4,258
08/09	141,876	19,384	10,996	3,530	5,010
09/10	129,865	15,283	10,805	3,941	6,001

*Data for 09/10, as of July 2010. Source: William Sharp, FWC (Marathon, FL), personal communication, November 8, 2010. Note: Annual data for those licenses that give the owner recreational lobster fishing privileges under lifetime and 5-year permits are cumulative.

Although fewer people actually fish recreationally for Caribbean spiny lobster than have licenses and permits to do so, Table 4.3.3.1 does provide current, upper-end approximate indicators for trends in such fishing through 09/10. The likely effects of weakened national economic conditions in the last two years are reflected more or less in columns 1-3 of Table 4.3.3.1 (all or some of the licenses in the columns 1-3 require annual renewal, whereas data in columns 4-5 are for lifetime licenses/permits).

Table 4.3.3.2. Florida landings of Caribbean spiny lobster, by sector.

	Recreational		Commercial			Total	
	Keys	Total	Keys	Total	Bait	Keys	Excluding bait
	Thousand pounds (ww)						
Fishing year	1	2	3	4	5	6	7
85/86	921	1,432	4,815	5,341	650	5,735	6,773
86/87	907	1,454	4,744	5,361	785	5,651	6,815
87/88	1,271	1,797	4,885	5,428	393	6,156	7,225
88/89	1,355	2,033	6,620	7,158	351	7,976	9,191
89/90	1,417	2,061	7,272	7,839	526	8,689	9,900
90/91	1,230	1,821	5,449	6,046	745	6,680	7,867
91/92	946	1,477	5,872	6,836	428	6,818	8,312
92/93	871	1,352	4,659	5,368	352	5,530	6,721
93/94	1,188	1,883	4,427	5,308	237	5,614	7,191
94/95	1,224	1,906	6,479	7,175	310	7,703	9,082
95/96	1,327	1,931	6,373	7,015	307	7,701	8,945
96/97	1,311	1,923	7,044	7,742	361	8,355	9,665
97/98	1,642	2,304	7,006	7,636	405	8,648	9,940
98/99	881	1,303	4,925	5,441	188	5,806	6,743
99/00	1,573	2,462	6,862	7,647	368	8,435	10,109
00/01	1,248	1,949	4,988	5,559	286	6,236	7,508
01/02	708	1,251	2,608	3,077	235	3,316	4,329
02/03	961	1,455	4,150	4,565	259	5,111	6,020
03/04	863	1,411	3,754	4,149	232	4,617	5,561
04/05	777	1,273	4,954	5,440	245	5,731	6,713
05/06	685	1,131	2,647	2,957	167	3,332	4,088
06/07	779	1,305	4,391	4,791	210	5,170	6,096
07/08	854	1,215	3,394	3,776	217	4,248	4,991
08/09	804	1,264	2,754	3,265	175	3,558	4,528
09/10	734	1,127	3,999	4,304	176	4,733	5,430
Averages							
01/02-04/05	911	1,468	4,091	4,558	251	5,002	6,026
05/06-09/10	771	1,208	3,437	3,819	189	4,208	5,027
Percentages							
01/02-04/05	62%		90%				
05/06-09/10	64%		90%				
Source: FTT data as of 31Aug10, personal communication, FWC. Pending the SEDAR for Caribbean spiny lobster, circa December 2010, it is assumed analytically that data for bait in column 5 are intended only for assessing resources (stocks) in a SEDAR context.							

Since 1991, regulation of recreational landings of Caribbean spiny lobster in Florida has been achieved through a complex system of now complementary state and federal bag limits, licenses and permits, which vary by area fished and time of year, as described in Section 3.1.2. A fisherman must purchase a lobster permit as an endorsement to a Florida saltwater recreational fishing license. In contrast with commercial fishing for spiny lobster, however, participation and entry are not limited (Shivalani, 2009, draft, p. 97). Information on landings and effort is obtained from twice-per year mail surveys of Florida recreational spiny lobster permit holders. The mail surveys cover fishing during the two-day sport season and from opening day to the first Monday in September of the regular recreational fishing season. This period of approximately 5 weeks includes most of the fishing effort of the licensed/permitted fishermen (Section 3.1.2).

Quoting Section 3.1.2:

> Presently, the sport season is scheduled the last consecutive Wednesday and Thursday of July each year, one week before the start of the commercial season. During the Special Two-Day Sport Season, recreational fishers are allowed up to 6 lobsters per person per day in Monroe County and Biscayne Bay National Park and up to 12 lobsters per person per day in other areas of the state. The bag limit during the regular recreational lobster-fishing season is six lobsters per person per day. During the sport season diving at night for lobsters is not permitted in Monroe County or adjacent federal waters. Bully netting and hoop netting are allowed at night. During the regular season, diving at night for lobster is allowed.

4.3.3 Direct and Indirect Effect on the Social Environment

By establishing sector allocations there would likely be some changes in fishing behavior and impacts to the social environment. The mere act of separating the ACL into two sector ACLs has the perception of creating scarcity in that limits have been imposed on each individual sector. The setting of an ACL has the same impact but on the overall fishery. Each subsequent division will drive perceptions of scarcity and likely change the fishing behavior of those within a particular sector. The commercial lobster fishery has been under a trap reduction program since the early 1990s and seen a gradual reduction in the number of traps being fished. This was the goal of the trap reduction program. However, recently the active trap reduction portion of the program has stopped and only passive trap reduction continues. This was requested by the industry which did not seem to believe the trap reduction program was producing the economic efficiency that was one of the goals of the program. Over the past decade, there has been a gradual increase in the portion of overall landings being taken by the recreational sector. As mentioned above, spiny lobster stock is dependent upon annual recruitment, so harvest is highly dependent upon the effort with either sector. Whether the trap reduction program is partly responsible for this shift is unknown. While traps have been reduced there has not been a parallel reduction in commercial landings. Recreational trips have declined also, so it may not be merely an increase in recreational effort either. It is likely that a complex set of factors are contributing to the shift in landings. Changes in regulation both to commercial diving and recreational diving and the use of casitas along with illegal activity have all likely had an impact on the shifting effort and harvest.

By not establishing separate sector allocations, **Alternative 1** allows for an overall ACL which may make tracking difficult as there is no in season monitoring for either sector, although trip tickets can be monitored for the commercial sector. This alternative would allow for harvest to freely flow between the commercial and recreational sectors as it has in the past. Although, if harvest exceeds the overall ACL then both sectors will close. This would likely become more an issue for the commercial sector as that season lasts longer than the recreational because they continue to fish when lobster become more scarce. **Alternatives 2 and 4** would provide an increase in allocation to the commercial sector and subsequent reduction to the recreational; while **Alternative 3** would provide an increase to the recreational sector. Of all the different scenarios, **Alternative 4** seems to have some support as it was selected by a special panel of stakeholders as representative of the most favorable of the options.

4.3.4 Direct and Indirect Effect on the Administrative Environment

There are no administrative impacts from allocating among the commercial and recreational sectors other than preparation of the amendment document and notices.

4.3.5 Council Conclusions

The Councils moved the subalterantives that would have allocated the ACL by gear within the commercial sectors to Appendix A Alternatives Considered but Eliminated from Detailed Consideration because some of the quotas were too small to track given the existing quota monitoring programs (e.g., 1% to the commercial bully net fishery). The Councils recognize the competition between commercial diving and commercial trapping but the existing quota monitoring programs do not provide the ability to track these separate commercial quotas.

4.4 Action 4: Acceptable Biological Catch (ABC) Control Rule, ABC Level(s), Annual Catch Limits, and Annual Catch Targets for Caribbean Spiny Lobster

4.4.1 Direct and Indirect Effects on the Physical and Biological/Ecological Environments

Setting an ACL or ACT could affect the physical environment if harvest changes from current levels. Lobster fishing, particularly when traps are used, can have negative impacts on the bottom as described in Section 4.9.1. Commercial trap fishing for Caribbean spiny lobster is not managed by landings but by restricting the number of trap tags issued by the State of Florida. Therefore, unless the state increases the number of trap tags it distributes, the number of traps could not increase even if more landings were allowed. If harvest is restricted under an ACL or ACT, fishing effort could be reduced through accountability measures such as a shortened season, and negative impacts might be decreased.

Setting an ACL or ACT potentially will have an impact on the biological environment if harvest changes from current levels, and AMs are triggered when they are met or exceeded. The ABC level will be determined pending results of the stock assessment update. An ACL equal to the ABC would allow a higher level of landings than an ACL lower than the ABC. Likewise, not setting an ACT would allow a higher level of landings than setting an ACT.

Traps impact species other than lobsters. Fish, crabs, and other invertebrates may be captured as bycatch. Marine mammals and sea turtles can become entangled in trap line. These negative impacts could increase or decrease if effort changes; however, even if ACLs or ACTs are set higher than current harvest levels, effort would not be expected to increase. Current effort is limited by the number of trap tags issued by the State of Florida, commercial and recreational bag limits, and the length of the fishing season. Although fishers could fish more often and fish during a longer part of the season to increase effort, they presumably are already fishing at the level they desire because regulations do not prohibit such increased effort.

The more divided the ACL is, the more accountability each division will have. With a single ACL for the stock, one sector could exceed its allocation without triggering accountability measures, as long as the stock ACL is not exceeded. If the ACL is separated by sectors, accountability measures would be triggered as each sector reaches its limit. This level of control would be expected to result in greater positive impacts on the biological environment because catch would be more restricted. Further, with separate ACLs or ACTs, different types of accountability measures could be triggered that are more suited to the particular sector, and therefore, be more effective in constraining harvest within the ACL.

4.4.2 Direct and Indirect Effect on the Economic Environment

4.4.2.1 ABC Control Rule and ABC

The economic impacts of the alternatives for the ABC control rule, ABCs, ACTs, ACLs, and AMs may be evaluated when various management reference point alternatives are specified, following the SEDAR for Caribbean spiny lobster, pending circa December 2010. Meanwhile, as for other sections, it noted that the Caribbean spiny lobster (*Panulirus argus*) resource is reportedly not undergoing overfishing, not overfished, and may be characterized as follows (personal communication, spiny lobster assessment panel meeting, September 2010, pending the SEDAR for Caribbean spiny lobster, circa December 2010):

> $MSY_{F20\%SPR}$ = 6.4 mp.
> Optimum $Yield_{F30\%SPR}$ = 5.91 mp.
> MSST: $B_{msy*1-M}$ = 7.56 mp.
> $F_{OY30\%SPR}$ = 0.28.
> MFMT: F_{msy} = $F_{20\%SPR}$ = 0.39.

It is assumed for purposes of analysis that ABC = ACL = OY = 5.91 mp (see Table 4.4.1.2.1, which is mostly the same as Table 4.3.2.1). The assumed ACL of 5.91 mp is greater than landings for **Alternative 1** (status quo), 5.027 mp (Table 4.4.1.2.1). Under Action 4, there are two other alternatives for specifying ABC, with three options each for **Alternatives 2-3**. If an option under **Alternative 2 or Alternative 3** for the ABC rule is chosen in combination some choices for other regulations for ABC, ACLs, ACTs, and AMs, then Actions 3-5 taken together could translate into sector and/or total allocations that are lower than those for the **Alternative 1** (status quo). If so, the resulting allocations could have an economic impact on both sectors, and/or they could impact one sector relative more than the other sector. While Amendment 10 applies to all southeastern coastal states (North Carolina through Texas), practically all of the landings of Caribbean spiny lobster occur in Florida, which has its own regulations for this species. Furthermore, Florida landings occur largely in Monroe County (approximately 90% for commercial landings and 67% for recreational landings, percentages from Table 4.3.2.2). Therefore, any economic impacts of Actions 3-5 would occur largely in Monroe County, and add to the cumulative economic impact on fishing in Monroe County of previous state, federal and local regulations and other changes (as discussed in Section 4.3.3).

Table 4.4.1.2.1. Caribbean spiny lobster landings in Florida, by sector.

Action 3, Alternatives	Action 3, sector percentages		Action 3, sector & total landings, mp (ww)		
	Commercial	Recreational	Commercial	Recreational	Total
1	76%	24%	3.819	1.208	5.027
2	80%	20%	4.728	1.182	5.910
3	74%	26%	4.373	1.537	5.910
4	78%	22%	4.610	1.300	5.910

FTT data as of 31Aug10, personal communication, FWC. Pending the SEDAR for Caribbean spiny lobster, circa December 2010, it is assumed that the annual averages for represent **Alternative 1** (status quo) for Actions 3-5. The sector allocations for **Alternatives 2-4**, Action 3 are computed using an assumed total of 5.91 and the allocation percentages shown.

4.4.2.2 ACLs

As stated in Section 4.4.1.2 (for ABC control rules), the economic impacts of the alternatives for the ABC control rule, ABCs, ACTs, ACLs, and AMs may be evaluated when various management reference point alternatives are specified, following the SEDAR for Caribbean spiny lobster, pending circa December 2010. Other comments in Section 4.4.1.2 are incorporated herein by reference.

4.4.2.3 ACTs

As stated in Section 4.4.1.2 (for ABC control rules), the economic impacts of the alternatives for the ABC control rule, ABCs, ACTs, ACLs, and AMs may be evaluated when various management reference point alternatives are specified, following the SEDAR for Caribbean spiny lobster, pending circa December 2010. Other comments in Section 4.4.1.2 are incorporated herein by reference.

4.4.3 Direct and Indirect Effect on the Social Environment

According to the National Standard guidelines, the setting of an ABC control rule, ABC levels, Annual Catch Limits have all been relegated primarily to biological assessments and reference points. It is the setting of Annual Catch Targets where social and economic considerations might enter the equation as management uncertainty is evaluated. While setting the biological parameters on catch through ABCs and ACLs can have indirect effects on the social environment, it is difficult to know what those effects will be until a definitive number has been assigned which translates into harvest levels. Certainly, setting thresholds that adequately assess biological risk through harvest levels on stocks that are vulnerable can help stabilize landings and thereby provide long-term benefits to the fishery which should translate into positive social benefits over time. It is the short term costs involved that often drive perceptions of negative impacts. These impacts can translate into real costs that have significant impacts to both the commercial and recreational sectors. For fisheries where information is scarce and management is uncertain, it becomes a real possibility that there can be negative short term impacts that may not have been necessary if thresholds are too restrictive. In other fisheries which have more certainty in management and monitoring of catch, a more precise harvest level can be set with certainty and reduce volatility in the fishery. The spiny lobster fishery does not seem to be overfished and has not experienced large fluctuations in landings. Though, there are many avenues for changes in stock status that are attributed to factors outside of manager's purview, i.e. disease, hurricanes or habitat degradation. Management has imposed restrictions on catch that over the years has imposed some certainty, yet the recreational fishery does not have the timely monitoring that can be imposed on the commercial fishery. Setting Annual Catch Targets are utilized in fisheries where there may management uncertainty that adds risk to reaching target harvest levels beyond the biological risks. It usually entails a further reduction in harvest levels to ensure catch remains at or below the ACL and does not wildly fluctuate. The spiny lobster fishery seems to be stable and may not require an ACT if managers feel a level of certainty in the present management regime.

4.4.4 Direct and Indirect Effects on the Administrative Environment

Harvest of Caribbean spiny lobster is currently managed by closed seasons, restrictions on the number of traps, and bag limits. Commercial fishermen report their catch through state trip tickets, which are compiled over several months before totals are available for federal management. Recreational catch is estimated based on telephone and dockside surveys. With establishment of an ACL or ACT, commercial landings may need to be included in the Southeast Fisheries Science Center's Quota Monitoring System. This system requires dealers to report landings, usually on a biweekly basis. If ACLs or ACTs are set by sector or gear, separate entries would be needed in the system.

4.4.5 Council Conclusions

Need to add

4.5 Action 5: Accountability Measures (AMs) by Sector

4.5.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

Alternative 1 is not considered a viable option since it would specify no AM and therefore, would not limit harvest to the ACL or correct for an ACL overage. The Magnuson-Stevens Act requires that mechanisms of accountability be established for all federally managed species. **Alternative 1** would not comply with this mandate, and would provide no biological benefit to the species. **Alternative 2** would attempt to limit harvest to levels at or below the ACL or ACT by reducing and/or closing harvest once a particular landings threshold is met. The most biologically beneficial in-season AM would be a combination of **Sub-option i**. and **Sub-option ii**. The combination of these options would help to hedge against an ACL overage by reducing the trip limit when 75% of the commercial ACL or ACT is projected to be met, and then would implement a closure of the commercial sector when the quota is projected to be met. Closing the commercial fishery or reducing the trip limit once the ACL or ACT is projected to be met would also remove the incentive to harvest spiny lobster because purchase and sale would also be prohibited.

The Council considered in-season AMs for the recreational sector of the spiny lobster fishery; however, difficulties in accurately tracking recreational harvest of spiny lobster in-season precluded further consideration of those alternatives (See Appendix A for Considered but Rejected Alternatives). The newly implemented Marine Recreational Information Program (MRIP) does not collect landings information on crustaceans, so in-season tracking of spiny lobster landings in the recreational fishery would depend on Florida's limited recreational data survey program. Therefore, the implementation of in-season AMs is not practical for the recreational sector.

Alternative 3 includes a large suite of possible post-season AMs that would be triggered in the event of an ACL overage. The post-season AM options are designed to compensate or correct for the magnitude of the overage during the following fishing year. In doing so, harvest levels would return to their baseline ACL over the course of two fishing years, the year of the overage and the year of the overage correction. Biologically, the ideal scenario is not allow the ACL to be exceeded to begin with, then no post-season AM would be required and stock would realize the biological benefits of sustainable harvest conditions into perpetuity. Unfortunately, management and scientific uncertainty, and numerous other variables including economic and unforeseen biologic and weather events, play a major role in annual spiny lobster landings, which may fall above or below any number of harvest parameters. The advantage of implementing post-season AMs is that the landings data for any given year can be examined in totality before the AM is actually triggered, as opposed to in-season AMs that could rely largely on projections of harvest that may or may not have a high degree of uncertainty. Using actual landings data to calculate the precise magnitude of an overage is biologically beneficial in that it ensures an adequate level of payback is implemented.

As is the case under **Alternative 2**. a combination of the separate recreational and commercial AMs (**Options a** and **b**), would yield similar biological benefits when compared to **Option c**, which builds in a combination sector AMs. **Option b** alone would be the least biologically beneficial post-season AM because it does not compensate for any overages created by the commercial fishery. The variability in recreational landings data should be taken into account when considering **Option B** under **Alternative 3**.

Currently, the state of Florida, where the majority of recreational fishing for spiny lobster takes place, tracks recreational landings through two separate annual surveys sent to fishermen holding recreational lobster permits. The surveys are distributed via e-mail to collect landings information on harvest during the Special Two-Day Season, and to collect landings information from the opening day of the regular season through the first Monday in September (when the majority of spiny lobster fishing effort occurs) (Sharp 2005). Since Florida is the only state to track recreational landings of spiny lobster and no recreational landings data are collected by NOAA Fisheries Service, a new quota-monitoring program that would incorporate a mechanism to collect recreational and commercial landings information to track combined or separate ACLs may be needed. A quota monitoring program for spiny lobster could potentially be dealer-based through the establishment of dealer permit and reporting program specifically designed for spiny lobster. Additionally, spiny lobster could be added to the list of species for which recreational landings data is captured through MRFSS and MRIP, though doing so may not address the issue of time lags between the time of harvest and the time when the data are available to fisheries managers. Any supplemental or improved data collection efforts for spiny lobster would likely yield greater biological benefit over the long-term.

Because recreational landings data are known to be highly variable and MRIP does not currently collect information on spiny lobster harvest, using a three-year running average of estimated recreational landings compared to the recreational ACL could reduce, to some extent, variability caused by anomalous spikes or declines in landings. Sudden spikes or reductions in harvest could greatly influence post season AMs in the recreational sector if they are only considered on a year-by-year basis. Averaging recreational spiny lobster harvest over several years would minimize the influence any one exceptionally poor or exceptionally good year could have on the magnitude of the pay-back or season length reduction. **Option a** would yield greater biological benefit than **Option b** because the commercial component of the fishery is larger than the recreational component; however, it does not account for any overages in the recreational sector. The most biologically beneficial post-season AM is **Option c**, which includes AMs for the commercial and recreational sectors, which would therefore be expected to adequately compensate for overages in one or both sectors. Reducing the length of the fishing season by the amount needed to pay back the overage in addition shortening the season length to prevent a future overage would likely have a greater biological benefit than only reducing the length of fishing season.

The most biologically beneficial AM for Caribbean spiny lobster is most likely some combination of in-season AMs and post-season AMs. Under this scenario, if the in-season AM failed at preventing commercial ACL overage, the Regional Administrator would still have the option to implementing a post-season AM in both sectors to compensate for the overage.

Alternative 1 would perpetuate the existing level of risk for interactions between ESA-listed species and the fishery. Establishing AMs is unlikely to alter fishing behavior in a way that would cause new adverse effects to *Acropora*. The impacts from **Alternatives 2** and **3,** and the associated sub-alternatives**,** on sea turtles and smalltooth sawfish are unclear. If they perpetuate the existing amount of fishing effort, but causes effort redistribution, any potential effort shift is unlikely to change the level of interaction between sea turtles and smalltooth sawfish and the fishery as a whole. If these alternatives reduce the overall amount of fishing effort in the fishery, the risk of interaction between sea turtles and smalltooth sawfish will likely decrease.

4.5.2 Direct and Indirect Effect on the Economic Environment

As stated in Section 4.4.1.2 (for ABC control rules), the economic impacts of the alternatives for the ABC control rule, ABCs, ACTs, ACLs, and AMs may be evaluated when various management reference point alternatives are specified, following the SEDAR for Caribbean spiny lobster, pending circa December 2010. Other comments in Section 4.4.1.2 are incorporated herein by reference, recognizing that Action 5 would directly affect the economic behavior of fishermen and that alternatives under other actions feed into Action 5.

There are some caveats. Some options under Action 5 (AMs) could have differential economic impacts by sector, adding to those that have accrued over time under existing State of Florida regulations. Under State of Florida regulations, participation and entry are not limited for recreational fishing in Florida, but they are clearly limited for commercial fishing (Shivalani, 2009, draft, p. 97). Commercial fishing effort for Caribbean spiny lobster (*Panulirus argus*) in Florida has been reduced substantially under the State's trap certificate reduction program, and it continues to be reduced, albeit at a slower rate (see Section 4.3.3). In other words, the number of commercial vessel and trips with landings are far below what they were in the early 1990s, along with the number of hours fished and the number of traps fished (Vondruska 2010a). The State's trap certificate reduction program was intended to reduce congestion on the fishing grounds, and to improve economic conditions of those remaining in the commercial fishery. By contrast, some options under Action 5 (AMs) may turn out to have a negative economic impact on commercial fishing via limits on landings, trips and season length, but have no impact on recreation fishing. Other options under Action 5 (AM's) could impact both sectors, or they could impact recreational fishing, but not commercial fishing.

Alternative 2 (**Option a**) of Action 5 would create a hard quota for the commercial sector, meaning an in-season quota-based closure, based on a ACL or a ACT, as determined under Action 4, and create no AM for recreational fishing. **Alternative 2** (**Option b**) would create an in-season trip limit for commercial fishing when 75% of the ACL or ACT projected to be met, and create no AM for recreational fishing.

Alternative 3 (**Option a**) would create post-season reductions in ACLs or ACTs for the commercial sector, or create post-season reductions in season length for the commercial sector, or create post-season trip limits for the commercial sector, and create no AM for recreational fishing.

Alternative 3 (**Option b**) would create post-season reductions in ACLs or ACTs for recreational sector, or create post-season reductions in season length for the recreational sector, or create post-season trip limits for the recreational sector, and create no AM for commercial fishing.

If **option a, Alternative** 3, Action 5, were selected, a post-season AM would be applied to the commercial sector only in the event of an ACL overage (referring either to the overall ACL or to a commercial sector ACL). "Option b," **Alternative** 3, Action 5, would seem require use of a recreational sector ACL, implying that "Option a" would require use a commercial sector ACL. "Option c," **Alternative** 3, Action 5, could affect both sectors (with an overall ACL), or either or both sectors (with sector ACLs).

4.5.3 Direct and Indirect Effect on the Social Environment

The setting of Accountability Measures can have significant direct and indirect effects on the social environment as they usually impose some restriction on harvest. The long term effects should be beneficial as they provide protection for further negative impacts on the stock. While the negative effects are usually short term, they may at times induce other indirect effects through changes in fishing behavior.

Alternative 1 would put no accountability measures in place and would risk further damage to the stock if the ACLs or ACTs were exceeded. This would avoid short term negative social impacts, but may longer term impacts if stock status were jeopardized. The implementation of in season AMs in **Alternative 2** would require projection of the harvest in the commercial fishery to ensure no overages. This type of quota monitoring is not as precise as post season and cannot be accomplished with the recreational fishery as in season monitoring is not feasible. In season monitoring might contain the overage and lessen the chance of exceeding the ACL if monitoring precision is adequate. The many options under **Alternative 3**, post season monitoring, can be more precise in both determining the size of the overage, but also the payback necessary. It does however, increase the risk of exceeding an ACL. What impacts are derived from either in season or post season accountability measures would depend upon the volatility of the fishery and the perceived risks of exceeding the ACL. In spiny lobster, it would seem there would be few risks as the fishery seems to be fairly stable and post season accountability measures may be adequate. However, as discussed earlier, fishing behaviors can change depending upon management measures chosen and the perception of scarcity. If ACLs begin to be exceeded and accountability measures are implemented which close the fishery, effort may be directed elsewhere. The ability to redirect fishing effort is becoming more difficult as limited entry management is becoming more common. Therefore, if there are fewer choices for redirecting effort, whether it's changing fisheries or choosing temporary work outside the fishery, the indirect effects on the social environment may extend beyond the lobster fishery. As mentioned in the discussion of **Section 3.5** the description of the social environment there are outside factors that are affecting fishermen in South Florida. Continued social disruption may be confounded by these other factors that have gradually pushed fishermen and their associated businesses from the waterfront. On the other hand, if accountability measures are adopted that keep stock status viable and productive, the effects on the social environment may have negative short term effects, but longer term benefits.

4.5.4 Direct and Indirect Effect on the Administrative Environment

Alternative 1 would not produce near-term administrative impacts. However, this alternative would not comply with Magnuson-Stevens Act requirements and therefore, may trigger some type of legal action for not doing so. If this scenario were to occur, the burden on the administrative environment would be great in the future. **Alternatives 2** and **3** would produce a small negative impact on the administrative environment regardless of the choice of options and sub-options. Under each of the sub-options spiny lobster would need to be added to the list of species tracked via MRFSS, MRIP, and through the quota management system. Implementing these ACL/AM tracking mechanisms is not a trivial task and could result in significant administrative cost and time in the near-term and long-term.   Additionally, each of the sub-options would require a notice to be drafted and disseminated to fishery participants notifying them of the previous year's overages, and how much the next year's catch limit and/or bag limit would be reduced, or season shortened.

4.5.5 Council Conclusions

The Councils moved the subalterantives that would have established recreational in-season AMs to Appendix A Alternatives Considered but Eliminated from Detailed Consideration because there is no existing program to track recreational landings during the season. A post-season mail survey is conducted by the marine agency in the State of Florida, however, the Councils concluded this could not be used for in-season monitoring. MRFSS does not collect data on lobsters. The Councils recognize the post-season adjustments may be more severe without in-season adjustments, but there simply is no existing data collection program that could be used to monitor the reacreational landings during the season.

4.6 Action 6: Develop or Update a Framework Procedure and Protocol for Enhanced Cooperative Management for Spiny Lobster

4.6.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

Alternative 1 would maintain the Regional Administrator's current ability to adjust total allowable catch, quotas, trip limits, bag limits, size limits, seasonal closures, and area closures; however, no means would exist to make needed adjustments to the National Standard 1 harvest parameters in a timely manner. Often, when a harvest reduction is needed, corrective action is required quickly. Not allowing ACLs, ACTs, and AMs to be adjusted through framework would most likely lead to extended delays in implementing harvest reductions and/or associated AMs. Such a scenario could be biologically detrimental because excessive levels of fishing mortality, or even overfishing, would persist until the appropriate harvest limitations could be put in place through amendment action. Alternately, if new data shows a stock is doing better than previous assessments indicated, unnecessary restrictions could prevent the fishery from harvesting its optimum yield. The impacts on the physical environment would not change under this alternative.

Alternative 2 would have no impact on the physical or biological environment because its only purpose is to update the protocol, which defines the roles of federal and State of Florida agencies in managing spiny lobster. The updates would include relevant agency names and authorities. Regardless of how the current framework procedures or protocols are modified, those changes will have no immediate effect because those changes will not cause immediate changes in harvest objectives.

Alternatives 3 and 4 would likely be biologically beneficial for spiny lobster. Under **Alternative 3,** adjustments to ACLs, ACTs, and AMs could be made relatively quickly as new fishery and stock abundance information becomes available. Under **Alternative 4**, adjustments to other management measures would also be simplified. By changing the current framework procedure to allow for periodic adjustments to National Standard 1 harvest parameters, management measures could be altered in a timely manner to implement harvest level changes or AMs in response to stock assessment or survey results. Allowing ACL and other adjustments to be made through framework actions could eliminate the need to prepare and analyze individual amendments or amendment actions for each adjustment needed. Framework actions are initiated by the Councils and implemented by the Regional Administrator, and require less time when compared to the lengthy amendment process. The majority of public participation and comment on framework issues typically takes place when the framework procedure is initially drafted during the regular amendment process, as in this action. Eliminating these time-consuming factors would enable harvest modifications to be expedited when they are most needed. The physical environment would be indirectly impacted because changes in harvest levels would change effort levels, either increasing or decreasing the impact of traps on the bottom. A quicker change to the regulations would result in a quicker change in the physical impacts of the fishery.

4.6.2 Direct and Indirect Effect on the Economic Environment

Action 6 appears to primarily administrative in intent, and the discussion is quite specific and detailed, for more so than for other Actions in Amendment 10 so far. Implementation of Amendment 10 depends on cooperative management. However, Amendment 10 is complicated, with large numbers of possible combinations for alternatives and options. There may be differences of opinion about economic impacts among respective legislative bodies, regulatory bodies and courts. Indeed, it would seem that cooperative management has a history being less "cooperative" than now appears to be the case respecting fishing for Caribbean spiny lobster in state and federal waters in Florida (Section 3). Any differences in regulation between Florida and the Councils would have the most economic impact. This is because practically all of the landings of Caribbean spiny lobster occur in Florida, which has its own regulations for this species. Furthermore, Florida landings occur largely in Monroe County (approximately 90% for commercial landings and 67% for recreational landings, percentages from Table 4.3.2.2). Hence, economic impacts under Amendment 10 would occur primarily in Florida and largely in Monroe County.

4.6.3 Direct and Indirect Effect on the Social Environment

The development of a framework procedure would have beneficial impacts on the social environment as management can react to changes in the stock status or fishery in a more timely manner. **Alternative 1**, the no action alternative would not allow for these types of changes and could, over time, have negative indirect effects. However, framework actions that are done rapidly do not always provide for as much public input and comment on the actions as other regulatory processes. The benefits of timely action often outweigh the diminished timeframe for comment though. **Alternative 2** would provide consistency in language with regulatory changes and have few effects on the social environment. **Alternatives 3 and 4** provide options for implementing a framework procedure that becomes less restrictive in terms of timing and public input going from **Option a to Option c**. As mentioned earlier, timing and public input become the parameters that are constrained by these options. While public input and participation by advisory panels can be beneficial, it is time consuming and can slow the process. Yet, that participation can provide a more acceptable regulation.

4.6.4 Direct and Indirect Effect on the Administrative Environment

Alternative 1 would be the most administratively burdensome of the alternatives being considered, because all modifications to ACLs, ACTs, and AMs would need to be implemented through an FMP amendment, which is a more laborious and time consuming process than a framework action. **Alternative 2** would have no impact on the administrative environment. **Alternatives 3** would incur less of an administrative burden than **Alternative 1** because several steps in the lengthy amendment process would be eliminated if the Regional Administrator were given the latitude to adjust ACLs, ACTs, and AMs through framework actions. **Alternative 4** would incur even less of an administrative burden because other management measures could also be adjusted through framework actions. **Alternative 4 Option b** would be the least burdensome because it would allow the widest range of actions to take place under the framework procedure.

The Gulf Council is considering alternatives to the framework procedures of all Gulf FMPs that are similar to the options in **Alternative 4**. If the Councils choose the same basic framework for the Spiny Lobster FMP as for other Gulf FMPs, the process of implementing framework actions may be more streamlined.

4.6.5 Council Conclusions

The Councils concluded that the Protocol for Enhanced Cooperative Management needs to be updated to reflect the current agencies/processes in place. The Framework Procedure also needed to be updated to reflect new MSA requirements.

4.7 Action 7: Modify Regulations Regarding Possession and Handling of Short Caribbean Spiny Lobsters as "Undersized Attractants"

4.7.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

This action is being considered in order to address law enforcement concerns related to allowing vessels to maintain undersized spiny lobster onboard fishing vessels. The number and storage requirements for undersize spiny lobster allowed to be retained have been modified several times since the original Spiny Lobster FMP was implemented. In 1982 the Spiny Lobster FMP included the first provisions for keeping undersized spiny lobster for use as attractants. At that time no more than three live undersize lobsters could be placed in each trap or no more than 200 undersize lobsters could be maintained on board a vessel, whichever was greater. The July 1987 final rule implementing Amendment 1 changed the number of undersize lobster that could be kept on board to 100. In May 1988, a second final rule implementing Amendment 1 was published and included a requirement that all undersize lobster are to be maintained in a live well. A regulatory amendment was developed in 1992, which further revised the provisions regarding keeping undersize spiny lobster for use as attractants. The final rule for this regulatory amendment was published in November 1992, and reduced the number of undersize lobster allowed to be kept from 100 to 50, and maintained the live well requirement. The 1992 regulations are still in place today.

Currently, regulations at 50 CFR 640.21(c) state:

> *A live spiny lobster under the minimum size limit specified in paragraph (b)(1) of this section that is harvested in the EEZ by a trap may be retained aboard the harvesting vessel for future use as an attractant in a trap provided it is held in alive well aboard the vessel. No more than fifty undersized spiny lobsters, or one per trap aboard the vessel, whichever is greater, may be retained aboard for use as attractants. The live well must provide a minimum of ¾ gallons (1.7 liters) of seawater per spiny lobster. An undersized spiny lobster so retained must be released alive and unharmed immediately upon leaving the trap lines and prior to one hour after official sunset each day.*

Therefore, each vessel is not necessarily limited to only 50 undersize lobsters, but one lobster per trap. In the commercial spiny lobster fishery, it is common for a vessel to carry more than 100 traps on any one trip. This allowance may contribute to the magnitude of negative biological impacts and positive socioeconomic impacts. Traditionally, fishermen have realized great success using live lobster as bait in lobster traps. Experiments have shown that traps baited with short lobsters catch approximately three times more lobster than traps baited with any other method (Moe 1991; Heatwole et al. 1988).

Allowing possession of undersized lobster on board any permitted spiny lobster vessel within the EEZ makes it difficult for law enforcement officials to discern whether those undersized lobsters are truly being maintained for use as attractants, or for illegal purposes. If a vessel is stopped by a law enforcement official with undersized lobster onboard in transit toward port with the intention to sell or keep those lobsters, prosecution is made more difficult by the fact that regulations allow undersized spiny lobster to be kept under certain conditions. Furthermore, the state of Florida has implemented their own requirements for the number of undersize lobster allowed to be kept onboard for use as attractants, which are slightly different from current implemented federal regulations. Florida regulations state:

> *A person aboard a vessel with a C# and trap certificates may harvest and possess while on the water 50 undersized spiny lobster (shorts) and one short per trap aboard the boat. Shorts must be released alive and unharmed upon leaving trap lines (livewell specifications apply). The allowance for shorts applies to the trap fishery only and sale is prohibited.*

The state of Florida allows not only 50 undersized lobsters to be maintained onboard a licensed vessels, they also allow one undersized lobster per trap as well, which is inconsistent with current federal regulations.

In addition to law enforcement concerns, there may also be negative biological impacts of allowing 50 or more undersized spiny lobster to be maintained in a live well. If undersized spiny lobster continue to be sold illegally, and transported under the guise of being used as attractants, those lobster are not returned to the water as they should be and they are not able to reproductively contribute to the population. Secondly, trauma incurred during holding in live wells, caused by crowding, duration of confinement during transport, relocation to a different environment, or exposure to the PaV1 virus, and may also contribute to undersized spiny lobster mortality, which may negatively impact the population. It should be noted that some undersize lobster are able to escape from the trap; however, the magnitude of such occurrences is unknown. Hunt et al (1986) indicated an exposure and confinement mortality rate of 26.3 percent for lobsters exposed to air and confined in traps for four weeks. Lobsters that were then held in live wells and confined for the same amount of time showed a mortality rate of 10.1 percent. A study conducted by Matthews (2001) indicated similar reductions in the mortality rates of spiny lobster kept for use as attractants based on observation of commercial lobster traps. due to the implementation of the live well requirement. Additionally, the Matthews study showed that commercial and recreational harvest of spiny lobster increased notably as a result of decreased mortality of undersized lobsters maintained in live wells (Matthews 2001). These mortality rates were reviewed and utilized in SEDAR 8 (2005) and its subsequent 2010 update. Mortality from ghost fishing of lost traps is unknown. Although live wells reduce the risk of mortality do to air exposure some lobsters may perish as a result of predation or starvation when confined to a trap. Furthermore, the continued practice of using sub-legal size lobsters as bait has been shown to increase injuries caused by handing and to reduce the growth rate, causing females to mature at smaller sizes (Maxwell et al. 2009). Smaller females carry fewer eggs then larger females, and thus are considered less fecund than females that reach sexual maturity at larger sizes (Maxwell et al. 2009).

Alternative 1 would have the second highest negative impact on the biological environment of the three alternatives under consideration. Under **Alternative 1**, there would be no change from the current regulatory requirement to keep no more than 50 undersized lobsters, or one per trap aboard the vessel, whichever is greater, for use as attractants. **Alternative 1** produces the highest rate of spiny lobster mortality associated with use as attractants relative to **Alternatives 2** and **3**.

Additionally, **Alternative 1** does not address the enforcement concerns referenced above. If undersized spiny lobster continue to be sold illegally, and transported under the guise of being used as attractants, those lobster are not returned to the water as they should be they are, therefore, not able reproductively contribute to the population. Secondly, trauma incurred during holding in live wells, caused by crowding, duration of confinement during transport or relocation to a different environment, may also contribute to undersized spiny lobster mortality, which may negatively impact the population.

Through time, the Caribbean spiny lobster population has fluctuated substantially (Figure 4.7.1.1). The total biomass ranged from 15,000 mt in 1985-86 to 20,200 mt in 1995-96 and was 19,200 mt at the beginning of 2003-04. Spawning biomass increased from 3,300 mt in 1985-86 to 5,700 mt in 2003-04 (SEDAR 8 2005) indicating undersized spiny lobster benefit from use of live wells in the form of decreased mortality rates. The SEDAR 8 Update (2010) used an estimated 10 percent confinement mortality rate for undersized Caribbean spiny lobster kept for use as attractants; however, the time of the season and soak times can cause confinement mortality rates to fluctuate. It is difficult to know the precise number of undersize Caribbean spiny lobster used as attractants in any given year; however, it is understood to be a very common practice in the commercial sector and SEDAR 8, 2005 indicates the total fishing mortality rate in 2003-04 fishing year was 0.85 per year with the bait mortality portion of that fishing mortality rate being 0.05 per year. Figure 4-3 illustrates fishing related mortality attributable to each sector and use of undersized lobster as attractants through history.

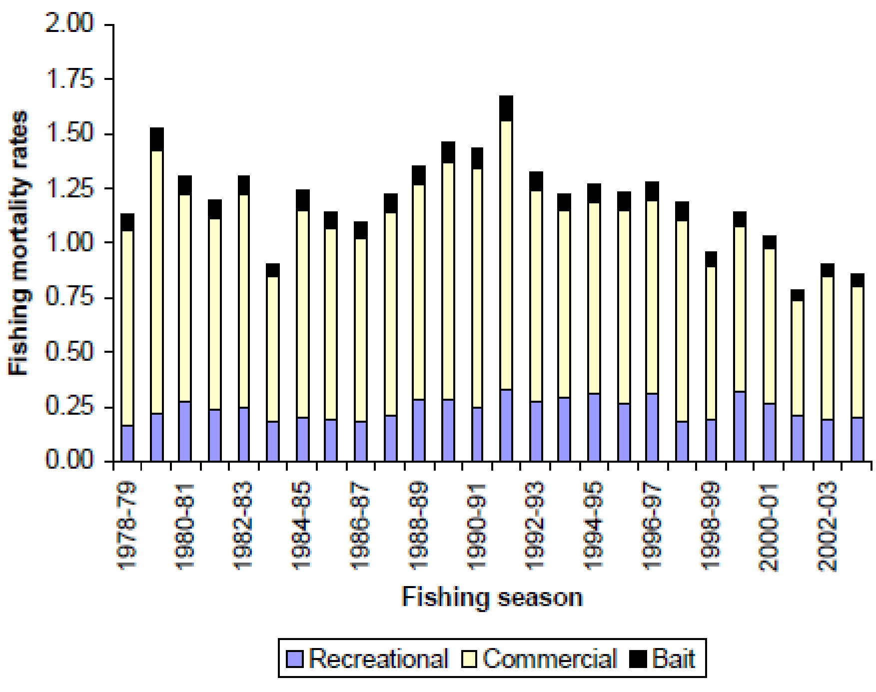

Figure 4.7.1.1. Fishing mortality per year by fishing year for the recreational fishery (purple bars), commercial fishery (yellow bars), and bait fishery (black bars).
Source: SEDAR 8, 2005

Alternative 2 would be the most biologically beneficial alternative under this action since, theoretically, all mortality associated with using undersized lobsters as attractants would cease. Under **Alternative 2** there would be an approximate decrease in confinement mortality of 10 percent (SEDAR8 Update 2010). Prohibiting the use of undersize Caribbean spiny lobsters as attractants may also reduce the risk of potential ACL overages and hedge against future overfishing. Additionally, **Alternative 2** would solve enforcement problems related to undersized Caribbean spiny lobster since there would no longer be a legal reason for any vessel to have undersize Caribbean spiny lobster onboard.

Alternative 3 would not address the issues raised by the Office of Law Enforcement; however, it could help to reduce fishing mortality attributable to use of undersized lobsters for baiting purposes. **Alternative 3** would not benefit the biological environment to the extent **Alternative 2** would, and depending upon the option chosen, may only yield negligible biological benefits over the status quo. Limiting the number of undersized lobster that could be used as attractants to 35 (**Option b.**) could potentially reduce the current level of confinement mortality by about half, which would likely contribute to some improvement in stock abundance. Additionally, allowing only 35 undersized lobster to be used as bait, and removing the provision that allows one undersized lobster per trap (whichever is greater), could hedge against overfishing, but not to the same degree as **Alternative 2**. **Option a** would provide the least biological benefit of all the alternatives and options under consideration since it deviates the least from the status quo. **Option a** would retain the allowance for 50 undersized Caribbean spiny lobster, but would remove the one lobster per trap provision. In doing so, vessels would be limited to 50 undersized lobsters regardless of the number of traps they are carrying onboard. There may be some biological benefit realized under this option; however, the degree to which those benefits would impact the environment would depend on the number of fishermen who traditionally carry more than 50 traps and keep more than 50 undersized lobsters for use as attractants.

Preferred Alternative 4 is very similar to **Alternative 1** in that it would allow spiny lobster to be kept onboard for use as attractants ; however, it would change the provision to allow 50 spiny lobster *plus* one per trap, rather than 50 spiny lobster "*or*" one per trap, and it would remove the "whichever is greater" portion of the provision. This alternative is the least biologically beneficial of all the alternatives considered since it would increase the number of spiny lobsters able to be maintained onboard a vessel. Changing this provision under **Preferred Alternative 4** would make the federal regulations compatible with Florida's state regulations. The purpose of keeping 50 spiny lobsters onboard is ensure there is an adequate supply of attractants during the baiting process for each trap, i.e., some traps will be onboard being baited while others would be in the water with baits already in them.

Depending on one's interpretation of the Magnuson-Stevens Act National Standard 9 requirement to minimize bycatch and bycatch mortality to the extent practicable, and how undersized spiny lobster are being used, an argument can be made that allowing the use of undersized attractants at all violates National Standard 9. Most commercial spiny lobster fishermen do not consider keeping undersized lobsters for use as attractants as a form of bycatch or bycatch mortality because they are "borrowing" from the resource with the intent to release the lobsters back into the environment alive. It is true that a small percentage, (10 percent depending on the time of year and soak time), of lobsters kept to be used as attractants die as a result. Whether or not this is an acceptable level of mortality that does not impact the overall sustainability of the stock has yet to be determined. The decision to allow or not allow the use of undersize spiny lobsters as attractants depends heavily on the impact of attractant-related mortalities on stock abundance.

There is concern that allowing spiny lobsters to be kept onboard, even at the status-quo level, could perpetuate the spread of the PaV1 virus, which typically affects juvenile spiny lobsters and causes general lethargy. The virus can be transmitted via prolonged contact, and ingestion. Spiny lobsters infected with the PaV1 virus are typically avoided by healthy, normally social, conspecifics (Behringer et al, 2008). A study conducted by Behringer (2010), found that healthy spiny lobsters were less likely to cohabitate with infected with PaV1, which could leave them vulnerable to predation if they were to choose a less safe shelter in order to avoid contact with the infected lobster. Therefore, the higher the number of spiny lobsters allowed to be maintained in lives wells the higher the risk of perpetuating the spread of the PaV1 virus, especially amongst young spiny lobsters that are more susceptible to acquiring the virus.

Alternative 1 would perpetuate the existing level of risk for interactions between ESA-listed species and the fishery. Modifying or removing the 50-shorts rule is unlikely to alter fishing behavior in a way that would cause new adverse effects to *Acropora*. The impacts from **Alternatives 2**, **3,** and **Preferred 4,** and the associated options**,** on sea turtles and smalltooth sawfish are unclear. If they perpetuate the existing amount of fishing effort, but causes effort redistribution, any potential effort shift is unlikely to change the level of interaction between sea turtles and smalltooth sawfish and the fishery as a whole. If these alternatives reduce the overall amount of fishing effort in the fishery, the risk of interaction between sea turtles and smalltooth sawfish will likely decrease.

4.7.2 Direct and Indirect Effect on the Economic Environment

Alternative 1 (status quo) would allow the possession of no more than 50 undersized Caribbean spiny lobsters or one per trap aboard the vessel, whichever is greater, for use as attractants.

Alternative 1 would not result in any change in the use of undersized Caribbean spiny lobsters in lobster traps as attractants. As a result, all status quo operation of the fishery, and associated economic benefits, would remain unchanged. However, if **Alternative 2** would reduce the risk of exceeding the ACL when compared with **Alternative 1**, then **Alternative 1** would increase the likelihood of shortened fishing seasons, trip limits, bag limits, or whatever the Councils choose as a means to regulate fishing when landings exceed or are expected to exceed the ACL.

Alternative 2 would prohibit the possession and use of undersized Caribbean spiny lobster as attractants. Compared with Alternative 1 (status quo), **Alternative 2** could reduce the likelihood of incurring shortened fishing seasons, trip limits, bag limits, or whatever the Councils choose as a means to regulate fishing when landings exceed or are expected to exceed the ACL.

It is assumed here that what is counted as "bait" for stock assessment purposes represents the estimated fishing mortality associated with the use of undersized Caribbean spiny lobster as attractants, pending clarification in the SEDAR for spiny lobster, circa December 2010. If so, the bait-associated fishing mortality is 189,000 pounds per year under **Alternative 1** (Table 4.3.3.2), and fishing mortality would be reduced by this amount **Alternative 2**. At least some, if not most the undersized Caribbean spiny lobster used as attractants are kept alive on board a vessel and returned to the water alive, as required (quoting 50 CFR 640.21(c)):

> The live well must provide a minimum of ¾ gallon (1.7 liters) of seawater per lobster. An undersized spiny lobster so retained [for use as an attractant] must be released alive and unharmed immediately leaving the trap lines and prior to prior to one hour after sunset each day.

However, fishermen who are more likely to have used undersized Caribbean spiny lobster as attractants and those who are less likely to do so may disagree in terms of perceived impact on the resource or as a matter of intra-fishery opinions about the “other guy,” according to survey data (Shivlani et al, 2004, Table 46 and text, p. 77).

Alternative 2 would in practice require the use of more purchased bait, hence increase trip costs on average for commercial fishing for spiny lobster as a whole. This would reduce producer surplus for this activity.

Under **Alternative 1** (status) conditions, many commercial trap fishermen may already purchase bait, based on fishermen’s perceptions on how to best attract lobsters (sample data for four landing areas in Monroe County and one in the Miami River in 01/02; Shivlani et al, 2004, Table 46 and text, p. 77). Those who reported more use of undersized lobsters as attractants had much lower average trip costs for bait compared with those who used purchased bait (such as cowhide), and they had shorter trips, and lower average trip costs for other major items as well. Average trips costs for bait were in the range of $12.72 (Middle Keys) to $133.24 (Key West), with the average trip costs for bait costs of $60.90 for the whole sample (data in current dollars for 01/02, not adjusted to 2008$).

Alternative 3 would allow the possession and use of undersized Caribbean spiny lobster, but modify the number allowed, regardless of the number of traps fished:

> Option a: allow 50 undersized lobsters.
> Option b: allow 35 undersized lobsters.

Depending on how it is interpreted, **Alternative 3** should reduce the fishing mortality associated with the use undersized Caribbean spiny lobster as attractants, more so for **Alternative 3, option b**, than for **Alternative 3, option a,** when compared with **Alternative 1** (status quo), for which the assumed fishing mortality is 189,000 pounds per year (Table 4.3.3.2). The economic impact of **Alternative 3** would be less than that of **Alternative 2,** and require the use of less purchased bait, hence less increase in trip costs for commercial fishing for spiny lobster as a whole. It would reduce producer surplus less than **Alternative 2**, when both are compared with **Alternative 1**. Compared with **Alternative 1**, **Alternative 3** would require the use of more purchased bait, hence an increase in trip costs for commercial fishing for spiny lobster as a whole. It would reduce producer surplus from that for **Alternative 1**.

Alternative 4 (Gulf preferred alternative) would allow possession and use of undersized Caribbean spiny lobster not exceeding 50 per boat and l per trap on board if used exclusively for luring, decoying or otherwise attracting non-captive spiny lobsters into traps. This compares with of no more than 50 undersized Caribbean spiny lobsters or one per trap aboard the vessel for **Alternative 1**.

Depending on how it is interpreted, **Alternative 4** would reduce fishing mortality associated with the use undersized Caribbean spiny lobster as attractants far less than **Alternative 2,** and require the use of less purchased bait, hence less increase in trip costs for commercial fishing for spiny lobster as a whole. It would reduce producer surplus less than **Alternative 2**, when both are compared with **Alternative 1**.

It is estimated that **Alternative 4** could allow perhaps 50-80 attractants on board vessel during fishing operations (50 per vessel plus 1 per trap on board, perhaps 30-35 on average) when estimated as described below. This compares with having a maximum 50 on board under **Alternative 1**, assuming the averages estimated below are indicative (a maximum of either 50 per vessel or 30-35 per vessel based on the average number of traps on board during fishing operations).

The number of traps fished on a trip can be estimated for **Alternative 1** (status quo), when this number is interpreted to mean the number of traps hauled to remove lobsters. This is not necessarily an indication of the number traps on a vessel, which may be 30-35 at any one time during fishing operations (annual averages for trips obtained as: traps hauled per trip / sets per trip = 200 / 7 = 29; 280 / 8 = 35). In the last 5 years, the average number of traps hauled per trip was mostly in the range of 200-280 traps on trips of 14-17 hours (hours away from port), with 7-8 sets per trip, which is interpreted to mean trap lines hauled and returned to the water per trip) (underlying data as used in Vondruska 2010a). The total number traps fished on all trips declines by month on average, along with total pounds landed, and the median number of traps fished per trip.

4.7.3 Direct and Indirect Effect on the Social Environment

The use of undersized lobster as attractants has been acceptable practice in the spiny lobster fishery for some time. It complicates law enforcement as the size limits on harvested lobster can make determination of the lobster's disposition as bait or product questionable. The no action **Alternative 1** would continue the difficulty that law enforcement faces with prosecuting undersized lobster violations. **Alternative 2** could solve the law enforcement issue, but may impose a hardship on lobster fishermen who utilize "shorts" as attractants, if their harvest is reduced as a result. The two options under **Alternative 3** would continue to allow undersized lobster for attractants, but would reduce the number allowed on board and make it inconsistent with current state regulations. **Option a** would allow 50 "shorts" but make no allowance for number of traps. **Option b** would reduce the number to 35 with no allowance for traps. In either case, the difficulty for law enforcement would remain. With **Alternative 4** there is consistency with state regulation which would benefit law enforcement but still does not address the difficulty with the law enforcement determination of undersize harvest. There does not seem to be an alternative that solves all the issues involved with the use of “shorts” as an attractant in the spiny lobster fishery.

4.7.4 Direct and Indirect Effect on the Administrative Environment

Alternative 2 would create the lowest impact on the administrative environment since it would remove the need for enforcement personnel to check vessels for specific numbers of undersized Caribbean spiny lobsters. Enforcement officers would simply check for the absence or presence of undersized lobsters. Additionally, the job of gathering prosecutorial evidence to prove a violation would be made simpler because the vessel operator would not be able to circumvent the undersized lobster prohibition by claiming they were in transit, or had several more traps in the water. **Options a** and **b** under **Alternative 3** would not increase the administrative burden over the status quo since numbers of undersized lobsters would still need to be documented, just at a lower number. However, **Alternatives 1, 3,** and **Preferred 4,** would not address the current enforcement concerns regarding the use of undersized Caribbean spiny lobster, and difficulty in prosecuting related violations would persist. Because **Preferred Alternative 4** is consistent with current state regulations in Florida, and therefore, would likely ease the burden on enforcement to track compliance across the state/federal jurisdictional boundary.

4.7.5 Council Conclusions

Need to add

4.8 Action 8: Modify Tailing Requirements for Caribbean Spiny Lobster for Vessels that Obtain a Tailing Permit

4.8.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

Currently, a Tail-Separation Permit is required for any vessel that wishes to land spiny lobster with tails detached for storage purposes on trips longer than 48 hours in duration. As of January 2010, there are 334 vessels with active Tail-Separation Permits. Regulations at 50 CFR 640.21(d) do not require that a vessel fishing for spiny lobster in the EEZ first have a federal or state permit/license/endorsement before they may obtain a federal Tail-Separation Permit. Vessels wishing to obtain a Tail-Separation Permit only have to meet the qualifying criteria of certifying that at least 10 percent of their earned income is derived from commercial fishing, and be on a trip for 48 hours or more. However, any vessel owner wishing to legally sell Caribbean spiny lobster must have the requisite permit/license/endorsement. The regulations do not explicitly state that a vessel must be associated with either a Florida Restricted Species Endorsement, or a federal Spiny Lobster Permit, leaving open the possibility of a non-commercially permitted vessel to obtain a tailing permit, which may affect enforcement of the minimum size requirements, the spear fishing prohibition, and illegal sales. Action 11 of Amendment 1 to the Spiny Lobster FMP (1987) clearly states the Council's initial intent for issuance of tailing permits:

> *The separation of lobster carapace and tail at sea shall be prohibited except by species permit. To be eligible for a tail separation permit, the fishing craft must have been assigned a commercial lobster permit, and must be operated for lobster fishing in the EEZ for two or more days from port. Furthermore, a signed statement that his fishing activity necessitates a tail separation permit.*

However, regulations regarding tailing permit requirements have changed several times since the inception of the permit. In 1990 a final rule implementing Amendment 1 was published in the *Federal Register*. This rule prohibited tailing of spiny lobster harvested from the EEZ except by special permit, and required that a vessel must be associated with a federal commercial spiny lobster permit in order to obtain a Tail-Separation Permit. In 1992 the Council opted to make the Tail-Separation Permit an endorsement to the federal Spiny Lobster Permit through a regulatory amendment. At that time, it was also determined that federal Spiny Lobster Permit issuance would discontinue when Florida's trap certificate and identification program was implemented and when Florida designated spiny lobster as a restricted species, thus limiting the sellers of Caribbean spiny lobster to individuals who have Restricted Species Endorsements on their Florida Saltwater Products License. The Florida trap certificate and identification program was implemented through a final rule published in 1993. Therefore, as stated in the 1992 regulatory amendment, a federal Spiny Lobster Permit was no longer required for vessels fishing for spiny lobster in state or federal waters off Florida. However, the regulations stated that only vessels with federal Spiny Lobster Permits could obtain a Tail-Separation Endorsement. In order to allow vessels participating in Florida's trap certificate program without a federal Spiny Lobster Permit, to obtain a Tail-Separation Endorsement, the regulations were modified to change the "Tail-Separation Endorsement" to a "Tail-Separation Permit", and removed the requirement for a federal Spiny Lobster Permit, as outlined in the 1992 regulatory amendment. The regulations currently state:

> *The possession aboard a fishing vessel of a separated spiny lobster tail in or from the EEZ is authorized only when the possession is incidental to fishing exclusively in the EEZ on a trip of 48 hours or more and a federal Tail-Separation Permit specified in 50 CFR 640.4(a)(2).*

50 CFR 640.4(a)(2) states:

> *For a person to possess aboard a fishing vessel a separated spiny lobster tail in or from the EEZ, a Tail-Separation Permit must be issued to the vessel and must be on board.*

The intent of allowing fishermen to tail Caribbean spiny lobster was to promote ease of storage and transport of the harvested lobster on long commercial trips. Tail-Separation Permits were not initially intended for use by non-commercially permitted vessels. However, because the regulations do not explicitly state that a federal Spiny Lobster Permit, or a Florida Saltwater Products License with a Restricted Species Endorsement are required in order to obtain a Tail-Separation Permit some recreational fishermen have obtained Tail-Separation Permits for their own purposes. Tail-Separation Permits, even if restricted to the commercial sector, are not biologically advantageous, since commercial vessels with tailing permits are able to fish more efficiently for spiny lobster than those vessels without the permit. Because whole lobsters utilize more storage space than tails, vessels that are associated with a Tail-Separation Permit are able to store much more product than vessels that have to store the lobster whole. Space limitations such as cooler capacity onboard fishing vessels can also affect product quality. Therefore, fishermen that are allowed to tail their harvested lobster may not only store more product onboard during long trips, they may do so without having to compromise its quality. Greater efficiency means those vessels with Tail-Separation Permits are also able to take more spiny lobster from the population at a faster rate, which could be detrimental in the long term for overall stock abundance. Therefore, eliminating the Tail-Separation Permit requirements could potentially benefit the biological environment in addition to complimenting law enforcement efforts.

Alternately, a revision to the regulations may clarify that non-commercially permitted fishermen may not obtain a Tail-Separation Permit regardless of how long a trip is or how much of their earned income is derived from other types of commercial fishing. Revising the regulations in this way would not require an amendment action. The Council would have the option to approve or disapprove the change in regulations when they deem the proposed rule. Currently there are 334 active Tail-Separation Permits.

Several fishery participants that attended the scoping meetings were in favor of requiring all Caribbean spiny lobster be either landed all whole or landed all tailed. The rationale for proposing this alternative is that requiring spiny lobster to be landed all whole or all tailed would prevent the abuse of having a short carapace but a long tail. Requiring that all lobster be landed tailed or whole would prevent the practice of only tailing undersized lobster, and would close the loophole for those who attempt circumvent the three-inch carapace length minimum size requirement.

Alternative 1 would not modify the current Tail-Separation Permit regulations for Caribbean spiny lobster. A Tail-Separation Permit would still be required in order to land spiny lobsters tailed, and the trips would still be required to be 48 hours or longer in duration. Under **Alternative 1** the problem of some recreational fishermen obtaining Tail-Separation Permits, and some fishermen tailing only undersized lobster and keeping the legal sized lobster whole for landing would persist. There would be no biological benefit realized under **Alternative 1**. **Alternative 2** would be the most biologically beneficial of all the alternatives being considered under this action. Removing the ability for fishermen to land any Caribbean spiny lobster tailed would increase the probability that most lobster landed would be of legal size since they could easily be measured. According to Witham et al., spiny lobsters reach sexual maturity at lengths of approximately 2.8-3.2 inches (1968). Legal sized lobsters are likely to have reached their reproductive potential and are able to contribute to the overall stock abundance. Therefore, ensuring that spiny lobsters are able to mature enough to reproductively contribute to the population by making it more difficult for fishermen to profit off of undersized harvest would remove the incentive for the practice to continue.

Preferred Alternative 3 would address the issue of recreational fishermen obtaining Tail-Separation Permits, but it would not address the issue of commercial fishermen landing undersized lobster by tailing them. **Preferred Alternative 3** would provide a minimal biological benefit since it is thought that there are very few recreational fishermen who have in their possession a Tail-Separation Permit. However, clarifying the regulations now would prevent even more recreational fishermen from trying to obtain the Tail-Separation Permit in the future, which would be biologically beneficial since it would reduce the risk that undersized lobster could be kept onboard in a tailed condition.

Preferred Alternative 4 would address the issue of some fishermen landing part of their catch whole and part of it tailed; presuming they are tailing select lobsters in order to land sub-legal spiny lobsters for profit. If vessels were to consistently land all Caribbean spiny lobster tailed rather than whole the chance that a portion of that harvest is sub-legal is higher than if fishermen chose to land their entire harvest whole. However, whole lobster may be more desirable in the market, and therefore, this measure may reduce the incentive to land all spiny lobster tailed even though it may result in storage issues on long trips. If under **Preferred Alternative 4**, most fishermen choose to land the majority of their Caribbean spiny lobster harvest whole, the action would biologically beneficial. If the majority of fishermen choose to land their harvest tailed, there is a chance this action could be biologically detrimental to the species, since there would be an increased risk that undersized lobster would be taken. Additionally, this alternative alone does not address the issue of recreational fishermen obtaining Tail-Separation Permits. However, if **Preferred Alternative 3** were chosen in combination with **Preferred Alternative 4**, the issue of recreational fishermen obtaining Tail-Separation Permits would be addressed, and could; therefore, result in greater biological benefit than if **Preferred Alternative 4** were chosen alone.

Alternative 1 would perpetuate the existing level of risk for interactions between ESA-listed species and the fishery. Requiring that all Caribbean spiny lobster be landed whole or all spiny lobster be landed tailed is unlikely to alter fishing behavior in a way that would cause new adverse effects to *Acropora*. The impacts from **Alternatives 2** through **4,** on sea turtles and smalltooth sawfish are unclear. If they perpetuate the existing amount of fishing effort, but causes effort redistribution, any potential effort shift is unlikely to change the level of interaction between sea turtles and smalltooth sawfish and the fishery as a whole. If these alternatives reduce the overall amount of fishing effort in the fishery, the risk of interaction between sea turtles and smalltooth sawfish will likely decrease.

4.8.2 Direct and Indirect Effect on the Economic Environment

Among the alternatives for Action 8, **Alternative 3** appears to administrative in nature in terms of the requirements for obtaining a "tailing permit." Compared with **Alternative 1**, it could have an economic impact on commercial fishing, if fishermen had to cease fishing or return to port in order to produce all the requisite permits for law enforcement officers.

Alternative 2 could have more economic impact (negative economic benefits) when compared with **Alternatives 1, 3 and 4,** because no lobster tails could be landed from catch in the EEZ. In stock assessment terms, **Alternative 2** is believed to have the greatest impact among the four alternatives in reducing fishing mortality, qualitatively speaking. This is because under-sized lobsters could not be "tailed" before being landed, should fishermen illegally sell or attempt to sell under-sized lobster (Section 4.8.1). Of course, the purchasing under-sized has legal ramifications as well, and the number of dealers (first-buyers) in the Keys is much lower than in the past (Section 4.3.3; Shivlani 2009; Vondruska 2010a). Some case reports of law enforcement actions for possession, sale and/or purchase of under-sized lobsters and/or incorrect labeling of species tend to be anecdotal, but dramatic, thereby drawing media attention. Some cases seem at best egregious. Drawing attention to them may serve to affect illegal human behavior. Quantitative data from law enforcement case reports were summarized for imports several years in Amendment 8.

There is concern about the ability of recreational fishermen to obtain tailing permits, and this concern is addressed most completely in **Alternative 2** (Sections 2.8 and 4.8.1).

Although prohibiting of the landing tails for lobsters caught in the EZZ under **Alternative 2** may reduce fishing mortality attributed to the commercial harvest and sale of illegal, under-sized lobster, it seems contrary to long-established U.S. market preferences for legal-size spiny lobster tails. Therefore, **Alternative 2** would disallow fishermen as business operators a choice to pursue some possible market options. It would transfer the economic value-added in removing the lobster heads to processors, if the shipments to end users consist of heads-off, shell-on frozen tails. The market is quite competitive and quality is a factor. Quality may be higher if the lobsters are headed soon after harvest and kept well, even if vessels have on-board wells to hold market-size lobsters.

It is estimated that a significant portion of the southeast commercial landings of Caribbean spiny lobster are exported (Vondruska 2010b). Exports include what are thought to be mostly frozen, shell-on tails, as for the U.S. market, but relatively more live and fresh or frozen whole lobsters, which are preferred in foreign markets. The U.S. exports go to Canada, France, Japan, China and many other countries in Asia, Europe and the Western Hemisphere (Vondruska 2010b, Tables 10-11).

Shell-on, heads-off spiny lobster tails have long been the most common product form in the U.S. market, which is dominated by imports, as for shrimp (Vondruska 2010b). Under Amendment 8, U.S. imports of Caribbean spiny lobster tails must be whole, shell-on (not tail meat), so as allow determination of their size and species which is not readily possible for meat alone (implemented February 2009, Table 1.4.1). For U.S. commercial landings of Caribbean spiny lobster, it is assumed that the lobster tails must also be landed shell-on to allow their measurement (original FMP, implemented 1982; Section 1.4, Amendment 10). Whether it is easier to measure whole Caribbean spiny lobsters or Caribbean spiny lobster shell-on tails is not intuitively clear. In either case, consistency of regulations would imply the U.S. landings are be subject measurement in the same manner as imports have been since early 2009. since the implantation of the implementation of the FMP in 1982.

4.8.3 Direct and Indirect Effect on the Social Environment

Modifying the tailing requirements can certainly benefit the social environment; yet, the alternatives do not provide a complete solution to the problem. **Alternative 1** would provide no solution as no action would be taken. While **Alternative 2** would solve most of the law enforcement issues, it would not provide the benefits of the original intent which allows for fishermen who take longer fishing trips to accommodate space issues with whole lobsters. By requiring recreational fishermen to obtain state commercial permits to obtain a tailing permit under **Preferred Alternative 3** would remove some of the uncertainty for law enforcement, yet still impose some ambiguity in the regulations making it difficult to regulate harvest of undersized lobster. By requiring fishermen to either land all tailed or whole product in **Preferred Alternative 4** would remove some of the difficulty in prosecuting the harvest of undersized lobster and in conjunction with **Preferred Alternative 3** may be the best solution to a difficult problem while continuing to provide for fishermen's concerns of space on long trips.

4.8.4 Direct and Indirect Effect on the Administrative Environment

Alternative 2 would have a positive impact on the administrative and law enforcement environments since the Tail-Separation Permit would no longer exist and the practice of tailing Caribbean spiny lobsters would be prohibited. **Preferred Alternative 3** would create a very small administrative burden when compared to the status quo because some updates to the current regulatory text would be necessary. **Preferred Alternative 4** would also require a modification to the regulations; however, the administrative burden would be very low. If the majority of fishermen chose to land their harvest whole the burden on law enforcement officers would be reduced for those trips. Law enforcement issues may still exist for those fishermen who may choose to land their entire harvest tailed under **Preferred Alternative 4**.

4.8.5 Council Conclusions

Need to add

4.9 Action 9: Limit Spiny Lobster Fishing in Certain Areas in the EEZ off Florida to Address Endangered Species Act Concerns for Staghorn and Elkhorn Corals

IPT Recommends changing to read: Action 9: Limit Spiny Lobster Fishing in Certain Areas in the EEZ off Florida to Protect Threatened Staghorn and Elkhorn Corals (*Acropora*)

4.9.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

Spiny lobster traps are generally not deployed on coral or hardbottom (Lewis et al. 2009), and most fishers appear to drop traps on seagrass, rubble, or sandy habitats because these areas are less likely to damage traps (Hill et al. 2003). Traps also appear to move less on these substrates (Uhrin et al. 2005). However, the relatively poor water quality in the Lower and Middle Keys may cause fishers to accidentally deploy traps on habitats that could support *Acropora*. The ESA biological opinion that evaluated the impacts of the spiny lobster fishery determined that the deployment and retrieval of traps during normal fishing operations had little impact to *Acropora* relative to traps moved from their original locations during storms.

Lewis et al. (2009) analyzed the impacts to benthic habitat in the Florida Keys of trap movement during storms. The study documented the distance traps moved during non-tropical storm events.[7] Buoyed traps moved an average of 15 ft during each storm and as much as 98 ft from their original location (Lewis et al. 2009). The movement of buoyed spiny lobster traps following a tropical storm or hurricane has never been measured during a trap impact study, largely because those traps move so far from their original locations that they are rarely, if ever, recovered. However, anecdotal evidence indicates that fishermen have found traps several miles from their original location after tropical storms and/or hurricanes (FFWCC unpublished data).

The movement of traps during storms poses the greatest threat to *Acropora*. Because of *Acropora*s' branching morphology, colonies of any size are susceptible to fragmentation/breakage and abrasion from traps and trap lines. Even traps initially placed by fishermen in locations devoid of *Acropora* colonies can be moved by storms into reef habitats and cause damage. Creating closed areas would reduce the likelihood of traps contacting colonies even if they are moved by storms. Closed areas with a diameter of 200 ft or more would likely be sufficient to protect *Acropora* colonies from trap movements occurring during typical storm conditions (i.e., non-tropical systems).

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The **Alternatives 2, 3, and 4** were developed primarily to protect colonies with high conservation value and areas of high *Acropora* density. The largest "super colonies" were designated as conservation priority 1 because of their importance to sexual reproduction. *Acropora* corals are generally considered sexually mature when the surface area of live tissue exceeds 100 cm^2. Elkhorn corals with a living tissue surface area of 1000 cm^2 could be considered "super colonies." A similar distinction could be made for staghorn corals with a living tissue surface area of 500 cm^2. Colonies of this size have exponentially higher reproductive potential compared to other sexually mature colonies, and represent essential sources of gamete production. Colonies of this size are also exceedingly rare. Sampling at over 1,000 locations throughout the Florida Keys and the Dry Tortugas identified only 17 super colonies (6 staghorn colonies and 9 elkhorn colonies). The same level of sampling has also identified 62 sexually mature colonies (32 staghorn colonies and 30 elkhorn colonies) and 61 non-sexually mature colonies (58 staghorn colonies and 3 elkhorn colonies). Smaller, but still sexually mature, colonies have designated as conservation priority 2, and non-sexually mature colonies have been designated conservation priority 3.

Alternative 1 (No Action) would have the least biological benefit to *Acropora*, and would perpetuate the existing level of risk of interaction between these species and the fishery. **Alternative 1** would not meet the requirement established under the biological opinion. **Alternative 2** would provide the greatest biological benefit to *Acropora* and other hardbottom/coral resources. This alternative would greatly minimize any risk of interaction between *Acropora* and spiny lobster traps in federal waters. Relative to **Alternative 2**, **Alternatives 3 and 4** would be less biologically beneficial to *Acropora* colonies located outside the closed areas. **Alternative 3 Options a-c** would reduce the risk of trap damage to *Acropora* by prohibiting the use of traps near areas of high *Acropora* density or near colonies with high conservation value. **Alternative 3 Option a** would likely provide the greatest biological benefit because it closes a larger area to trapping. **Alternative 3 Option b and c** would likely have decreasing biological benefits, respectively. As closed areas get smaller the potential for interactions between trap gear and corals increase. **Alternative 4** and the associated options

[8] Storm events were defined as sustained winds greater than 15 knots, last two days or more (Lewis et al. 2009).

would provide slightly more biological benefit to *Acropora* colonies than **Alternative 3** and the associated options because it would prohibit all fishing for spiny lobster in the proposed closed areas. **Alternatives 2, 3, and 4** would fulfill the requirements of the terms and conditions prescribed in the biological opinion. Figures 4.9.1.1 through 4.9.1.3c depict the locations of the proposed closed and existing areas from west to east. **Alternative 1** would perpetuate the existing level of risk for interactions between other ESA-listed species and the fishery. The impacts from **Alternatives 2-4** and their associated options on sea turtles and smalltooth sawfish are unclear. If these closed areas perpetuate the existing amount of fishing effort, but cause effort redistribution, any potential effort shift is unlikely to change the level of interaction between sea turtles and smalltooth sawfish and the fishery as a whole. If these alternatives reduce the overall amount of fishing effort in the fishery, the risk of interaction between sea turtles and smalltooth sawfish would likely decrease.

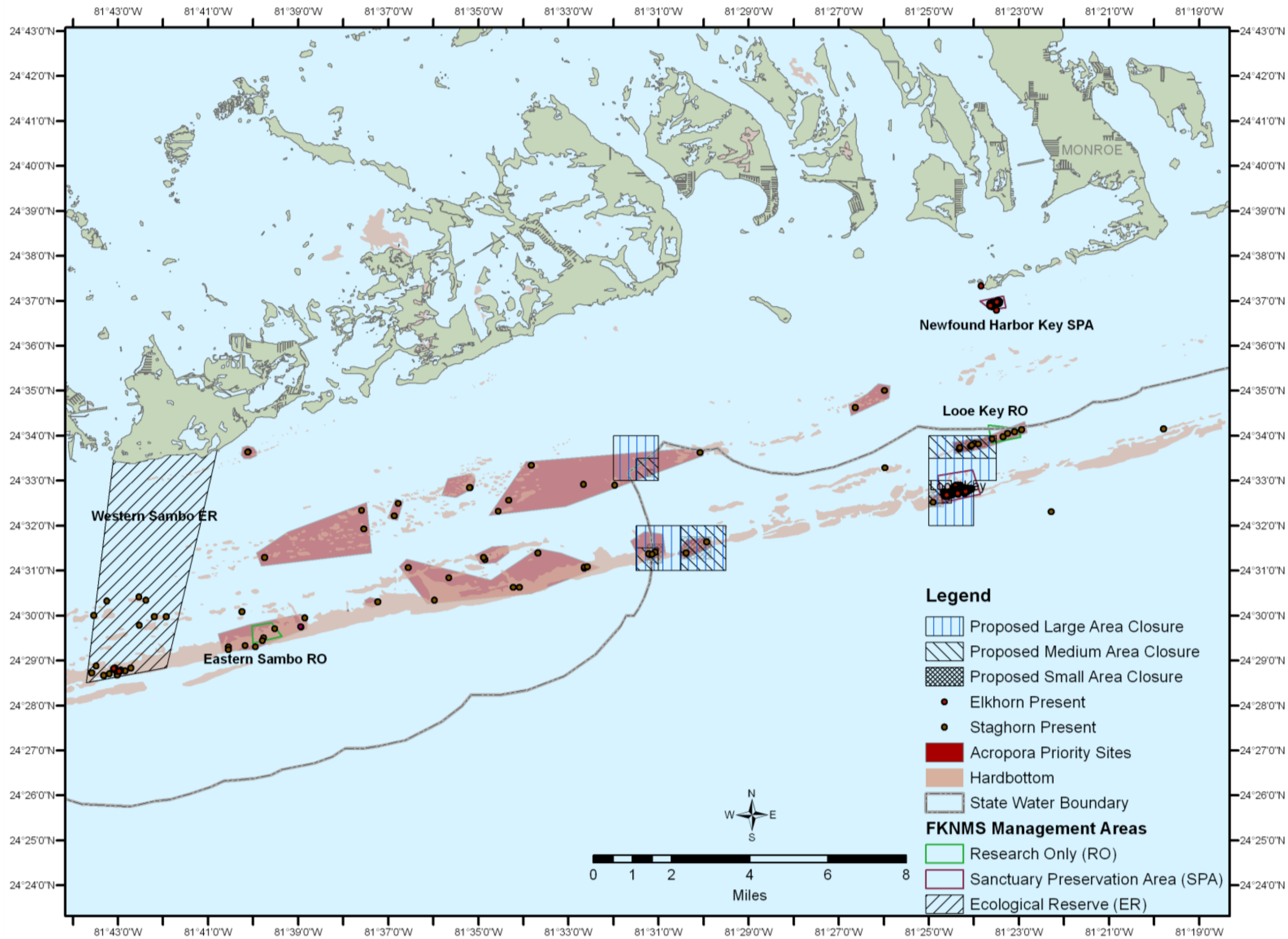

Figure 4.9.1.1. Proposed closed areas in the Lower Keys.

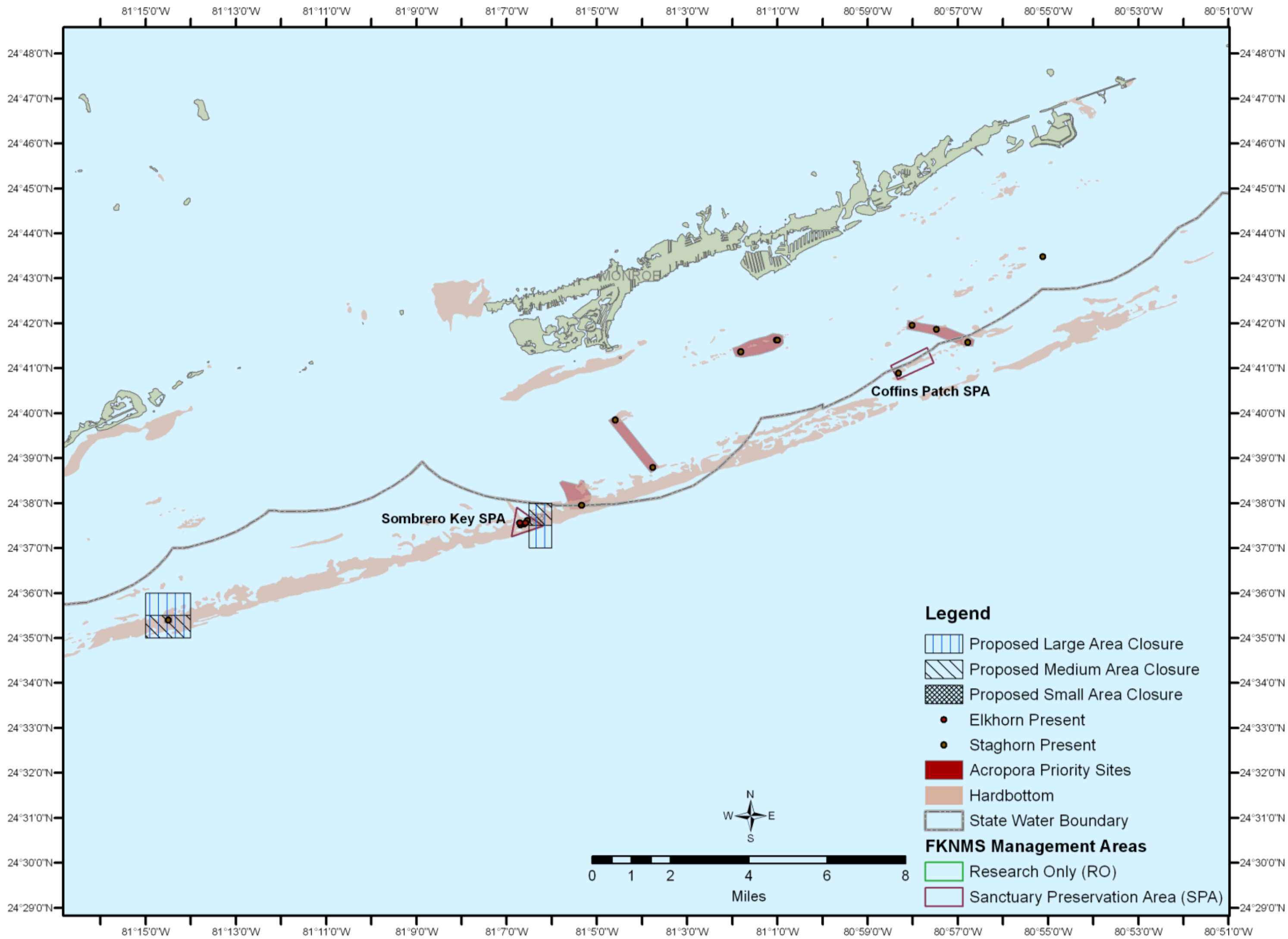

Figure 4.9.1.2. Proposed closed areas in the Middle Keys.

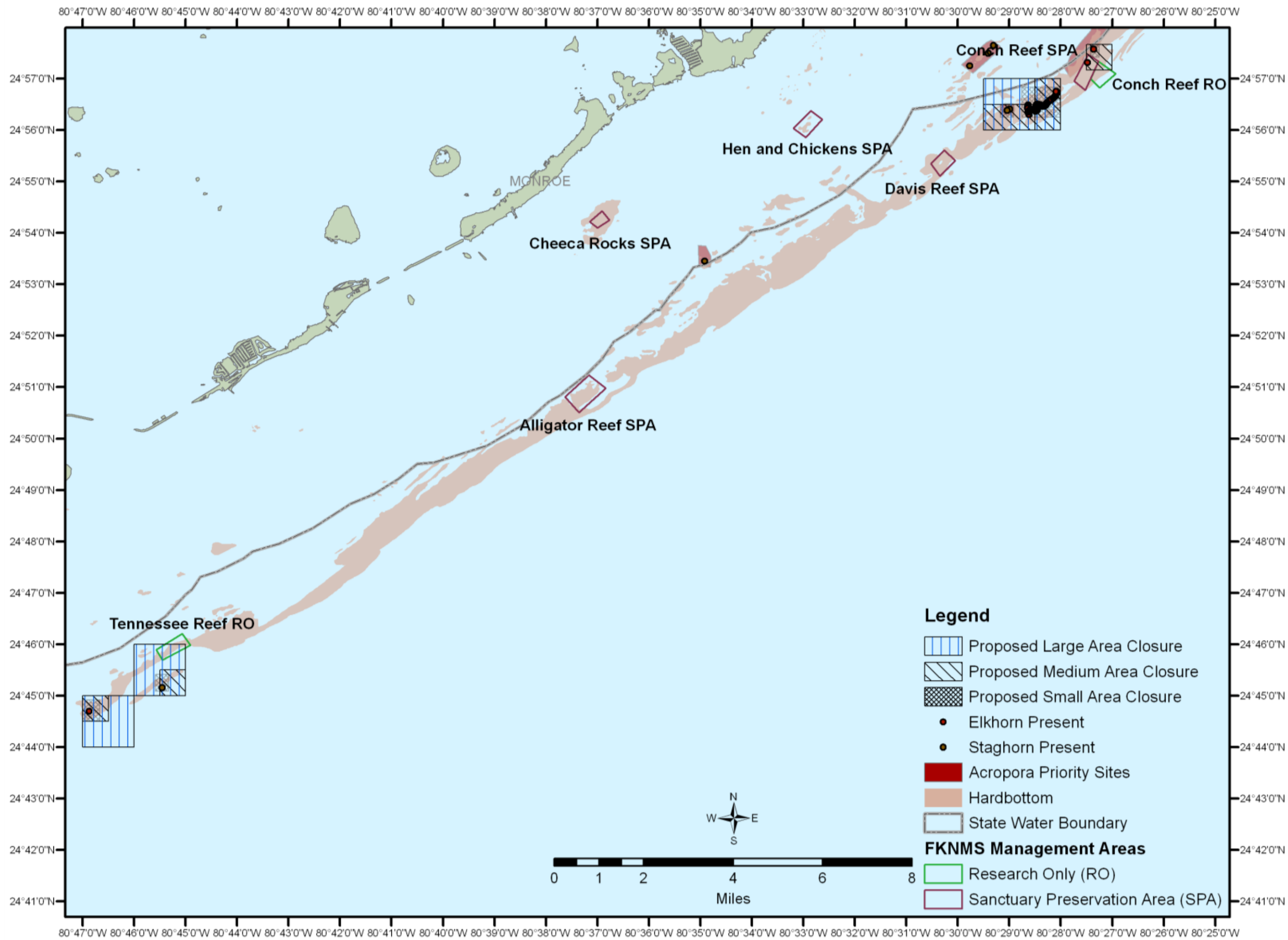

Figure 4.9.1.3a. Proposed closed areas in the Upper Keys.

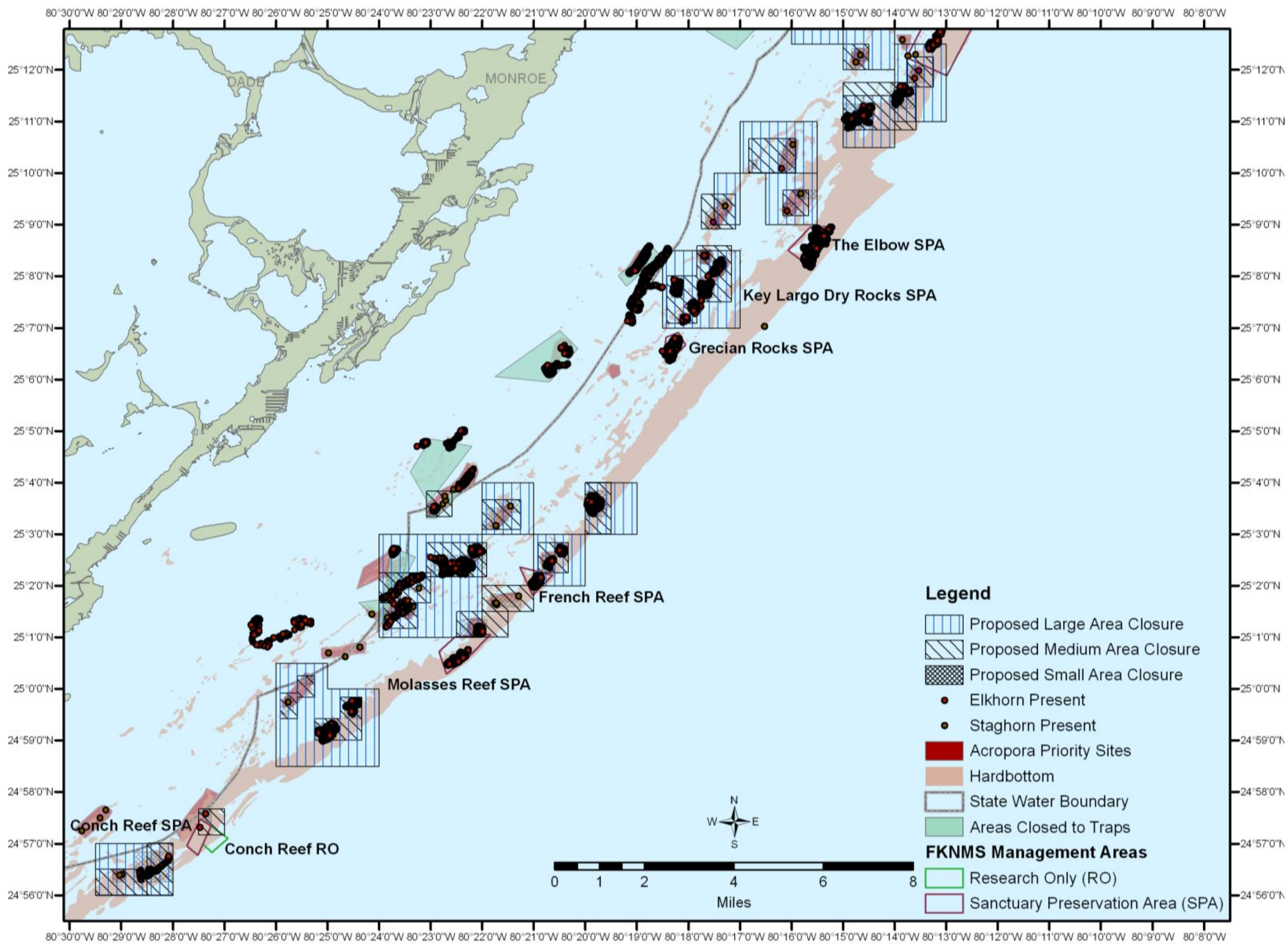

Figure 4.9.1.3b. Proposed closed areas in the Upper Keys con't.

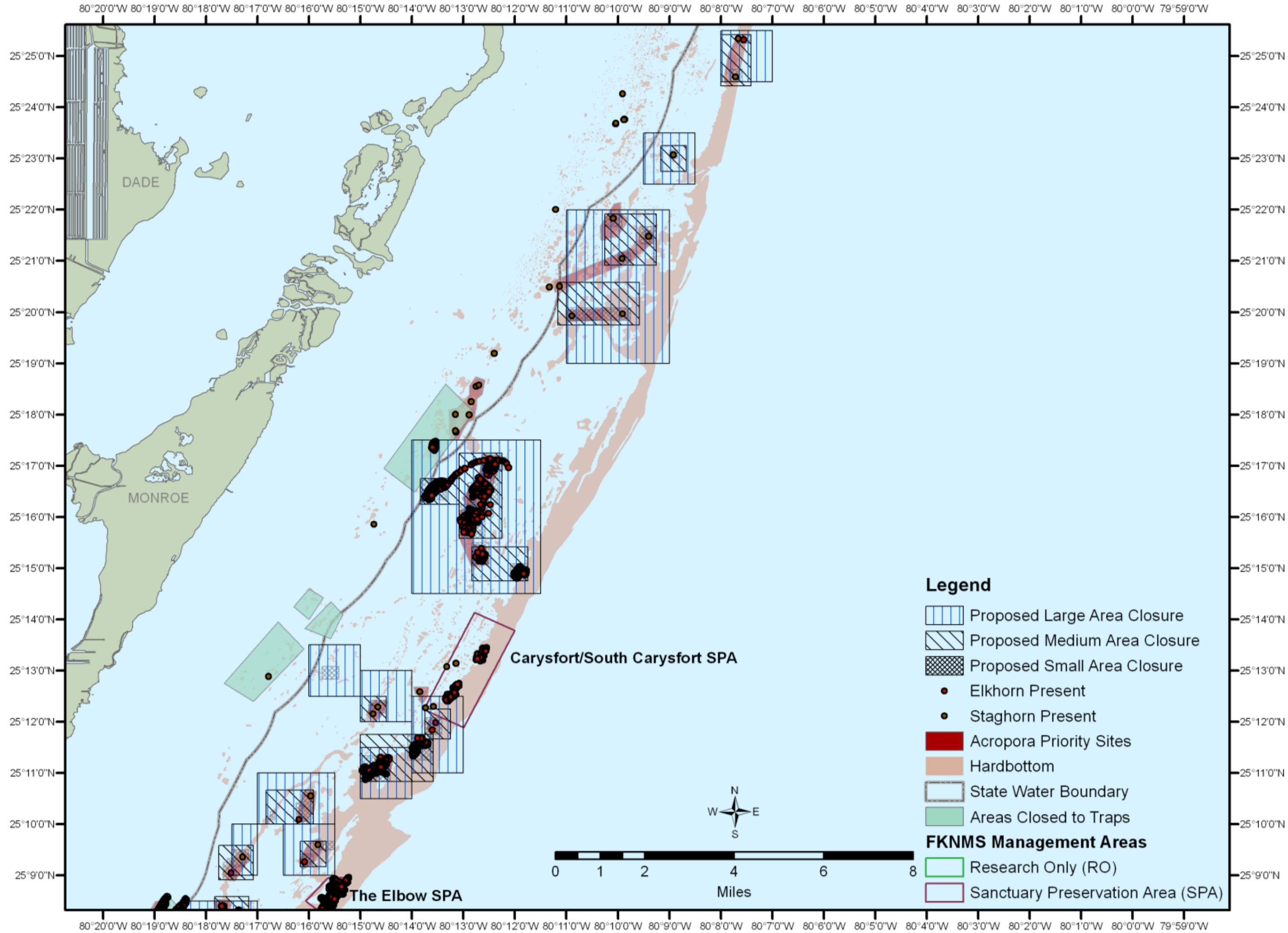

Figure 4.9.1.3c. Proposed closed areas in the Upper Keys con't.

4.9.2 Direct and Indirect Effect on the Economic Environment

As indicated in Sections 2.9 and 4.9.1, the biological opinion on the spiny lobster fishery requires the Councils to protect the indicated coral species by expanding existing closed areas or creating new areas. Section 2.9 succinctly depicts an existing set of alternatives. Section 2.9 also depicts a replacement set of alternatives recommended by the IPT and provides very detailed maps of the related proposed close areas in the Lower Keys, Middle Keys, and Upper Keys. Unfortunately in terms in terms assessing economic impacts, the extent of lobster fishing in these proposed closed does not appear to be known in part because they are relatively small when compared with the areas used in data on commercial available from NMFS, SEFSC. Ideally, choosing the alternatives and options with least economic impact on commercial and/or recreational fishing for Caribbean spiny lobster would be preferred. The biological impacts of alternatives and options are assessed in terms of the indicated coral species, not spiny lobster.

Murray (2005) suggests that fishermen could be a good source of the rather detailed information needed to assess the economic impact of alternatives under Action 9, as for the Dry Tortugas Ecological Reserve. Another study suggests that commercial fishermen operating in the Keys have long tenure, tend to be full-time operators and derive a high percentage of their personal income from commercial fishing, and have considerable investment in vessels and traps (Shivlani et al. 2004, p. 8). Murray (2005) used data from 88/89 and 04/05 surveys of commercial fishermen that could be used to assess the socioeconomic impacts of the Dry Tortugas Ecological Reserve. Both studies suggest similar economic characteristics of the fishermen and experience-based knowledge of the areas they fish.

It might be assumed that **Alternative 2** could have more economic impact on commercial fishing for Caribbean spiny lobster than **Alternatives 3 and 4**, but the validity of this assumption is unclear. **Alternatives 3 and 4** might expose commercial fishing to further regulation in the future if protection of the indicated coral does not meet expectations. The biological comparison of alternatives in Section 2.9 indicates that **Alternative 2** would be most beneficial protecting the indicated coral in that it covers more area, and it would close an as yet unspecified portion of the EEZ to trap fishing for waters less than 30 m deep. The large number of smaller areas under **Alternative 3** would be less beneficial in protecting the indicated coral in that traps are more likely to interact with the coral. **Alternative 4** differs from **Alternative 3** in that it covers all fishing for spiny lobster, but the economic difference may be small if the waters are sufficiently deep that the lobsters are accessible primarily with traps and not diving.

Compared with **Alternative 1** (status quo), it is estimated that **Alternative 2** would preclude virtually all of the trips in Federal (EEZ) waters in the Keys area, referring to trips with landings of spiny lobster (Table 4.9.2.1). This is an upper-end estimate because it assumes that all of the trips with this specification and reported depths of less than 30 fathoms (less than 180 feet) would not occur. These trips have relatively high average landings, and if they do not occur, the landings of Caribbean spiny lobster would be reduced by 0.519 mp compared with 3.67 mp for Florida and 3.28 mp for Monroe

County (Table 4.9.2.1). The total for trip gross revenue for all species landed would be reduced by $3.1 million in 2008$, 13% of the total for Florida and 15% of the total for Monroe County.

Table 4.9.2.1. Caribbean spiny lobster landings.

	Caribbean spiny lobster					Trip gross		
Area	Trips	Thousand pounds	Lbs / trip	Thousand 2008$	2008$ / trip	Thousand 2008$	%, Florida	%, Monroe
Florida	15,568	3,671	236	$22,227	$1,428	$23,533	100%	
Monroe	13,237	3,282	248	$20,724	$1,566	$20,724	88%	100%
Keys, Federal	1,187	519	437	$2,878	$2,424	$3,137	13%	15%

NMFS, SEFSC, FTT (19Mar10), data and methods as in Vondruska 2010a. **Alternative 1** (status quo) is represented by annual averages for fishing years 04/05 - 09/10. The trip averages are computed from unrounded data in this table and may differ from those in other tables where averages for columns (of annual data) are used. Depth in feet = 180 feet = (30 fathoms x 6 feet per fathom).

4.9.3 Direct and Indirect Effect on the Social Environment

Closure of fishing areas is always a controversial management strategy and can have numerous direct and indirect effects to the social environment. Yet, to meet the mandates of the biological opinion, closed areas may be the most viable solution. The proposed options for closed areas attest to the difficulty in balancing the impact to the fishery and impacts to the endangered species. **Alternative 1**, the no action alternative, would not meet the requirement in the biological opinion, so is not a viable option. The most restrictive, **Alternative 2** would prohibit traps on all hard bottom in the South Atlantic EEZ and likely have the most direct impacts on the social environment. **Alternatives 3 and 4** offer a broad array of options which provide less negative social impacts than **Alterative 2**, but may introduce other inefficiencies with regard to enforcement and compliance. Choosing smaller close areas may provide more flexibility for fishermen, but may make it more difficult to monitor and enforce compliance. Larger closed areas may enhance enforcement, but could have more negative social effects on fishermen as they find less area to fish which could reduce harvests. Closed areas to fish could also create crowding as fishermen move more traps into areas closer to where others are already placing traps.

4.9.4 Direct and Indirect Effect on the Administrative Environment

Alternative 1 would maintain the current closed areas and would not meet the requirements of the biological opinion. This lack of action may precipitate legal action under the ESA against NOAA Fisheries Service and the Councils. Thus this alternative could greatly increase the administrative burden. Any alternative that creates new closed areas will increase the administrative burden over the current level due to changes in maps, outreach and education of the public, and greater enforcement needs. **Alternative 2** would be the most inclusive and require enforcement over the largest area. **Alternatives 3 and 4** are similar except **Alternative 3** applies to trap fishing only, and **Alternative 4** applies to all lobster fishing. **Alternative 4** would be easier to enforce because any boat in a closed area with lobster on board would be in violation of regulations. **Option a** under each alternative would create large areas around *Acropora* colonies, **Option b** would create medium areas, and **Option c** would create small areas. Larger areas could incorporate multiple colonies and thereby reduce the actual number of closed areas. Thus, the expectation is **Option a** would result in fewer, larger closed areas; **Option c** would result in more, small areas; and **Option b** would be between the two. Therefore, **Option a** would create less administrative and enforcement burden than **Option b or c**.

4.9.5 Council Conclusions

Need to add

4.10 Action 10: Require Gear Markings so All Spiny Lobster Trap Lines in the EEZ off Florida are Identifiable

4.10.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

Lines are consistently found as marine debris and most frequently without buoys or traps still attached. These conditions make it extremely difficult to determine if line found in the environment, or entangling protected species, originated from the spiny lobster fishery. A lack of uniquely identifiable markings also makes monitoring incidental take by the fishery difficult. Trap line marking requirements would allow for greater accuracy in identifying fishery interactions with protected species, leading to more targeted measures to reduce the level and severity of those impacts.

Alternative 1 (No Action) would have no biological benefit for protected species and would not satisfy the line marking requirements of the biological opinion. **Alternative 2** would likely have slightly more biological benefit than **Alternative 3.** Requiring gear markings along the entire length of trap lines would minimize the likelihood that a portion of a spiny lobster trap line is recovered without an identifiable mark. **Alternative 3** would provide greater biological benefit than **Alternative 1** but the benefits would likely be less than **Alternative 2** for the reason described above. **Alternatives 2 and 3** would fulfill the requirements of the terms and conditions prescribed in the biological opinion. **Alternative 1** would have the least biological benefit to sea turtles and smalltooth sawfish and would perpetuate the existing level of risk for interactions between these species and the fishery. The trap marking requirements under **Alternatives 2 and 3** would provide indirect benefits to sea turtles and smalltooth sawfish. Trap marking requirements would provide better understanding of the frequency of interactions between these species and the fishery. By better understanding of which fisheries are interacting with sea turtles and smalltooth sawfish, ways to reduce those interactions can be developed.

4.10.2 Direct and Indirect Effect on the Economic Environment

The biological opinion requires that incidental take protected resources in the EEZ be monitored, Differences economic impact on commercial fishing for Caribbean spiny lobster among the alternatives for marking trap lines are not immediately apparent. All appear to have an August 2014 compliance date, and this would appear to allow enough for fishermen to purchase the required lines as part their ongoing repair and replacement work.

4.10.3 Direct and Indirect Effect on the Social Environment

Marking trap lines should not have significant effects on the social environment other than imposing some added costs to modify the gear. The no action **Alternative 1** would not meet requirements of the biological opinion and therefore is unlikely option. **Alternative 2 – 4** would require some type of marking on trap lines which are required in other fisheries and would resolve any future problems with identification of trap lines being associated with interactions with endangered species.

4.10.4 Direct and Indirect Effect on the Administrative Environment

Alternative 1 would maintain the current closed areas and would not meet the requirements of the biological opinion. This lack of action may precipitate legal action under the ESA against NOAA Fisheries Service and the Councils. Thus this alternative could greatly increase the administrative burden. **Alternatives 2-4** would increase the need for enforcement to check if trap lines are properly colored or marked. On the other hand, the ability to identify lines entangled with endangered species would reduce the difficulty in determining assignment of incidental take to a particular fishery by NOAA Fisheries Protected Resources Division. In general, none of the alternatives would be more or less burdensome than the other.

4.10.5 Council Conclusions

Need to add

4.11 Action 11: Allow the Public to Remove Trap Line, Buoys, or Otherwise make Unfishable, any Spiny Lobster Gear Found in the EEZ off Florida

4.11.1 Direct and Indirect Effect on the Physical and Biological/Ecological Environments

The biological opinion on the spiny lobster fishery requires the Councils explore allowing the public to remove derelict trap gear from the EEZ off Florida. Lost traps pose multiple threats to the environment and protected species. Lost traps can "ghost" fish for a year or more (FWC unpubl. data, Lewis et al. 2009). Trailing trap lines can become entangled in the reef, damaging corals and sponges (Chiappone et al. 2005). Marine mammals and ESA-listed sea turtles and marine fish can become entangled in trailing ropes (Guillroy et al. 2005, Seitz and Poulakis 2006; Lewis et al. 2009). Wooden traps eventually degrade after many months, but plastic trap throats and polystyrene buoys persist indefinitely in the marine environment. Seagrass meadows can be damaged when traps are lost or left for periods longer than six weeks (Uhrin et al. 2005). Thousands of lost and abandoned traps can have a significant effect on the reef environment and benthic habitats.

Alternative 1 (No Action) would have no biological benefit for protected species or benthic habitat and would perpetuate the existing level of risk for interactions between these protected species and lost trap gear. **Alternative 2** would likely have the greatest biological benefits. This alternative would allow for the complete removal of all derelict or abandoned traps for the longest period of time, potentially increasing the number of derelict or abandoned traps removed. **Alternative 3** would also allow for the complete removal of derelict or abandoned trap gear, but for a shorter period. As a result, the biological benefit of **Alternative 3** may be less than **Alternative 2**. **Alternatives 4 and 5** would likely have less biological benefit than **Alternatives 2 and 3**. Allowing the public to remove trap line, buoys, and throats, would help reduce the potential impacts from ghost fishing and entanglement. However, traps remaining in the environment still have the potential to cause damage to benthic habitat. **Alternative 4** would allow more time for the public to remove trap line, buoys, and throats from derelict or abandoned traps, potentially increasing the biological benefit. Compared to **Alternatives 2-4**, **Alternative 5** would likely have the least biological benefit. It is currently unclear what type of biological impact **Alternative 6** would have. If the delegation of authority to the Florida FWC leads to the removal of more derelicts traps and trap debris, the biological benefits from the alternative would likely be within the range anticipated from **Alternatives 2-5**. If **Alternative 6** ultimately results in no change or fewer derelict traps and trap debris being removed, then its biological benefit would likely be similar to the effect anticipated under **Alternative 1**. **Alternative 1** would perpetuate the existing level of risk for interactions between other ESA-listed species and derelict traps and trap debris. The impacts from **Alternatives 2-6** on sea turtles and smalltooth sawfish are unclear. If these alternative lead to the removal of more derelicts traps and trap debris they would likely benefit sea turtles and smalltooth sawfish. However, if the alternatives result in no change in the number of derelict traps or trap debris removed, then they would likely perpetuate the existing level of risk for interactions with sea turtles and smalltooth sawfish. If the alternatives actually lead to fewer derelict traps or trap debris to be removed, they could actually increase the likelihood of adverse impacts occurring to sea turtles and smalltooth

4.11.2 Direct and Indirect Effect on the Economic Environment

The IPT provided recommendations for changes in wording of the alternatives in Section 2.1l, and Section 4.11 documents current State of Florida regulations. It is indicated in Section 2.11 that biological opinion on the commercial fishery for spiny lobster requires the Councils to explore options to allow the public to remove derelict spiny lobster gear in the EEZ off Florida.

Fishermen's views about removal traps being legally fished someone other than themselves are discussed in Section 4.11.1. It is also indicated that high proportions of the licensed traps were lost during the 05/06 season because of hurricanes, far more than normally lost. Apparently only a small proportion the traps lost, 10%-20%, is ever recovered, meaning that the rest, 80%-90% become derelict. Retrieval of derelict by FWC employees and other government employees at times specified by the FWC.

Under Action 11, **Alternatives 2-5** would allow the public to remove derelict traps during different portions of the closed season for commercial fishing (following wording suggested by the IPT in Section 2.11). **Alternative 6** would delegate authority for removal the EEZ to the Florida FWC, as now occurs in waters under State jurisdiction.

Though none of these five alternatives would affect ongoing commercial fishing activity during the open season, fishermen's perception about any trap removal can impact their economic activity, wellbeing, and willingness to support regulations. Thus, **Alternative 6** may have the least economic impact. Federal and/or state outreach programs could change fishermen's perceptions over time, but change in attitudes may be a long time in coming and not as supportive as fishery managers may hope, as for the Florida Trap Certificate Program (Shivlani et al. 2004).

4.11.3 Direct and Indirect Effect on the Social Environment

Allowing the public to remove spiny lobster traps, lines or buoys could have indirect effects on the social environment. Trap fishermen are often very protective of their traps. Indeed, there are federal regulations involving the disturbance and molestation of traps while in season. Yet, the number of derelict traps does pose problems of both biological impacts and perception. Because they degrade the habitat and can continue to ghost fish, the removal of derelict traps can have positive social benefits. Fishermen are supportive of trap removal programs but are often suspect of having the general public involved. Trap molestation is always a concern for trap fishermen and if the public is provided with an opportunity to clear derelict traps during the closed season, there may be a perception that they may conclude that their duty extends to other times and areas. Yet, public involvement in trap cleanup can be very effective as it increases the number of individuals who can remove traps.

4.11.4 Direct and Indirect Effect on the Administrative Environment

Alternative 1 would have no impacts on the administrative environment. **Alternatives 2 and 3** would allow members of the public to remove derelict traps from the water. These alternatives may create enforcement problems because someone with a trap aboard their vessel may have been removing it from the water because they found it abandoned or because they were illegal fishing. **Alternatives 4 and 5** would only allow the public to disable traps and would not allow them to retain the traps on board; thus enforcement would be easier. **Alternatives 2 and 4** would allow removal or disabling of traps during the closed season for lobster. Enforcement would need to be vigilant during this time to ensure the public did not unintentionally remove other traps, such as stone crab traps, which may be legally fishing. **Alternatives 3 and 5** would allow removal or disabling of traps only when both lobster and stone crab seasons are closed. These alternatives would create a much lower burden on enforcement because all similar traps would be prohibited during this time and could be considered derelict if in the water. **Alternative 6** would allow the state of Florida to administer the clean-up of derelict traps in the EEZ off Florida. Florida currently has a program to remove abandoned traps in state waters. This alternative would have no impacts on the administrative environment for the federal government, but would increase the burden on the state government.

4.11.5 Council Conclusions

Need to add

4.12 Cumulative Effects Analysis

As directed by NEPA, federal agencies are mandated to assess not only the indirect and direct impacts, but the cumulative impacts as well. NEPA defines a cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 C.F.R. 1508.7). Cumulative effects can either be additive or synergistic. A synergistic effect is when the combined effects are greater than the sum of the individual effects.

This section uses an approach for assessing cumulative effects that is based upon guidance offered by the CEQ publication "Considering Cumulative Effects" (1997). The report outlines 11 items for consideration in drafting a CEA for a proposed action.

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.
2. Establish the geographic scope of the analysis.
3. Establish the timeframe for the analysis.
4. Identify the other actions affecting the resources, ecosystems, and human communities of concern.
5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stress.
6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.
7. Define a baseline condition for the resources, ecosystems, and human communities.
8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.
9. Determine the magnitude and significance of cumulative effects.
10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.
11. Monitor the cumulative effects of the selected alternative and adapt management.

The CEA for the biophysical environment will follow these 11 steps. Cumulative effects on the biophysical environment and the socio-economic environment will be analyzed separately.

4.13 Other Effects

4.13.1 Unavoidable Adverse Effects

Environmental impacts identified in Section 4 did not identify any adverse effects.

4.13.2 Relationship Between Short-Term Uses and Long-Term Productivity

Need to add

4.13.3 Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitments of agency resources proposed herein. The actions to set ACLs, AMs, and other management measures in the spiny lobster fishery are readily changeable by the Councils in the future. There may be some loss of immediate income (irretrievable in the context of an individual not being able to benefit from compounded value over time) to some sectors from the potential limitation of harvest due to accountability measures.

4.14 Any Other Disclosures

CEQ guidance on environmental consequences (40 CFR §1502.16) indicates the following elements should be considered for the scientific and analytic basis for comparisons of alternatives. These are:

a) Direct effects and their significance.
b) Indirect effects and their significance.
c) Possible conflicts between the proposed action and the objectives of federal, regional, state, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned.
d) The environmental effects of alternatives including the proposed action.
e) Energy requirements and conservation potential of various alternatives and mitigation measures.
f) Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.
g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.
h) Means to mitigate adverse environmental impacts.

5.0 FISHERY IMPACT ANALYSIS/SOCIAL IMPACT STATEMENT

Mandates to conduct Social Impact Assessments come from both the National Environmental Policy Act (NEPA) and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). NEPA requires federal agencies to consider the interactions of natural and human environments by using a "...systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences...in planning and decision-making" [NEPA section 102 (2) (a)]. Under the Council on Environmental Quality's (CEQ, 1986) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, a clarification of the terms "human environment" expanded the interpretation to include the relationship of people with their natural and physical environment (40 CFR 1508.14). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects which may be direct, indirect or cumulative (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994).

Recent amendments to the Magnuson-Stevens Act require Fishery Management Plans (FMPs) address the impacts of any management measures on the participants in the affected fishery and those participants in other fisheries that may be affected directly or indirectly through the inclusion of a fishery impact statement [Magnuson-Stevens Act section 303 (a) (9)]. Most recently, with the addition of National Standard 8, FMPs must now consider the impacts upon fishing communities to the extent practicable to assure their sustained participation and minimize adverse economic impacts upon those communities [Magnuson-Stevens Act section 301 (a) (8)]. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. With an increasing need for management action, the consequences of such changes need to be examined to minimize the negative impacts experienced by the populations concerned to the extent practicable.

5.1 Data Limitations and Methods

Social impacts are generally the consequences to human populations that follow from some type of public or private action. Those consequences may include alterations to "...the ways in which people live, work or play, relate to one another, organize to meet their needs and generally cope as members of a society..." (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994:1). In addition, included under this interpretation are cultural impacts that may involve changes in values and beliefs, which affect the way people identify themselves within their occupation, communities and society in general. Social impacts analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Therefore, it is important that as much information as possible concerning a fishery and its participants be gathered for an assessment.

It is important to identify any foreseeable adverse effects on the human environment. With quantitative data often lacking, qualitative data can be used to provide a rough estimate of some of the impacts based on the best available science. In addition, when there is a body of empirical findings available from the social science literature, it needs to be summarized and referenced in the analyses.

5.2 Summary of Social Impact Assessment

Need to add

6.0 RESPONSE TO COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

Will be added after the DEIS comment period.

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8.0 LIST OF AGENCIES, ORGANIZATIONS AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

Department of Commerce Office of General Counsel
Environmental Defense
Florida Fish and Wildlife Conservation Commission
Florida Keys Commercial Fishermen's Association
Monroe County Commercial Fishermen's Association
National Fisheries Institute
National Marine Fisheries Service Office of General Counsel
National Marine Fisheries Service Office of General Counsel Southeast Region
National Marine Fisheries Service Southeast Regional Office
National Marine Fisheries Service Southeast Fisheries Science Center
National Marine Fisheries Service Silver Spring Office
National Marine Fisheries Service Office of Law Enforcement
United States Coast Guard
United States Fish and Wildlife Services

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10.0 INDEX

Will be added prior to public hearings.

Appendix A. Alternatives Considered but Eliminated from Detailed Analyses

Action: Delegate management of the Spiny Lobster FMP to Florida FWC

Alternative 1: No Action – Continue the current state and federal management system

Alternative 2: Delegate all management to Florida FWC, except establishment of an annual catch limit (ACL)

Alternative 3: Delegate certain management criteria to Florida FWC, except establishment of an ACL

Management criteria to delegate include:

Options a: Numerical specification of ACL and breakdown into sector-specific ACLs based on the definitions later in document

Options b: Commercial quotas and recreational allocations based on the allocations specified later in this document

Options c: Size limits

Options d: Recreational bag limits

Options e: Commercial trip limits

Options f: Permit endorsements

Options g: Fishing seasons

Options h: Application of the accountability measures, including closing the fishery when a sector reaches its quota and/or allocation

Options i: Rules and regulations for traps, including gear marking, tagging, etc.

Options j: Data collection and reporting requirements

Options k: Closed areas

<u>Comparison of Alternatives</u>: The Fishery Management Plan for Spiny Lobster in the Gulf of Mexico and South Atlantic (Spiny Lobster FMP) has been jointly managed by the Gulf of Mexico and South Atlantic Fishery Management Councils (Councils) since 1982. In 1989, the Spiny Lobster FMP was amended to establish compatible regulations between the federal and state fisheries. Thereafter, the Florida Fish and Wildlife Conservation Commission (FWC) has taken the lead in Caribbean spiny lobster fishery management, with NOAA Fisheries Service establishing compatible regulations when applicable. The commercial fishery is currently managed with a trap limitation and permitting program, minimum size limits, closed fishing seasons, gear restrictions, and other prohibitions. The recreational fishery is currently managed with minimum size limits, bag limits, closed fishing seasons, gear restrictions, and other prohibitions (Table 2.1.1).

The joint jurisdiction of the two Councils extends from the North Carolina/Virginia border in the South Atlantic to the Texas/Mexico border in the Gulf of Mexico. A majority of the commercial and recreational landings for Caribbean spiny lobster occurs in the waters off Florida (Table 2.1.1). Caribbean spiny lobster are also found in waters off other states within the Councils' jurisdiction, but in these areas, low abundance results in low levels of harvest. For example in the Gulf of Mexico, Alabama reported no commercial landings of spiny lobster species (C. Denson, Alabama Marine Resources Division, Alabama Department of Conservation and Natural Resources, personal communication). There were no reported commercial landings for spiny lobster in

Mississippi, Louisiana, and Texas and no program currently in place to document recreational landings in any of the states but Florida (Source: http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html).

Off Georgia there were no commercial landings of Caribbean spiny lobster species from state or federal waters for the years 1999-2008 (J. Califf, Commercial Fisheries Statistics Coordinator, Coastal Resources Division, Georgia Department of Natural Resources, personal communication). Similarly, in the state waters off South Carolina there were no recorded landings of spiny lobster species. In federal waters off South Carolina, commercial landings by divers between 1991 and 2003 included 6 pounds landed one year, and between 2004 and 2008, 15 pounds was landed in one year (G. Steele, Biological Statistician, South Carolina Department of Natural Resources, personal communication).

In state waters off North Carolina, there were no recorded landings of Caribbean spiny lobster. However, in federal waters off North Carolina there were low landings for Caribbean spiny lobster in 2001, 2003, 2004, 2006, 2007, and 2008. The average landings were 100 pounds or less live whole animal weight by commercial divers. The ex-vessel value for Caribbean spiny lobster species during this time period (1999-2008) ranged from $50 to $3,500 (A. Bianchi, Trip Ticket Coordinator, North Carolina Division of Marine Fisheries, personal communication). In 1999, 2000, 2002, and 2005 commercial landings for those species were not recorded by the North Carolina Division of Marine Fisheries.

Because of the low landings from states other than Florida, the federal fishery is currently managed through regulations affecting the EEZ off states in three areas: the South Atlantic states not including Florida (North Carolina, South Carolina, and Georgia), the State of Florida, and the Gulf of Mexico states not including Florida (Texas, Louisiana, Mississippi, and Alabama). This division of regulations reflects differences in Caribbean spiny lobster abundance and fishing effort in these regions (Table 2.1.2).

Table 2.1.2. Average commercial landings of Caribbean spiny lobsters 1999-2008 for Gulf federal waters, South Atlantic federal waters, and state of Florida waters (both coasts). Average pounds landed are live whole animal weight.

Caribbean Spiny Lobster	Gulf federal	Atlantic federal	Florida state waters
Average Pounds	164,912	998,218	1,709,646
Average # Trips	413	2,976	8,903
Average $ Value	$828,149	$4,878,155	$8,827,990

Source: Florida FWC, Marine Fisheries Information System 2009.
Note: This data is based on the trip ticket program. There is only one space available for waters fished. Fishers could fish in both state and federal waters within one day, based on the season and other fishing behaviors. This table should be viewed with some caution, because there could be additional unaccounted variability, due to the way the data is recorded and analyzed.

Alternative 1, no action, would continue the current state and federal management system and set an ACL and accountability measures as determined in actions later in this amendment for Caribbean spiny lobster. If this alternative was selected as the preferred alternative, the National Standard 1 guideline would still need to be met in 2011. Alternative 2 or 3 would set an ACL and accountability measures (AMs), but delegate all or certain management measures, respectively. Delegation to Florida would require agreement from Florida FWC to accept the responsibility of Caribbean spiny lobster management. Alternative 2, would delegate all management of Caribbean spiny lobster to Florida FWC, but still set an ACL (see Action 4). If Alternative 2 was selected as a preferred alternative, Florida FWC could use various management criteria to maintain the ACL. This method of management is similar to what is occurring presently; Florida FWC has taken the lead in Caribbean spiny lobster fishery management, with NOAA Fisheries Service establishing compatible regulations when applicable through the Council's processes. One modification from the current management process in addition to setting an ACL is establishing AMs. If the ACL was exceeded Florida FWC would need to apply AMs, compatible in federal waters to account for these overages, under the National Standard 1 guidelines.

Alternative 3 would also set an ACL, but delegate certain management criteria to Florida FWC, such as size limits, bag limits, fishing seasons, and trip limits. This alternative could be become more complicated; if and when the ACL was exceeded NOAA Fisheries Service would need to implement the previously established AMs. If Florida FWC only has certain management criteria or vice versa, then the appropriate criteria for management may be split between the Councils and NOAA Fisheries Service and Florida FWC, making it more difficult to prevent the ACL from being exceeded or by initiating AMs, if and when they were exceeded. The public could also become confused, by management changes coming from NOAA Fisheries Service instead of Florida FWC and compatibility with these regulations. The benefit of delegating all or certain management criteria to Florida FWC is that the state can move faster than the federal system when and if, accountability measures need to be implemented. Alternatives 2 and 3 would still allow the Councils to maintain their joint Amendment 4 and 8 with the Caribbean Council (73 FR 1148). This newly implemented amendment prohibits importation of undersized Caribbean spiny lobsters into the U.S.

This action is primarily administrative and alternatives in this action are expected to have little impact on the biological or physical environments. Alternative 2 may be more streamlined than Alternative 3 or Alternative 1 simply due to all management criteria being delegated to Florida FWC. This may create more of an administrative burden for Florida FWC working jointly with NOAA Fisheries Service and the Councils, but be less burdensome to the public keeping up with regulatory changes. If Alternative 3 is selected as preferred, there may be more of an administrative burden for all parties involved, Florida FWC, NOAA Fisheries Service, and the Councils. In addition, by delegating only certain management criteria the process, meant to be streamlined, may become more burdensome for all parties involved. Further, members of the public following regulations for Caribbean spiny lobster may become confused if various management criteria are implemented from different agencies.

Action 1: Other species in the Spiny Lobster FMP

Alternative 2: Set ACLs and AMs for each species using historical landings
Option a: smoothtail spiny lobster, *Panulirus laevicauda*
Option b: spotted spiny lobster, *Panulirus guttatus*

Discussion: Alternative 2 would set ACLs and AMs for each species, which would be very difficult for smoothtail and spotted spiny lobster (Option a and b), because there are no historical landings available for these species. However, the other two species of slipper lobsters, Spanish and ridged (Option c and d) have commercial landings information, but are not targeted species. Positive biological and physical benefits are expected from setting ACLs and AMs; however, if no historical landings information is available, the rationale for setting biological determination criteria may have limited positive impacts on the physical or biological environment.

Action 2: Modify the current definitions of Maximum Sustainable Yield, Optimum Yield, Overfishing Threshold, and Overfished Threshold for Caribbean spiny lobster

2.3.4 Overfished Threshold

Alternative 2**:** Adopt the Gulf Council overfished threshold definition for the South Atlantic. The Gulf of Mexico definition: proxy for MSST of 15% transitional SPR, with the additional modification to static SPR.

Discussion: This action explores various alternatives for establishing biological reference points: MSY, OY, overfishing threshold, and overfished threshold. Currently the Gulf of Mexico and the South Atlantic Councils have different definitions for these biological reference points and the South Atlantic Council does not currently have an overfished threshold definition (GMFMC 1999; SAFMC 1998; SEDAR 8 2005).

Transitional SPR versus static SPR is used for the definitions of MSY, OY, overfishing, and overfished threshold by the Gulf Council. As the name suggests SPR ratio expresses spawning per recruit as a ratio in a fished condition, relative to the maximum theoretical amount of spawning per recruit that occurs when there is no fishing (Slipke and Maceina 2000; MRAG Americas 2001). Due to increased fishing effort reducing the potential reproductive output, the denominator in the spawning potential ratio is always greater than or equal to the numerator, so the resulting values will range between 0 and 1 (MRAG Americas 2001).

Generally, static SPR is more frequently used than transitional SPR. Static SPR requires minimal data inputs, whereas transitional SPR requires data from a full age-based stock assessment (Parkes 2001). Static SPR is calculated on a per-recruit basis assuming equilibrium conditions of recruitment and mortality throughout their life span. Transitional SPR is computed on a yearly basis and uses actual annual variation in population structure and mortality rates therefore it is considered a dynamic measure (MRAG Americas 2001; Slipke and Maceina 2001). The SEDAR 8 (2005) benchmark assessment terms of reference, suggest that static SPR was used is the assessment based on the South Atlantic Fishery Management Council's Spiny Lobster Amendment 6 (SAFMC 1998).

Alternative 2 under Action 2.3.4 would adopt the Gulf Council's current definition at 15% transitional SPR, with modification for consistency to static SPR. Again, static SPR is generally used when the stock is not overfished and stock assessments are not completed on an annual basis.

Action 3: Establish sector allocations for Caribbean spiny lobster in state and federal waters from North Carolina through Texas

Alternative 2: Allocate the spiny lobster ACL by the following sector and or gear allocations:

Option a: 75% to the commercial trap fishery, 4% to the commercial dive fishery, 1% to the commercial bully net fishery, and 20% to the recreational fishery

Alternative 3: Allocate the spiny lobster ACL by the following sector and or gear allocations:

Option a: 70% to the commercial trap fishery, 6% to the commercial dive fishery, 1% to the commercial bully net fishery, and 23% to the recreational fishery.

Alternative 4: Allocate the spiny lobster ACL by the following sector and or gear allocations:

Option a: 70% to the commercial trap fishery, 3% to the commercial dive fishery, 1% to the commercial bully net fishery, and 26% to the recreational fishery.

Alternative 5: Allocate the spiny lobster ACL by the following sector and or gear allocations:

Option a: 72% to the commercial trap fishery, 5% to the commercial dive fishery, 1% to the commercial bully net fishery, and 22% to the recreational fishery.

Alternative 6: Allocate the spiny lobster ACL by the following sector and or gear allocations:

Option a**:** 72% to the commercial trap fishery, 4% to the commercial dive fishery, 1% to the commercial bully net fishery, and 23% to the recreational fishery.

Discussion: The Florida Fish and Wildlife Conservation Commission (FWC) invited representatives of stakeholder groups participating in Florida's Lobster Fishery to serve as members of the Spiny Lobster Ad Hoc Advisory Board (Advisory Board). The Advisory Board was made up of five commercial trappers, three commercial divers, three recreational fishers, two wholesale dealers, two environmental groups, and one FWC representative on the board.

The Advisory Board was designed to bring together a group of stakeholder representatives from around the state who represent the diversity of the lobster fishery community and included commercial lobster trappers, commercial lobster divers, recreational lobster fishers, a special recreational license holder, wholesale lobster dealers, an environmental group, and a representative from the FWC. The goal was to provide constructive comments and guidance to the FWC in the form of proposed refinements to the management of Florida's spiny lobster fishery. Over a period of sixteen months the Advisory Board met approximately eight times for approximately two days each to focus on reviewing and discussing lobster fishery issues and proposals for refinements to Florida's spiny lobster fishery.

2.4.2 Set annual catch limits (ACLs) for Caribbean Spiny Lobster

Alternative 3: Set separate state and federal ACLs based on landings.
- Option a: sum of ACLs = ABC
- Option b: sum of ACLs = x% of ABC

Discussion: The Caribbean spiny lobster fishery occurs mainly off the state of Florida. Commercial landings data are available from 1984; starting in this year, commercial fishermen were required to sell their catch to licensed dealers who were required to submit trip tickets. Separate state and federal ACLs (Alternative 3) may be appropriate because a large amount of harvest is in state waters. However, distinguishing between landings from these areas is difficult. In addition, federal management would be limited to the portion of the fishery under federal authority. The sum of the state and federal ACLs could equal ABC (Option a) or be reduced from the ABC for management uncertainty (Option b).

2.4.3 Set Annual Catch Targets for Caribbean Spiny Lobster

Alternative 3: Set separate state and federal ACTs (If Action 4.2, Alternative 2 or 3 chosen).

Discussion: Separate federal/state ACTs (Alternative 3) would be appropriate if separate ACLs are set (Action 4.2, Alternative 3), or if a single ACL is set (Action 4.2, Alternative 2). However, the federal government does not have authority to manage harvest of Caribbean spiny lobster in state waters. Unless the states adopt the ACTs as quotas, and institute accountability measures, any ACT set by the Councils could be exceeded without consequence. In an extreme case, landings in state waters could exceed the ABC under these circumstances.

2.5 Action 5: Accountability Measures (AMS) by Sector

Alternative 2: Establish in-season AMs.
- Option b: Recreational
  - Sub-option i: quota closure
- Sub-option ii: reduce the bag limit when 75% of the recreational ACL or ACT is projected to be met.
- Option c: Recreational and commercial combined AM

Sub-option i: prohibit both recreational and commercial harvest when the commercial ACL or ACT, or combined ACL or ACT is projected to be met.

Sub-option ii: reduce the recreational and commercial bag/trip limits when 75% of the commercial ACL or ACT is projected to be met.

Discussion: Under Alternative 2, in-season AMs would be triggered in order to prevent the ACL from being exceeded. The efficacy of in-season AMs is largely reliant upon in-season monitoring of landings, which may be especially difficult for the recreational sector. The Marine Recreational Fishing Statistics Survey and the newly implemented Marine Recreational Information Program does not collect landings information on crustaceans. Therefore, in-season tracking of Caribbean spiny lobster landings in the recreational sector would be based on the Marine Recreational Fishing Statistics Survey program and state landings reports. An additional obstacle to tracking recreational harvest in-season is that there is a lag time between when the Caribbean spiny lobsters are landed and when those landings are reported in the landings database. This lag time means that projections of when the ACL is expected to be met would need to be employed. Landings projections are not always 100% accurate, thus using such estimates could lead to an in-season AM being triggered prematurely, or not soon enough causing an ACL overage.

2.8 Action 8: Modify Tailing Requirements for Caribbean Spiny Lobster for Vessels that Obtain a Tailing Permit

Alternative 4: Modify the requirements for obtaining a Tail-Separation Permit.

Discussion: Alternative 4 would modify the prerequisites needed for obtaining a Tail-Separation Permit in a way that would make them more restrictive and specific. The regulations could be modified in such a way that would address the issue of recreational fishermen obtaining Tail-Separation Permits, as well as the issue of some fishermen landing undersized lobster tailed and legal sized lobster whole. However, Alternative 4, unless the modification includes the complete removal of the Tail-Separation Permit, would not be as biologically beneficial as Alternative 2.

Appendix B. Regulatory Impact Review (RIR, economic impacts of preferred alternatives)

Appendix C. Regulatory Flexibility Analysis (RFA, economic impacts of proposed regulatory actions)

Appendix D. Bycatch Practicability Analysis

Appendix E. Other Applicable Laws

The Magnuson-Stevens Act (16 U.S.C. 1801 et seq.) provides the authority for U.S. fishery management. But fishery management decision-making is also affected by a number of other federal statutes designed to protect the biological and human components of U.S. fisheries, as well as the ecosystems within which those fisheries are conducted. Major laws affecting federal fishery management decision making are summarized below.

Administrative Procedures Act

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (APA) (5 U.S.C. Subchapter II), which establishes a “notice and comment” procedure to enable public participation in the rulemaking process. Under the APA, NOAA Fisheries is required to publish notification of proposed rules in the *Federal Register* and to solicit, consider and respond to public comment on those rules before they are finalized. The APA also establishes a 30-day wait period from the time a final rule is published until it takes effect.

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. 1451 et seq.) encourages state and federal cooperation in the development of plans that manage the use of natural coastal habitats, as well as the fish and wildlife those habitats support. When proposing an action determined to directly affect coastal resources managed under an approved coastal zone management program, NOAA Fisheries is required to provide the relevant state agency with a determination that the proposed action is consistent with the enforceable policies of the approved program to the maximum extent practicable at least 90 days before taking final action.

Information Quality Act

The Data Quality Act (DQA) (Public Law 106-443), which took effect October 1, 2002, requires the government for the first time to set standards for the quality of scientific information and statistics used and disseminated by federal agencies. Information includes any communication or representation of knowledge such as facts or data, in any medium or form, including textual, numerical, cartographic, narrative, or audiovisual forms (includes web dissemination, but not hyperlinks to information that others disseminate; does not include clearly stated opinions).

Specifically, the Act directs the Office of Management and Budget (OMB) to issue government wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies." Such guidelines have been issued, directing all federal agencies to create and issue agency-specific standards to 1) ensure Information Quality and develop a pre-dissemination review process; 2) establish administrative mechanisms allowing affected persons to seek and obtain correction of information; and 3) report periodically to OMB on the number and nature of complaints received.

Scientific information and data are key components of FMPs and amendments and the use of best available information is the second national standard under the Magnuson-Stevens Act. To be consistent with the Act, FMPs and amendments must be based on the best information available, properly reference all supporting materials and data, and should be reviewed by technically competent individuals. With respect to original data generated for FMPs and amendments, it is important to ensure that the data are collected according to documented procedures or in a manner that reflects standard practices accepted by the relevant scientific and technical communities. Data should also undergo quality control prior to being used by the agency.

Endangered Species Act

The Endangered Species Act (ESA) of 1973 (16 U.S.C. Section 1531 et seq.) requires that federal agencies use their authorities to conserve endangered and threatened species, and that they ensure actions they authorize, fund, or carry out are not likely to harm the continued existence of those species or the habitat designated to be critical to their survival and recovery. The ESA requires NOAA Fisheries, when proposing a fishery action that "may affect" critical habitat or endangered or threatened species, to consult with the appropriate administrative agency (itself for most marine species, the U.S. Fish and Wildlife Service for all remaining species) to determine the potential impacts of the proposed action. Consultations are concluded informally when proposed actions "may affect but are not likely to adversely affect" endangered or threatened species or designated critical habitat. Formal consultations, resulting in a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" endangered or threatened species or designated critical habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives.

On April 28, 1989, NOAA Fisheries Southeast Region (SERO) completed a formal consultation, including a Biological Opinion (Opinion), on the effects of commercial fishing activities in the Southeast Region on threatened and endangered species. The Opinion concluded that the Gulf of Mexico and South Atlantic spiny lobster fishery was likely to adversely affect, but not jeopardize the continued existence of ESA-listed sea turtles. Subsequent, informal consultations on the continued authorization of the fishery determined it was not likely to adversely affect ESA-listed species. The impacts of the Caribbean spiny lobster fishery on ESA-listed species were last evaluated in a formal consultation, concluded on May 19, 2005. The opinion concluded that Caribbean spiny lobster fishing was likely to adversely affect, but not jeopardize the continued existence of ESA-listed sea turtles.

As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary involvement or control over the action has been retained (or is authorized by law) and: 1) the amount or extent of the incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered; or 4) if a new species is listed or critical habitat designated that may be affected by the identified action.

Since the completion of the most recent formal consultations on these fisheries, two species of *Acropora* coral have been listed under the ESA, and may be affected by spiny lobster fishing. Additionally, new information is available revealing effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered. Accordingly, NOAA Fisheries Office of Sustainable Fisheries has requested initiation of a Section 7 consultation with the SERO's Protected Resources Division for this amendment. NOAA Fisheries anticipates completion of the consultations on the Gulf of Mexico/South Atlantic and Caribbean spiny lobster fisheries prior to Secretarial review and approval of the fishery plan amendments for the spiny lobster fisheries.

Rivers and Harbors Act of 1899

The Rivers and Harbors Act was created in 1899 to prevent navigable waters of the United States from being obstructed. Section 10 of the Act requires that anyone wishing to dredge, fill, or build a structure in any navigable water and associated wetlands obtain a permit from the ACOE. An activity affecting wetlands may require a Section 404 and Section 10 permit, thus both sections are often included together in a permit notice. When these activities are permitted, and there is direct loss of submerged habitat, such as seagrasses, then mitigation is often required to compensate for this loss.

Clean Water Act

In 1972, Congress passed the Clean Water Act (CWA) - also known as the Water Pollution Prevention and Control Act - to protect the quality of the nation's waterways including oceans, lakes, rivers and streams, aquifers, coastal areas, and aquatic resources. The law sets out broad rules for protecting the waters of the United States; Sections 404 and 401 apply directly to waters and aquatic resources protection.

Section 404 of the CWA (often referred to as "Section 404" or simply "404") forbids the unpermitted "discharge of dredge or fill material" into waters of the United States. Section 404 does not regulate every activity in aquatic resources or coastal areas, but requires anyone seeking to fill any area to first obtain a permit from the Army Corps of Engineers (ACOE). Constructing bridges, causeways, piers, port expansion, or any other construction or development activity along a waterway or in aquatic resources generally requires a 404 permit. When a fill project is permitted, there may be mitigation required to replace lost aquatic resources.

Section 401 of the Clean Water Act requires that an applicant for a Section 404 permit obtain a certificate from their state's environmental regulatory agency (if the state has delegated such authority to the agency) that the activity will not negatively impact water quality. This permit process is supposed to prevent the discharge of pollutants (pesticides, heavy metals, hydrocarbons) or sediments into waters, which may be above acceptable levels, because decreased water quality may endanger the health of the people, fish, and wildlife. However, acceptable pollutant levels have not been established for many aquatic resources, which make it difficult for state agencies to fully assess a project's impact on water quality.

National Marine Sanctuaries Act

Under the National Marine Sanctuaries Act (NMSA) (also known as Title III of the Marine Protection, Research and Sanctuaries Act of 1972), as amended, the Secretary of Commerce is authorized to designate National Marine Sanctuaries to protect distinctive natural and cultural resources whose protection and beneficial use requires comprehensive planning and management. The National Marine Sanctuaries are administered by NOAA's National Ocean Service. The Act provides authority for comprehensive and coordinated conservation and management of these marine areas. The National Marine Sanctuary System currently comprises 13 sanctuaries around the country, including sites in American Samoa and Hawaii. These sites include significant coral reef and kelp forest habitats, and breeding and feeding grounds of whales, sea lions, sharks, and sea turtles. A complete listing of the current sanctuaries and information about their location, size, characteristics, and affected fisheries can be found at http://www.sanctuaries.nos.noaa.gov/oms/oms.html.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act protects the quality of the aquatic environment needed for fish and wildlife resources. The Act requires consultation with the Fish and Wildlife Service (FWS) and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency (except TVA) under a Federal permit or license. NOAA Fisheries was brought into the process later, as these responsibilities were carried over, during the reorganization process that created NOAA. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources", and to ensure that the environmental value of a body of water or wetland is taken into account in the decision-making process during permit application reviews. Consultation is most often (but not exclusively) initiated when water resource agencies send the FWS or NOAA Fisheries a public notice of a Section 404 permit. FWS or NOAA Fisheries may file comments on the permit stating concerns about the negative impact the activity will have on the environment, and suggest measures to reduce the impact.

Executive Orders

E.O. 12114: Environmental Assessment of Actions Abroad

The purpose of this Executive Order is to enable responsible officials of Federal agencies having ultimate responsibility for authorizing and approving actions encompassed by this Order to be informed of pertinent environmental considerations and to take such considerations into account, with other pertinent considerations of national policy, in making decisions regarding such actions. While based on independent authority, this Order furthers the purpose of the National Environmental Policy Act and the Marine Protection Research and Sanctuaries Act and the Deepwater Port Act consistent with the foreign policy and national security policy of the United States, and represents the United

States government's exclusive and complete determination of the procedural and other actions to be taken by Federal agencies to further the purpose of the National Environmental Policy Act, with respect to the environment outside the United States, its territories and possessions.

Agencies in their procedures shall establish procedures by which their officers having ultimate responsibility for authority and approving actions in one of the following categories encompassed by this Order, take into consideration in making decisions concerning such actions, a document described in Section 2-4(a):
(a) major Federal actions significantly affecting the environment of the global commons outside the jurisdiction of any nation (e.g., the oceans or Antarctica);
(b) major Federal actions significantly affecting the environment of a foreign nation not participating with the United States and not otherwise involved in the action;
(c) major Federal actions significantly affecting the environment of a foreign nation which provide to that nation:

> (1) a product, or physical project producing a principal product or an emission or effluent, which is prohibited or strictly regulated by Federal law in the United States because its toxic effects on the environment create a serious public health risk; or
>
> (2) a physical project which in the United States is prohibited or strictly regulated by Federal law to protect the environment against radioactive substances.

(d) major Federal actions outside the United States, its territories and possessions which significantly affect natural or ecological resources of global importance designated for protection under this subsection by the President, or, in the case of such a resource protected by international agreement binding on the United States, by the Secretary of State. Recommendations to the President under this subsection shall be accompanied by the views of the Council on Environmental Quality and the Secretary of State.

The purpose of this amendment/EIS is to increase the spawning biomass of the spiny lobster population in the waters of the Caribbean and tropical western Atlantic (the oceans). It has been determined in section 6 there will be significant biological affects in a positive form; and as indicated numerous times throughout the document, the restrictions considered in this document were developed in accordance with a number of international agreements and accords passed by foreign nations.

E.O. 12866: Regulatory Planning and Review

Executive Order 12866: Regulatory Planning and Review, signed in 1993, requires federal agencies to assess the costs and benefits of their proposed regulations, including distributional impacts, and to select alternatives that maximize net benefits to society. To comply with E.O. 12866, NOAA Fisheries prepares a Regulatory Impact Review (RIR) for all fishery regulatory actions that either implement a new fishery management plan or significantly amend an existing plan. RIRs provide a comprehensive analysis of the costs and benefits to society associated with proposed regulatory actions, the problems and policy objectives prompting the regulatory proposals, and the major alternatives that could be used to solve the problems. The reviews also serve as the basis for the agency's determinations as to whether proposed regulations are a "significant regulatory action" under the criteria provided in E.O. 12866 and whether proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the RFA. A regulation is significant if it is likely to result in an annual effect on the economy of at least $100,000,000 or has other major economic effects.

E.O. 12630: Takings

The Executive Order on Government Actions and Interference with Constitutionally Protected Property Rights, which became effective March 18, 1988, requires that each federal agency prepare a Takings Implication Assessment for any of its administrative, regulatory, and legislative policies and actions that affect, or may affect, the use of any real or personal property. Clearance of a regulatory action must include a takings statement and, if appropriate, a Takings Implication Assessment. Management measures limiting fishing seasons, areas, quotas, fish size limits, and bag limits do not appear to have any taking implications. There is a takings implication if a fishing gear is prohibited, because fishermen who desire to leave a fishery might be unable to sell their investment, or if a fisherman is prohibited by federal action from exercising property rights granted by a state.

E.O. 13089: Coral Reef Protection

The Executive Order on Coral Reef Protection (June 11, 1998) requires federal agencies whose actions may affect U.S. coral reef ecosystems to identify those actions, utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and, to the extent permitted by law, ensure that actions they authorize, fund or carry out not degrade the condition of that ecosystem. By definition, a U.S. coral reef ecosystem means those species, habitats, and other national resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the United States (e.g., federal, state, territorial, or commonwealth waters).

E.O. 13112: Invasive Species

The Executive Order requires agencies to use authorities to prevent introduction of invasive species, respond to and control invasions in a cost effective and environmentally sound manner, and to provide for restoration of native species and habitat conditions in ecosystems that have been invaded. Further, agencies shall not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species in the U.S. or elsewhere unless a determination is made that the benefits of such actions clearly outweigh the potential harm; and that all feasible and prudent measures to minimize the risk of harm will be taken in conjunction with the actions. The actions undertaken in this amendment will not introduce, authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species in the U.S. or elsewhere.

E.O. 13132: Federalism

The Executive Order on federalism requires agencies in formulating and implementing policies that have federalism implications, to be guided by the fundamental federalism principles. The Order serves to guarantee the division of governmental responsibilities between the national government and the states that was intended by the framers of the

Constitution. Federalism is rooted in the belief that issues that are not national in scope or significance are most appropriately addressed by the level of government closest to the people. This Order is relevant to FMPs and amendment given the overlapping authorities of NOAA Fisheries, the states, and local authorities in managing coastal resources, including fisheries, and the need for a clear definition of responsibilities. It is important to recognize those components of the ecosystem over which fishery managers have no direct control and to develop strategies to address them in conjunction with appropriate state, tribes and local entities (international too). The proposed management measures in this Amendment to the Spiny Lobster FMPs of the Caribbean and the South Atlantic/Gulf of Mexico have been developed with the local, federal and international officials.

E.O. 13141: Environmental Review of Trade Agreements

This Executive Order requires the U.S. Trade Representative, through the interagency Trade Policy Staff to conduct environmental reviews of three of the most common agreements: comprehensive multilateral trade rounds, bilateral or multilateral free-trade agreements, and major new trade liberalization agreements in natural resource sectors. Although the procedures for environmental impact assessment in Executive Order 13141 are not subject to NEPA, they follow similar guidelines. Understanding the importance of this E.O. in relation to this Amendment/EIS, NOAA Fisheries Service has made a concerted effort to involve the USTR and other agencies involved with trade negotiations to inform them of the intention of the actions being undertaken by the Councils and NOAA Fisheries Service.

E.O. 13158: Marine Protected Areas

Executive Order 13158 (May 26, 2000) requires federal agencies to consider whether their proposed action(s) will affect any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural or cultural resource within the protected area.

E.O. 12898: Environmental Justice

This Executive Order mandates that each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. Federal agency responsibilities under this Executive Order include conducting their programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons from participation in, denying persons the benefit of, or subjecting persons to discrimination under, such, programs policies, and activities, because of their race, color, or national origin. Furthermore, each federal agency responsibility set forth under this Executive Order shall apply equally to Native American programs.

Specifically, federal agencies shall, to the maximum extent practicable; conduct human health and environmental research and analysis; collect human health and environmental data; collect, maintain and analyze information on the consumption patterns of those who principally rely on fish and/or wildlife for subsistence; allow for public participation and access to information relating to the incorporation of environmental justice principals in Federal agency programs or policies; and share information and eliminate unnecessary duplication of efforts through the use of existing data systems and cooperative agreements among Federal agencies and with State, local, and tribal governments. The proposed actions would be applied to all participants in the fishery, regardless of their race, color, national origin, or income level, and as a result are not considered discriminatory. Additionally, none of the proposed actions are expected to affect any existing subsistence consumption patterns. Therefore, no environmental justice issues are anticipated and no modifications to any proposed actions have been made to address environmental justice issues.

Marine Mammal Protection Act (MMPA)

The MMPA established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas. It also prohibits the importing of marine mammals and marine mammal products into the United States. Under the MMPA, the Secretary of Commerce (authority delegated to NOAA Fisheries) is responsible for the conservation and management of cetaceans and pinnipeds (other than walruses). The Secretary of the Interior is responsible for walruses, sea otters, polar bears, manatees, and dugongs.

In 1994, Congress amended the MMPA, to govern the taking of marine mammals incidental to commercial fishing operations. This amendment required the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction; development and implementation of take-reduction plans for stocks that may be reduced or are being maintained below their optimum sustainable population levels due to interactions with commercial fisheries; and studies of pinniped-fishery interactions. The MMPA requires a commercial fishery to be placed in one of three categories, based on the relative frequency of incidental serious injuries and mortalities of marine mammals. Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing; Category II designates fisheries with occasional serious injuries and mortalities; Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities. To legally fish in a Category I and/or II fishery, a fisherman must obtain a marine mammal authorization certificate by registering with the Marine Mammal Authorization Program (50 CFR 229.4) and accommodate an observer if requested (50 CFR 229.7(c)) and they must comply with any applicable take reduction plans.

The Caribbean spiny lobster trap/pot and Florida spiny lobster trap/pot fisheries are listed as part of a Category III fishery (72 FR 66048; November 27, 2007) because there has only been one documented interaction between these gears and marine mammals.

Paperwork Reduction Act
The Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501 et seq.) regulates the collection of public information by federal agencies to ensure that the public is not overburdened with information requests, that the federal government's information collection procedures are efficient, and that federal agencies adhere to appropriate rules governing the confidentiality of such information. The PRA requires NOAA Fisheries to obtain approval from the Office of Management and Budget before requesting most types of fishery information from the public. This action contains no PRA requirements.

Small Business Act
The Small Business Act of 1953, as amended, Section 8(a), 15 U.S.C. 634(b)(6), 636(j), 637(a) and (d); Public Laws 95-507 and 99-661, Section 1207; and Public Laws 100-656 and 101-37 are administered by the SBA. The objectives of the act are to foster business ownership by individuals who are both socially and economically disadvantaged; and to promote the competitive viability of such firms by providing business development assistance including, but not limited to, management and technical assistance, access to capital and other forms of financial assistance, business training and counseling, and access to sole source and limited competition federal contract opportunities, to help the firms to achieve competitive viability. Because most businesses associated with fishing are considered small businesses, NMFS, in implementing regulations, must make an assessment of how those regulations will affect small businesses. Implications to small businesses are discussed in the RIR herein (Section 7).

Magnuson-Stevens Act Essential Fish Habitat Provisions
The Magnuson-Stevens Act includes EFH requirements, and as such, each existing, and any new, FMPs must describe and identify EFH for the fishery, minimize to the extent practicable adverse effects on that EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of that EFH. The Council and NMFS have determined there are no adverse effects to EFH in this amendment as discussed in the Environmental Consequences section (Section 6).

Migratory Bird Treaty Act
Under the Migratory Bird Treaty Act (MBTA), it is unlawful to pursue, hunt, take, capture, kill, possess, trade, or transport any migratory bird, or any part, nest, or egg of a migratory bird, included in treaties between the United States and Great Britain, Mexico, Japan, or the former Union of Soviet Socialists Republics, except as permitted by regulations issued by the Department of the Interior (16 U.S.C. 703-712). Violations of the MBTA carry criminal penalties; any equipment and means of transportation used in activities in violation of the MBTA may be seized by the United States government and, upon conviction, must be forfeited to it. To date, the MBTA has been applied to the territory of the United States and coastal waters extending three miles from shore. Furthermore, Executive Order 13186 (see Section 9.5.9) was issued in 2001, which directs federal agencies, including NOAA Fisheries, to take certain actions to further implement the MBTA.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.) requires federal agencies to consider the environmental and social consequences of proposed major actions, as well as alternatives to those actions, and to provide this information for public consideration and comment before selecting a final course of action. Because NOAA Fisheries Service is proposing a major fishery action that may significantly affect the quality of the human environment, NOAA Fisheries Service has prepared this EIS to comply with NEPA and its implementing regulations.

Regulatory Flexibility Act

The purpose of the Regulatory Flexibility Act (RFA 1980, 5 U.S.C. 601 et seq.) is to ensure that federal agencies consider the economic impact of their regulatory proposals on small entities, analyze effective alternatives that minimize the economic impacts on small entities, and make their analyses available for public comment. The RFA does not seek preferential treatment for small entities, require agencies to adopt regulations that impose the least burden on small entities, or mandate exemptions for small entities. Rather, it requires agencies to examine public policy issues using an analytical process that identifies, among other things, barriers to small business competitiveness and seeks a level playing field for small entities, not an unfair advantage.

After an agency determines that the RFA applies, it must decide whether to conduct a full regulatory flexibility analysis (IRFA or Final Regulatory Flexibility Analysis) or to certify that the proposed rule will not "have a significant economic impact on a substantial number of small entities. In order to make this determination, the agency conducts a threshold analysis, which has the following 5 parts: 1) Description of small entities regulated by proposed action, which includes the SBA size standard(s), or those approved by the Office of Advocacy, for purposes of the analysis and size variations among these small entities; 2) Descriptions and estimates of the economic impacts of compliance requirements on the small entities, which include reporting and recordkeeping burdens and variations of impacts among size groupings of small entities; 3) Criteria used to determine if the economic impact is significant or not; 4) Criteria used to determine if the number of small entities that experience a significant economic impact is substantial or not; and 5) Descriptions of assumptions and uncertainties, including data used in the analysis. If the threshold analysis indicates that there will not be a significant economic impact on a substantial number of small entities, the agency can so certify.

Public Law 99-659: Vessel Safety

Public Law 99-659 amended the Magnuson-Stevens Act to require that a FMP or FMP amendment must consider, and may provide for, temporary adjustments (after consultation with the U.S. Coast Guard and persons utilizing the fishery) regarding access to a fishery for vessels that would be otherwise prevented from participating in the fishery because of safety concerns related to weather or to other ocean conditions.

Appendix F. Scoping Summary

SUMMARY MINUTES
PUBLIC HEARING – MARATHON, FL
SPINY LOBSTER AMENDMENT 10
JOINT AMENDMENT FOR THE GULF OF MEXICO AND SOUTH ATLANTIC FISHERY MANAGEMENT COUNCILS

September 22, 2009

Attendance:
Bob Gill, Gulf Council
Dr. Gregg Waugh, SAFMC
Dr. Carrie Simmons, Gulf Council Staff
Phyllis Miranda, Gulf Council Staff

36 Members of the Public

The public hearing was convened by Chairman Bob Gill at 6:00 p.m. Dr. Carrie Simmons reviewed the PowerPoint presentation with the public. The public was then invited to provide their comments.

Karl Lessard, Florida Keys Commercial Fishermen's Association. He read into the record from two written letters which had previously been provided to the Council at the June Council meeting and which are attached. In summary, these letters stated that they do not want the Councils to repeal the Spiny Lobster FMP, because it is felt that the state is not able to do a stock assessment alone. In addition, the size limit requirements on imports are crucial to maintain an economically viable fishery. The FKCFA is in support of the following allocation: 72% commercial trap fishery, 22% recreational divers, 5% commercial divers, and 1% bully net fishing. He requested that the Council set the ACL using a quota instead of using landing records. He added that they are mainly concerned about spiny lobster and the Council should do what they think is appropriate for the other lesser landed species in the FMP. He stated that mortality of short lobsters is estimated to be low, 8-10%; which is lower than fishing mortality on most other species.

Tim Daniels, Marathon, FL. He stated that the fishermen are scared that the catch limit on the lobster would be limited because of the data resulting from hurricanes and illegal fishing. The population has been reduced due to the hurricanes and this has caused them to not be able to catch as many lobsters. He stated that he would like to see the historical data to go back 20-30 years and that data be considered when setting an ACL. He felt that management of spiny lobster or stone crab should not be turned over to the state of Florida. He was in agreement with the previous allocation for Monroe County that Karl Lessard stated. He noted that the recreational diver mini-season is difficult to measure and control. He added that the use of shorts as an attractant is a necessary component of lobster fishing. He added that economic and social impact studies should be done on all the fisheries that are mandated under the MSA.

Hal Osburn, Florida Keys Commercial Fishermen's Association. He stated that sociological cultural information needs to be a focus of the studies and that ACLs and AMs should be based on the current stock assessment, not a future stock assessment as it is the best available data. He felt that the spiny lobster FMP should remain under the joint jurisdiction of the GMFMC, the SAFMC, and the FFWC. He added that the state cannot keep up with the requirements of managing the spiny lobster fishery and that the restriction on the importation of illegal size spiny lobster is very important and would not exist anymore under state management. He was of the opinion that all Caribbean spiny lobster landed should be landed either all whole or all tailed, and that having that regulation would prevent the abuse of having a short carapace but a long tail.

Gary Nichols, Nichols Seafood, Islamorada, FL and Organized Fishermen of Florida. He stated that lobster catch can historically be sustained to 6 million pounds. He would like to see an allocation that is closest to the 6 million pounds. He felt that the ACL should be based on the current stock assessment. He believed that the Councils should retain management of the spiny lobster. He stated that he is in favor of modifying the tailing permit to all tailed or all whole lobster landed. He added that the coral needs to be protected and that the coral working group and the Sanctuary were trying to identify more areas that needed to be closed to achieve that goal. He noted that he lobsters in deeper water and catches ridged slipper lobster, and he felt that whatever is appropriate to protect the spawning stock, such as egg bearing females, is important.

Jeff Cramer, Organized Fishermen of Florida. He stated that the current stock assessment should be used instead of using an updated assessment that may not reflect the true condition of the spiny lobster stock because of the hurricanes and other issues. He added that about a dozen fishermen in the coral workgroup were working with NOAA's Protected Species Division to identify areas that the corals are located. He said that the fishermen were willing to do anything to protect the corals and that the lobsters are not typically located near the corals. He felt that the Councils should maintain control over the FMP. He felt that the trip ticket system was flawed because on any given day he may fish in three areas, but only records one on the trip ticket. In general, he felt that fishing in federal waters was underreported and traps were moved between federal and state waters based on season and movement of the lobster. He stated that undersized lobsters imported from other countries were a big problem for local fishers. He indicated that he uses shorts as an attractant and that they were kept in good condition before going into the trap. He added that often the shorts escape the trap indicating that they could leave the trap at any time.

Richard Stiglitz, commercial fisherman, Monroe County, FL. He indicated that he has used shorts for 40 years. He stated that he takes care of the lobsters on his boat that he uses for shorts and that there is next to no short mortality on their boats. He felt that the ACLs need to be set high on the spiny lobster because a number set too low would be devastating to the Keys communities. He also stated that in the northern Gulf (Naples to

Tampa) is a population of large spawning females and it should always be protected. He did not think any fishers were currently targeting this area, but it should be protected. He was in agreement with other speakers, that federal management should stay involved.

<u>Additional attendees who chose not to speak on Spiny Lobster</u>:
Chris Johnson, charter boat captain, Marathon, FL
Christy Johnson, Seasquared Charters
John Bartus, Marathon Chamber of Commerce
Rick Turner, charter boat captain, Marathon, FL
Don Moll, charter boat captain
Michelle Owen, Environmental Defense Fund
David McKinney, Environmental Defense Fund
Elizabeth Prieto, Marathon, FL
Edwin Prieto, Marathon, FL
Barbara Maddox, Captain Pip's Marina & Hideaway, Marathon, FL
Leda Dunmire, Pew Environmental Group
Dawn Ward, University of Florida, Gainesville, FL
Toby Kight, Marathon, FL
John Harrison, Marathon, FL
Gigi Harrison, Marathon, FL
Donald Beechum, Marathon, FL
Paul Lebo, Marathon, FL
Gene Trag, Marathon, FL
Capt. Don Muller
Richard Turner, Marathon, FL

SUMMARY MINUTES
PUBLIC HEARING – KEY WEST, FL
SPINY LOBSTER AMENDMENT 10
JOINT AMENDMENT FOR THE GULF OF MEXICO AND SOUTH ATLANTIC FISHERY MANAGEMENT COUNCILS

September 21, 2009

Attendance:
Bob Gill, Gulf Council
Dr. Gregg Waugh, SAFMC
Dr. Carrie Simmons, Gulf Council Staff
Phyllis Miranda, Gulf Council Staff

43 Members of the Public

The public hearing was convened by Chairman Bob Gill at 6:00 p.m. Dr. Carrie Simmons reviewed the PowerPoint presentation with the public. The public was then invited to provide their comments.

John Coffin, Big Pine Key, FL. He read into the record a written statement, which is attached. In summary, he said the spiny lobster fishery should be left to Florida FWC. They are vested in dealing with allocation issues and knowledgeable of the history of the fishery as well as the diverse groups of people competing in the fishery. He listed several positive and negative reasons for the Florida FWC to take over management of the fishery. He noted that the federal management system would have a lot do deal with as far as allocation issues in the fishery if management was not given to Florida FWC.

Jim Sharpe, Jr., Big Pine Key, FL. He read into the record a written statement which is attached. In summary, he felt that Florida FWC should have full and unrestricted management of the spiny lobster fishery, because 95% of the lobster fishery occurs in state waters. He added that the state has been studying and managing the lobster fishery for years and should continue managing the fishery. He noted that the state had received money to study casitas to see if it can be used as a viable commercial gear in a portion of the commercial fishery. He indicated that the state is also studying new trap designs to decrease wind driven trap movement.

George Niles, Florida Keys Commercial Fishermen’s Association. He stated that he felt that the ACL for lobster should be set using the data from SEDAR. He added that the federal government should retain management of lobster, because the resources they had access to were of more value to the fishery than those that the state government had.

Bobby Pillar, Summerland Key, FL. He stated that he supported Mr. Niles’ position with regard to lobster being federally managed as opposed to state managed. He felt that something needed to be done about lobster being imported from other countries into the states before lobster season actually opens. He noted that in agreement with spiny lobsters being landed all tailed or all whole, the tailing permit could be modified.

Peter Bacle, Stock Island Lobster Co. He stated that neither state nor federal would do a good job of managing spiny lobster. He recommended no action on splitting the recreational and charterboat sectors. He felt that the ACL should be set for the fisheries in which there is an identifiable catch, i.e. the commercial industry. He added that there was no way to identify amounts of recreational catch. He was in agreement that short mortality was not a problem, because shorts really have lower mortality inside the traps because it is safer than outside the traps. He believes that the tailing permit should be kept, and that it was not an issue because his fish house handles very few tailed lobsters.

Lee Starling, commercial diver and spear fisherman, Key West, FL. He felt that the Gulf Council should retain management of spiny lobster. He stated that he was against the use of casitas, because he felt that they do impact migration patterns. He wanted to note that all types of fisheries have bycatch or potentially unintended consequences on other species, even divers. He felt that short lobsters used as attractants can get out of the traps and that mortality is not a problem.

<u>Additional attendees who chose not to speak on Spiny Lobster</u>:
Billy Wickers III, Big Coppit Key, FL
Capt. Bill Wickers, Key West Charter Boat Assoc.
Richard Gomez, Capt. Conch, Key West, FL
Robert Nevius, charter boat captain
Daniel Padron, Key West, FL
Craig Jiovani, C&J Ent. Co. Inc. d/b/a Charter Boat Grand Slam
Brice Barr, Double Down Sportfishing
Mimi Stafford, Key West, FL
Rob Harris, Conchy Joe's Marine & Tackle
Steven Lamp, Dream Catcher Charters
Gennifer Lamp, Key West, FL
Ron Meyers, Little Torch Key, FL
David McKinney, Environmental Defense Fund
Michelle Owen, Environmental Defense Fund
Kari MacLauchlin, University of Florida
Marlin Scott, Keys Radio Group
Chuck Coleman, Key West, FL
Josh Nicklaus, Key West, FL
Juan Blanco, Key West, FL

Appendix G. Public Hearing Summary

Appendix H. Maps showing known locations and conservation priorities of *Acropora* colonies in the Florida Keys

This appendix includes 17 charts; 1 index chart, and 16 additional charts. These maps provide two types of data on *Acropora* colonies. The first, *Acropora* conservation priorities, were developed using on colonial size and location data. The largest "super colonies" have been designated as conservation priority 1 because of their importance to sexual reproduction. Other smaller, but still sexually mature, colonies have designated as conservation priority 2, and non-sexually mature colonies have been designated conservation priority 3. The second dataset, *Acropora* presence, simply indicates where *Acropora* colonies were identified during sampling, and does not necessarily indicate the absence of *Acropora* elsewhere. Since no colonial size data were recorded at these sites, a conservation priority could not be assigned to these colonies. *Acropora* colonies, especially those occurring in high abundance, likely provide great conservation benefit to the species and should not be considered less important because they have not been assigned a conservation priority. In all likelihood, these areas provide significant conservation benefits and should be viewed as areas requiring special attention and protection.

All data have been transposed on top of NOAA nautical charts 11463, 11464, 11449, 11453, 11445, 11446, 11439, and 11438; here, the charts are arranged east to west (Upper Keys to the Dry Tortugas). To ease the use and transmission of these charts during the development of the amendment, the bathymetric data has been removed. To enhance viewing of data points, each chart has been subdivided into four quadrants (NE, SE, NW, and SW) and the depth contours have been removed. Since *Acropora* are only known to occur on hardbottom habitat and south of U.S. Highway 1, only the quadrants with hardbottom habitat and/or *Acropora* presence data are included here. Some overlap exists between charts and the orientation of north may be different on each chart. These maps are being used as reference to address requirements in the biological opinion to create new or expand existing closed areas to protect *Acropora* corals from spiny lobster fishing.

Included on each chart are the identified locations of *Acropora* from 1996-2009; *Acropora* conservation priorities; the 30-meter bathymetric contour; the boundary between state and federal waters; known areas of hardbottom habitat; any areas currently closed to trapping for spiny lobster; and any existing Florida Keys National Marine Sanctuary (FKNMS) Management Areas. "*Acropora* Priority Sites" also appear on these maps. These areas represent locations requiring high priority response from individuals responding to an environmentally damaging event, such as an oil spill because of the nature of the natural resources occurring there. These priority sites are included here only for reference and do not have any regulatory impact of fishing. *Acropora* are not found in waters deeper than 30 meter; the 30-meter depth contour has been included to identify the deepest extent at which *Acropora* is expected to occur. The charts also show hardbottom areas that may support *Acropora*, even if the presence of *Acropora* has not been confirmed there. *Acropora* is not anticipated in non-hardbottom habitat.

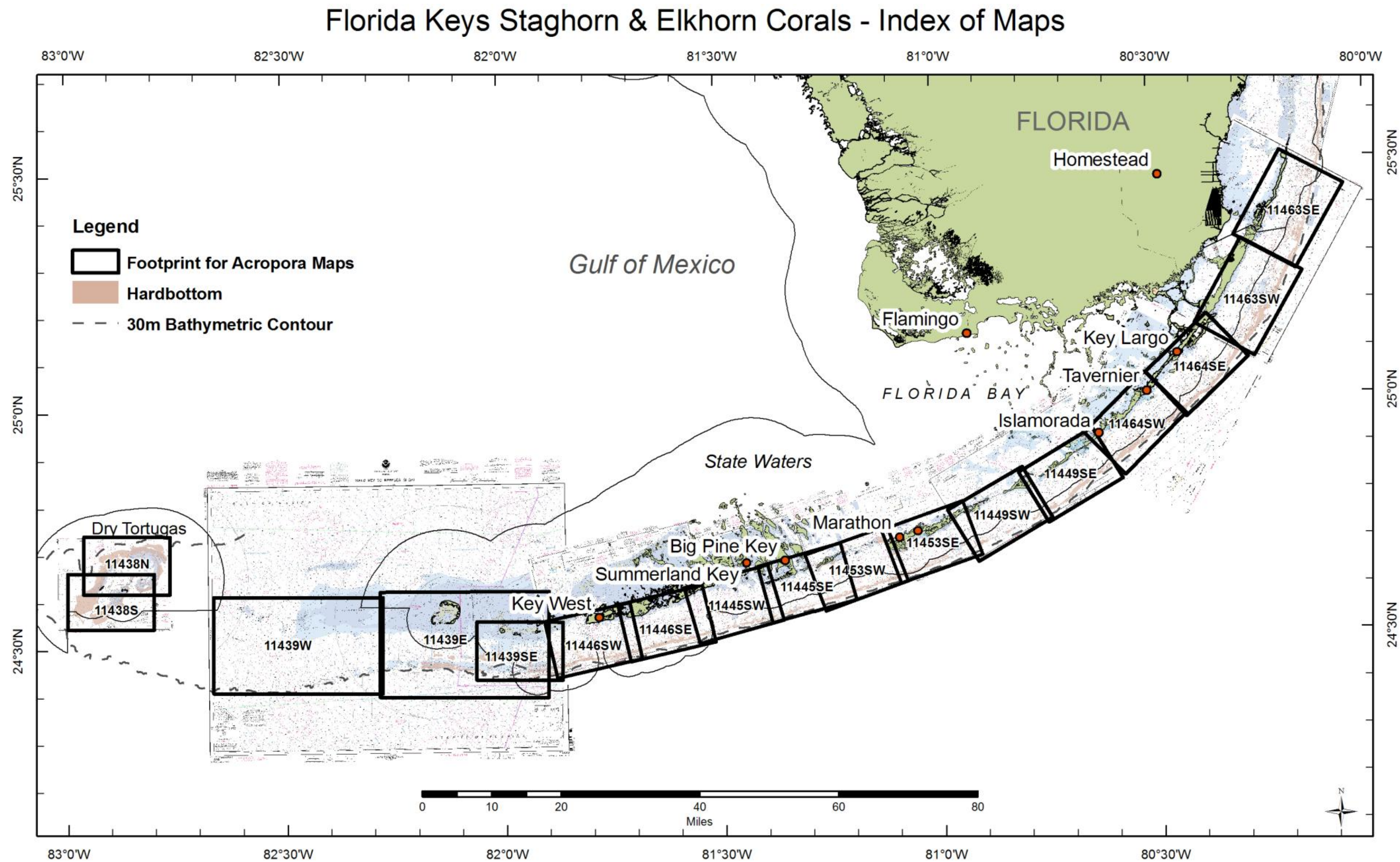


Figure 1 Index of maps showing known *Acropora* colony locations and conservation priorities in the Florida Keys

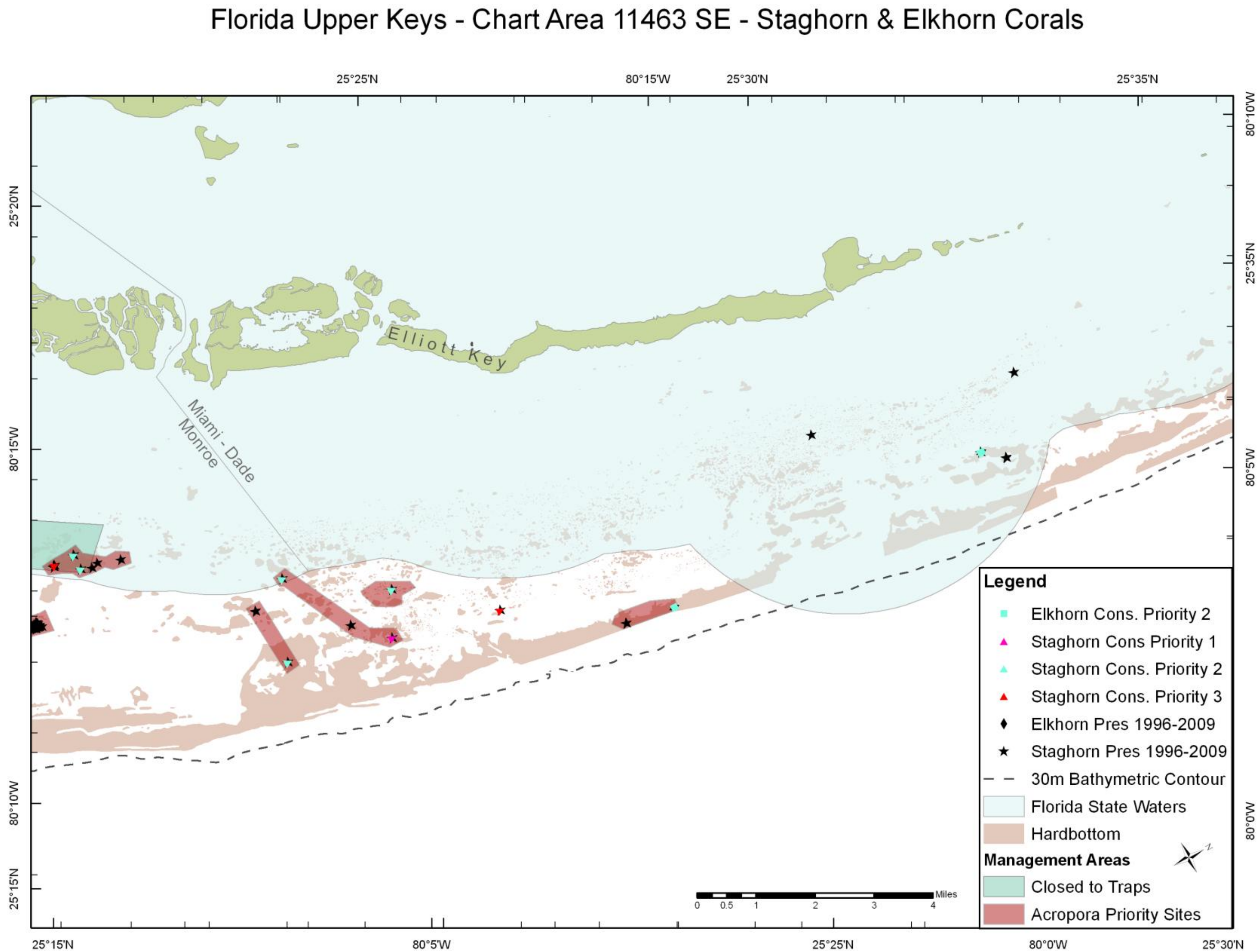


Figure 2 Map of known *Acropora* colony locations and conservation priorities in the Upper Florida Keys

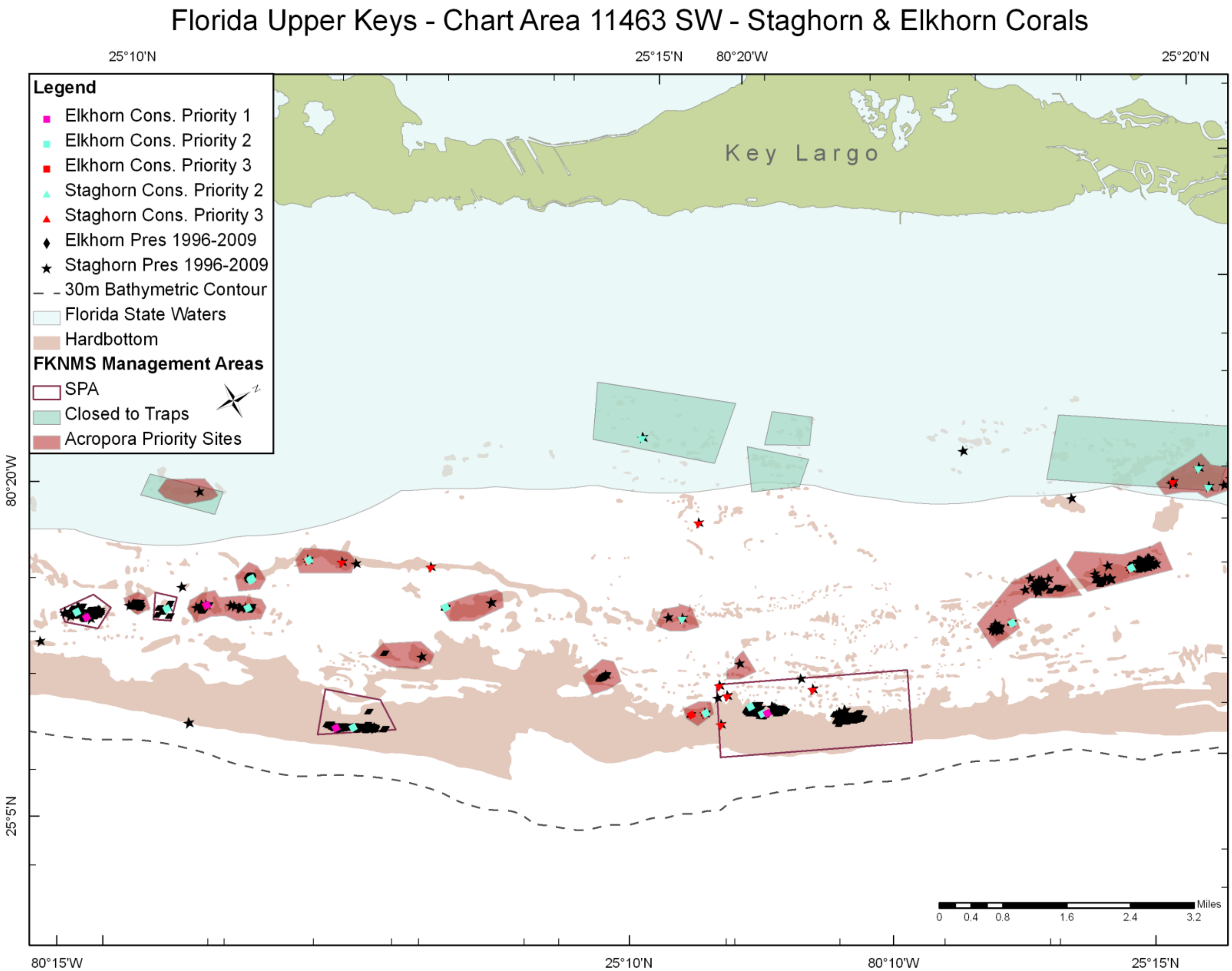


Figure 3 Map of known *Acropora* colony locations and conservation priorities in the Upper Florida Keys (cont'd)

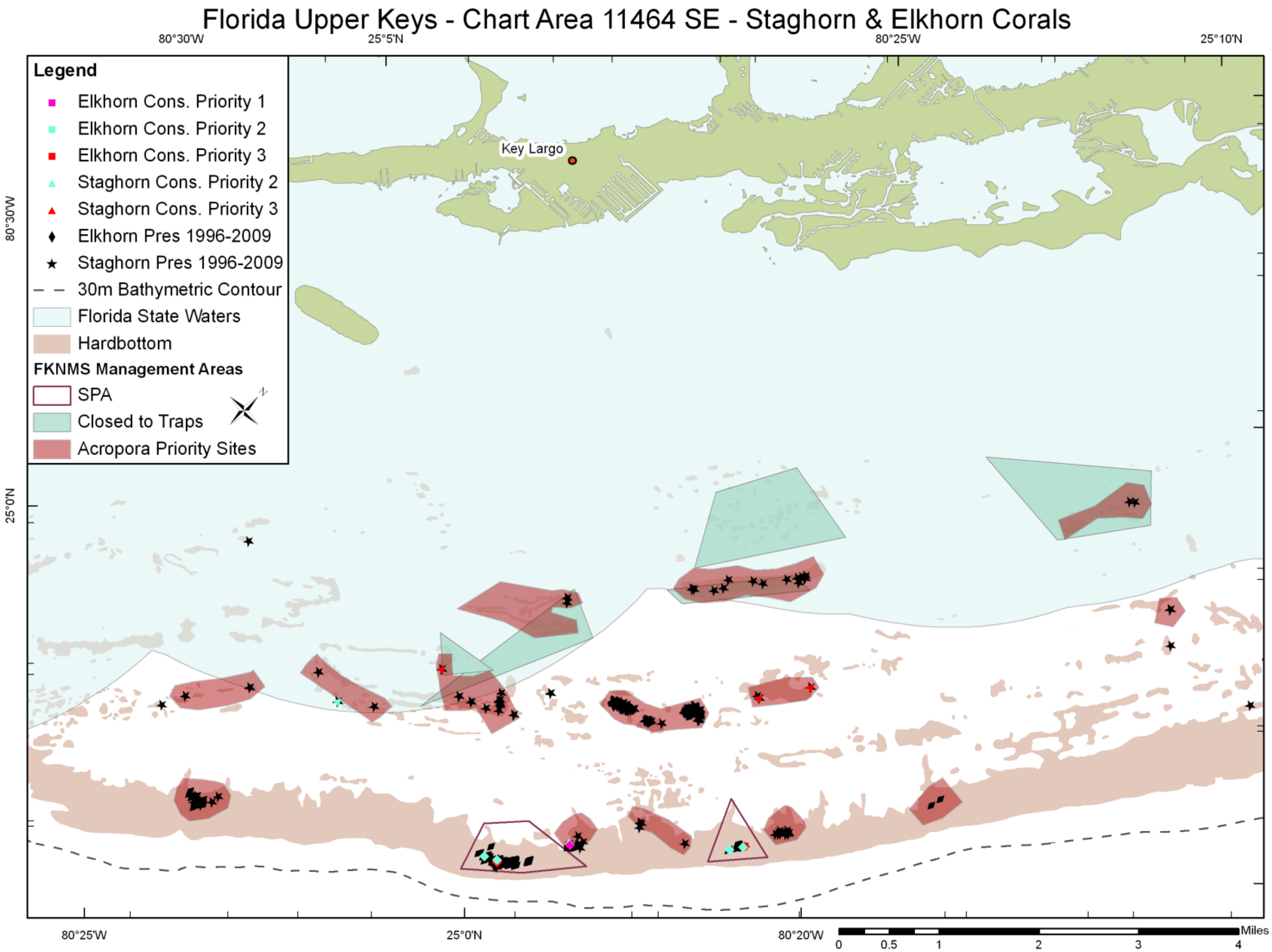


Figure 4 Map of known *Acropora* colony locations and conservation priorities in the Upper Florida Keys (cont'd)

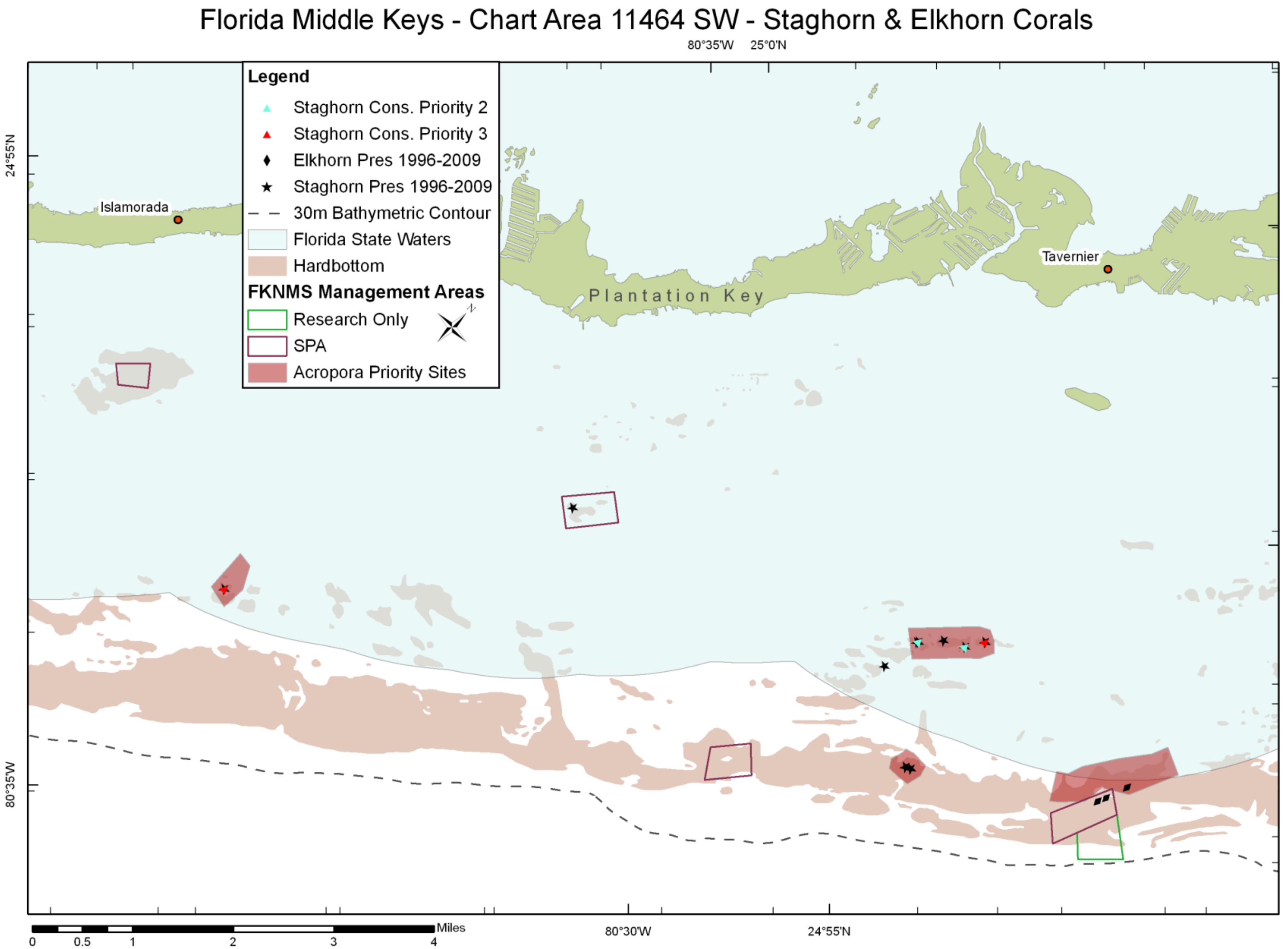


Figure 5 Map of known *Acropora* colony locations and conservation priorities in the Middle Florida Keys

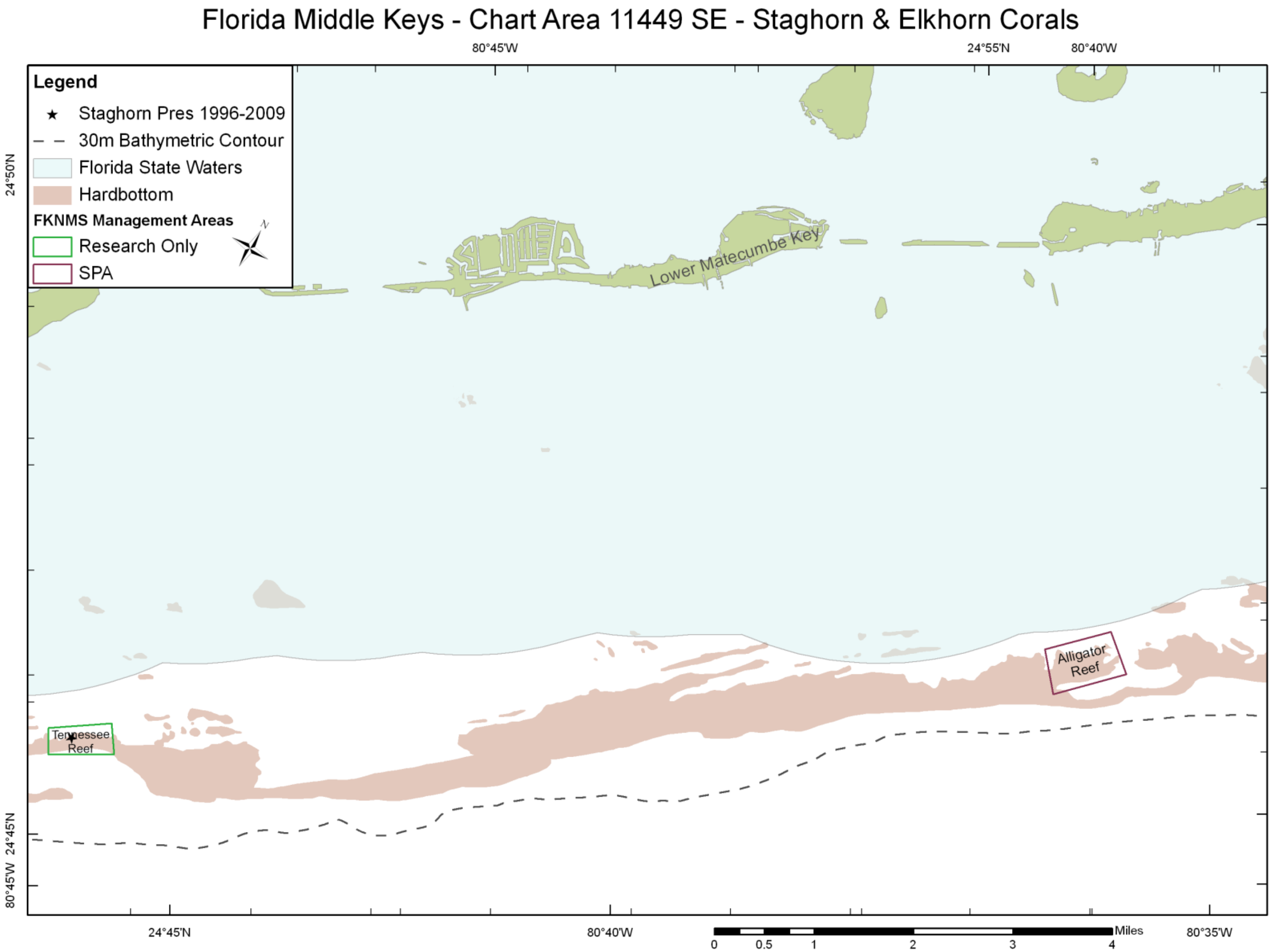


Figure 6 Map of known *Acropora* colony locations and conservation priorities in the Middle Florida Keys (cont'd)

Florida Middle Keys - Chart Area11449 SW - Staghorn & Elkhorn Corals

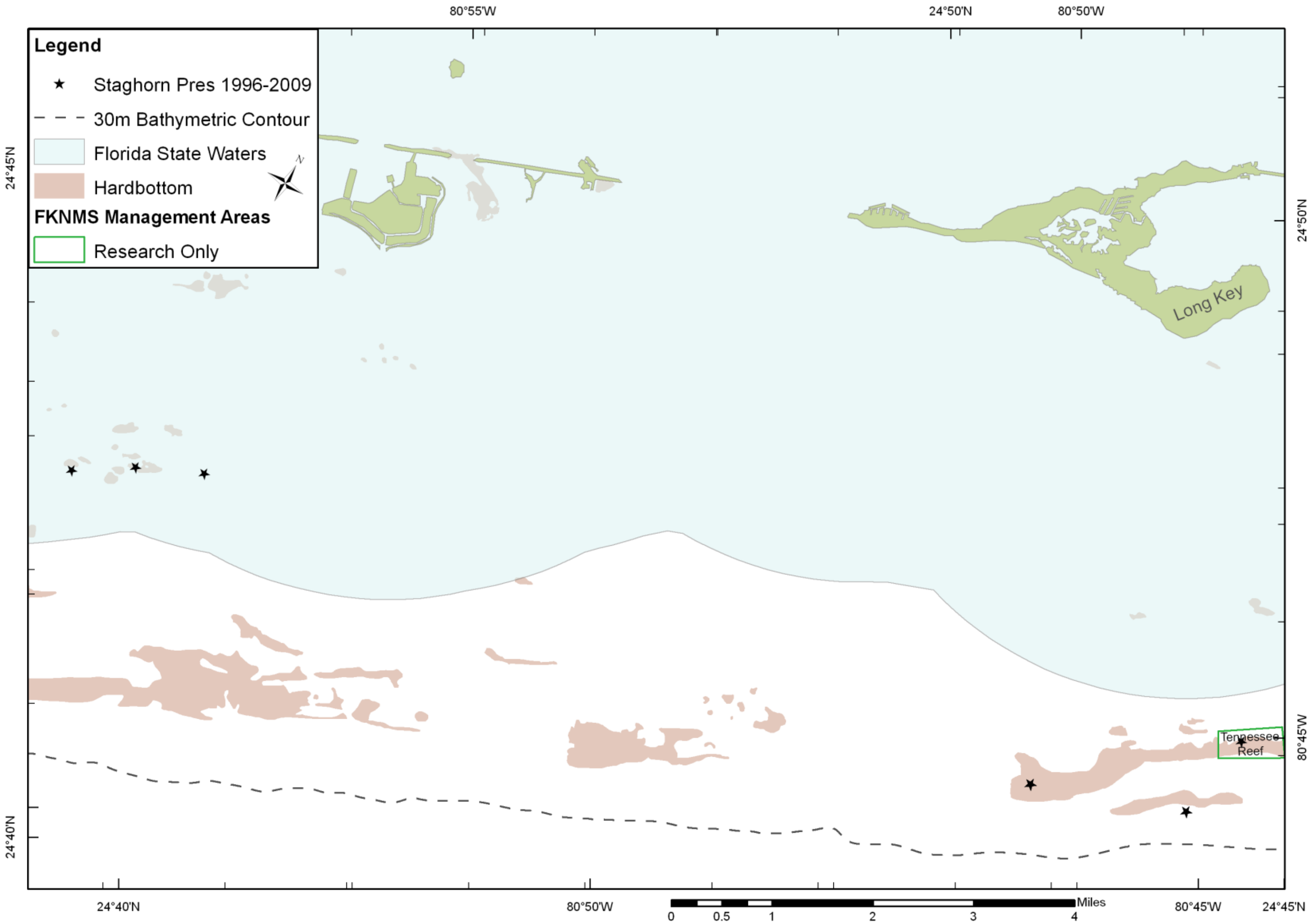


Figure 7 Map of known *Acropora* colony locations and conservation priorities in the Middle Florida Keys (cont'd)

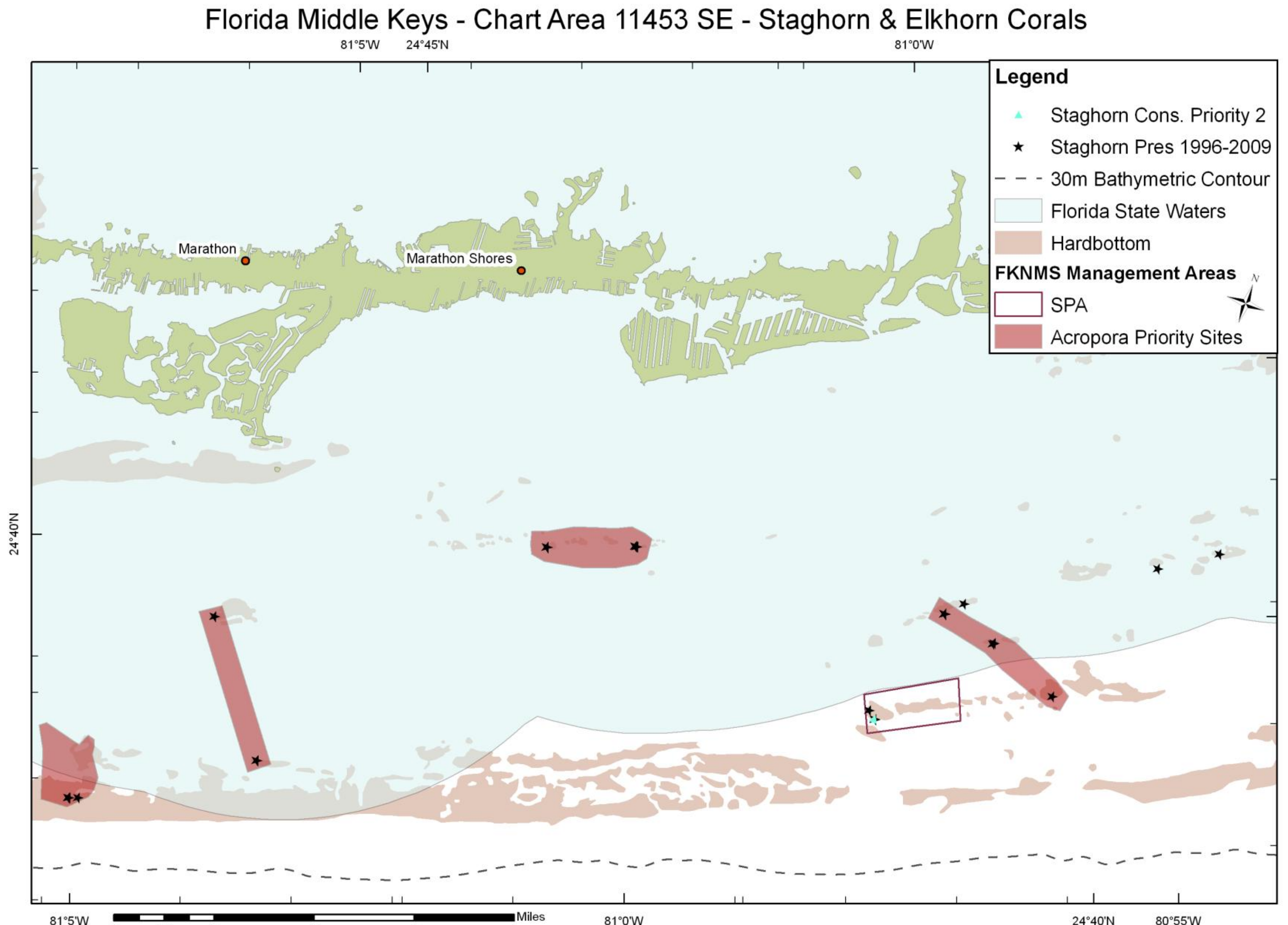


Figure 8 Map of known *Acropora* colony locations and conservation priorities in the Middle Florida Keys (cont'd)

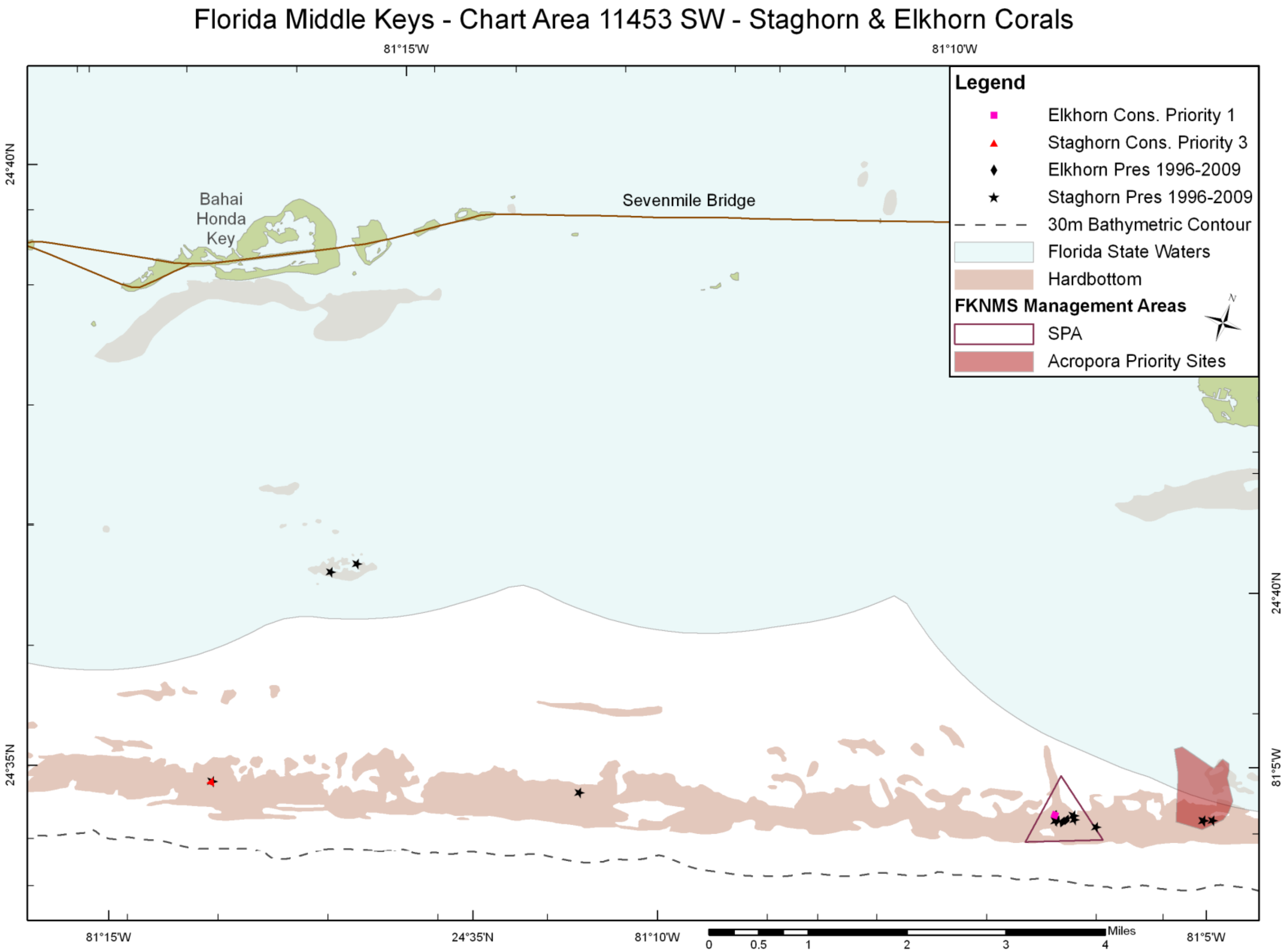


Figure 9 Map of known *Acropora* colony locations and conservation priorities in the Middle Florida Keys (cont'd)

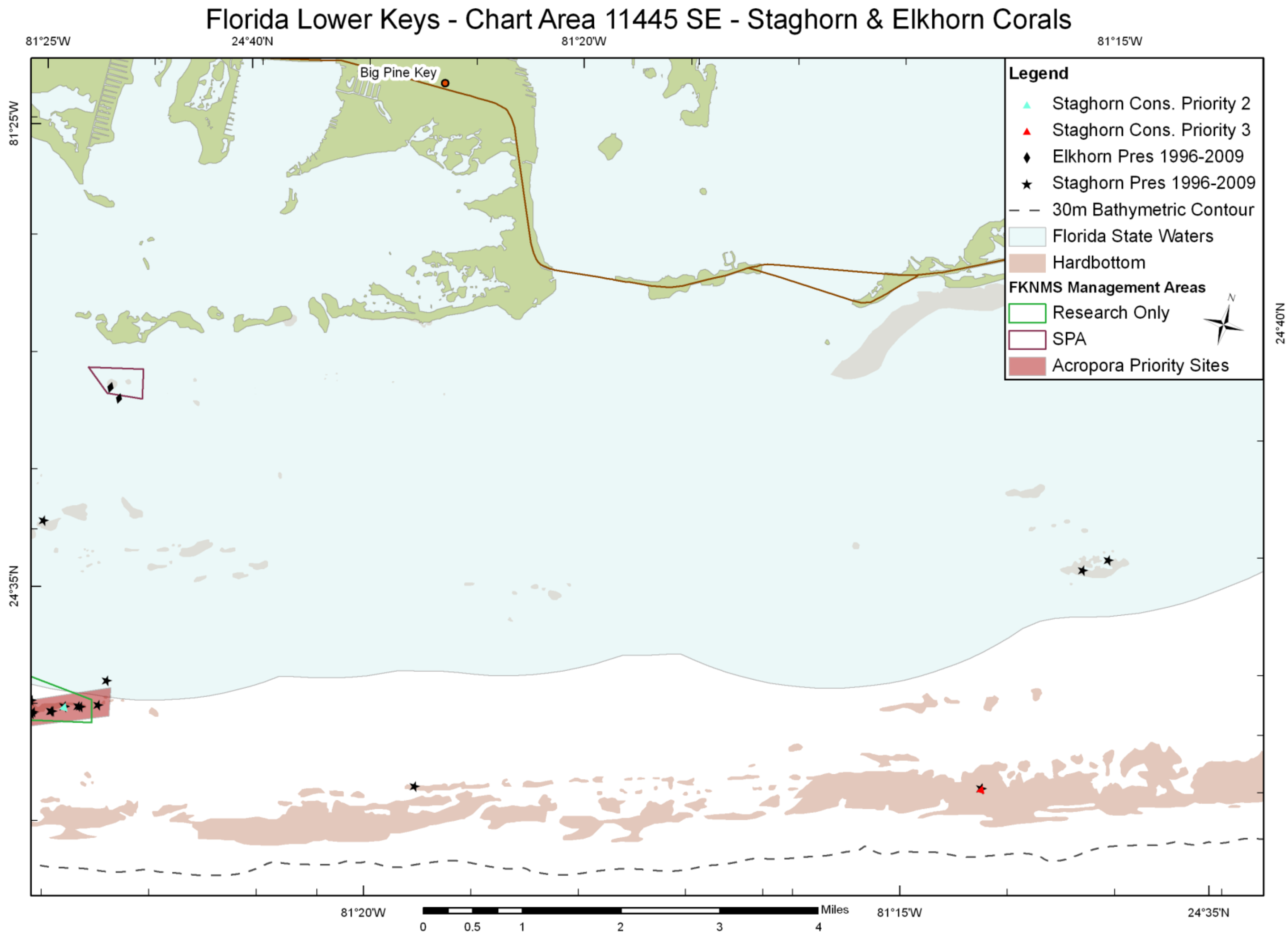


Figure 10 Map of known *Acropora* colony locations and conservation priorities in the Lower Florida Keys

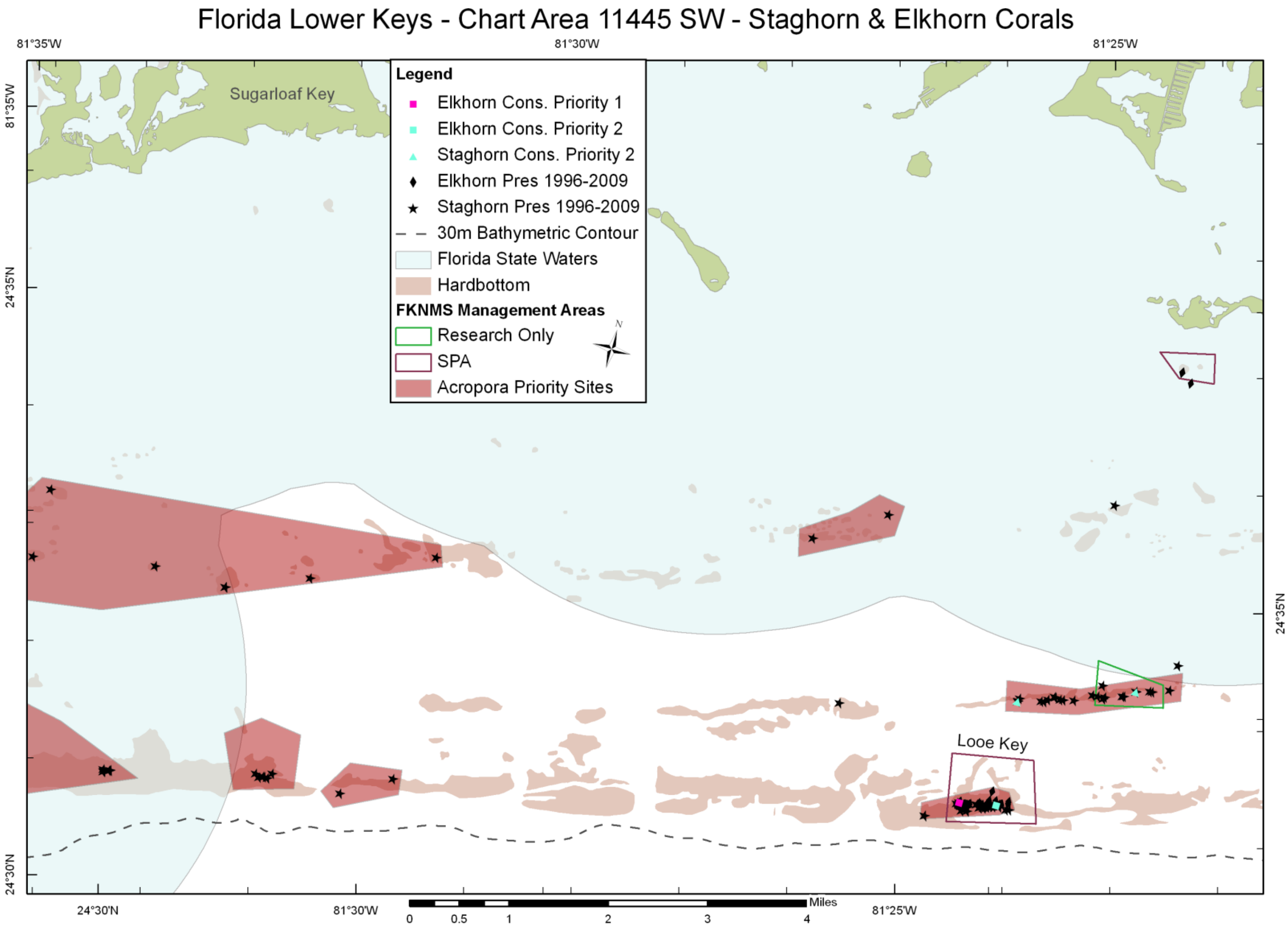


Figure 11 Map of known *Acropora* colony locations and conservation priorities in the Lower Florida Keys (cont'd)

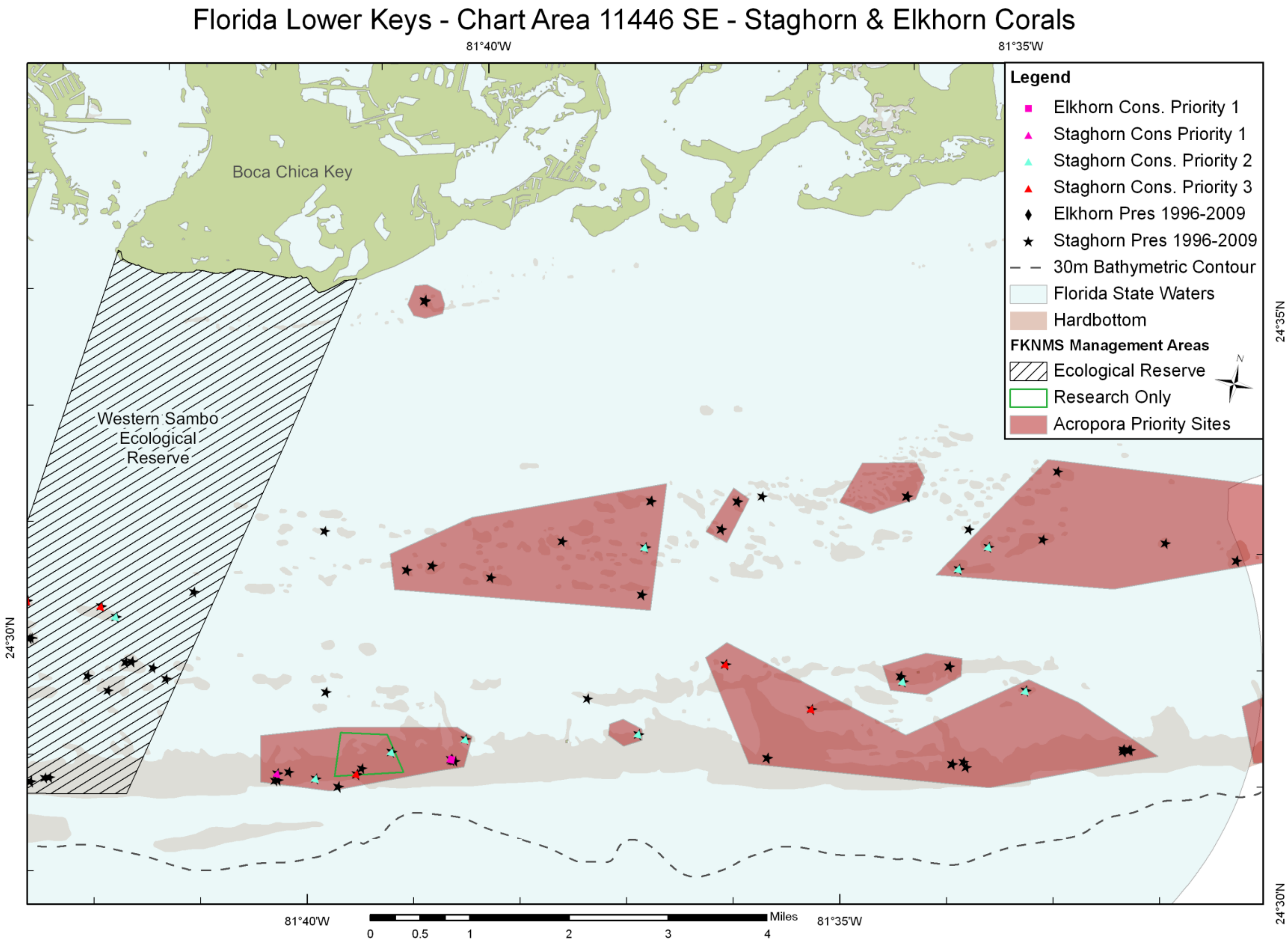


Figure 12 Map of known *Acropora* colony locations and conservation priorities in the Lower Florida Keys (cont'd)

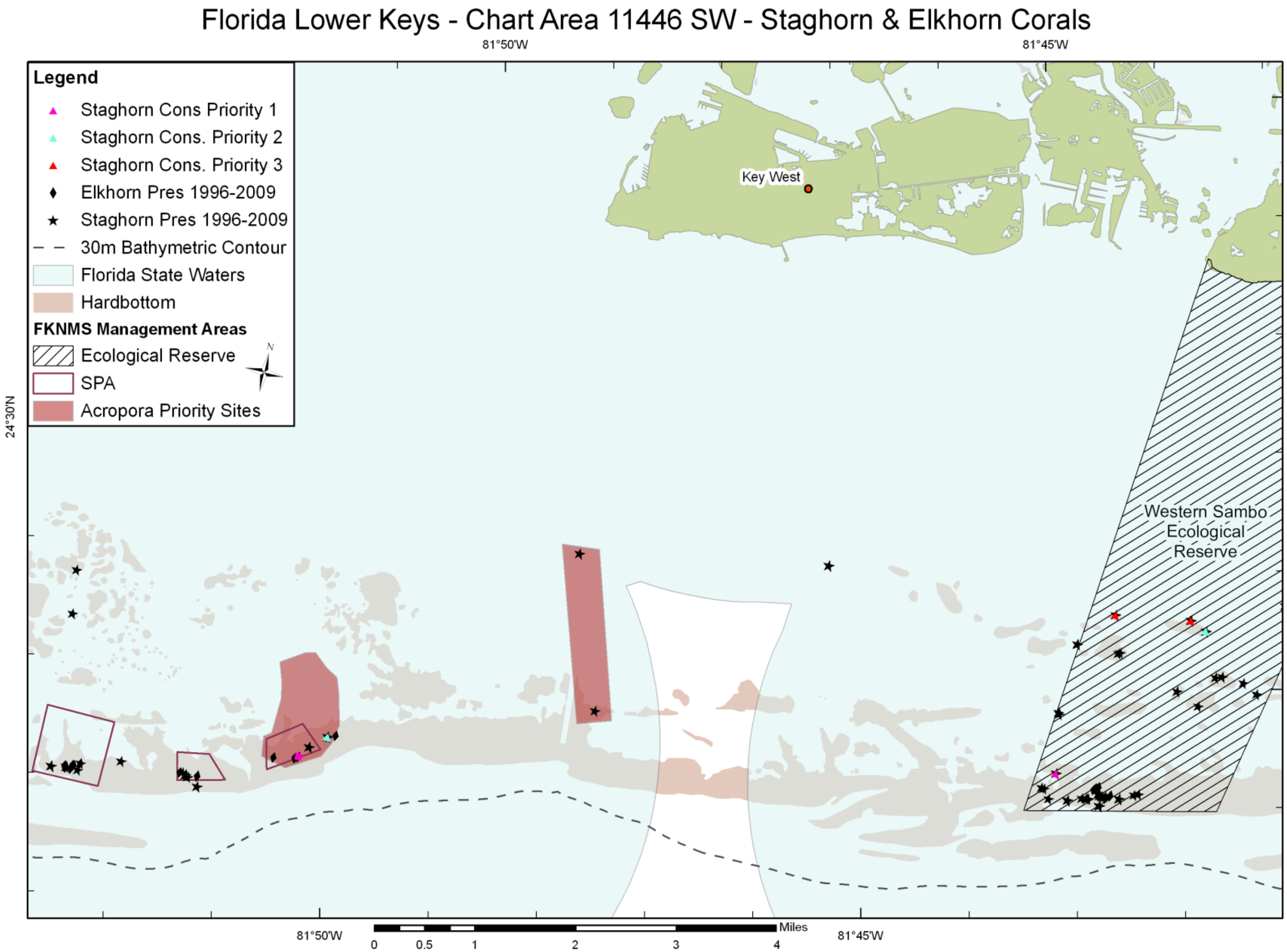


Figure 13 Map of known *Acropora* colony locations and conservation priorities in the Lower Florida Keys (cont'd)

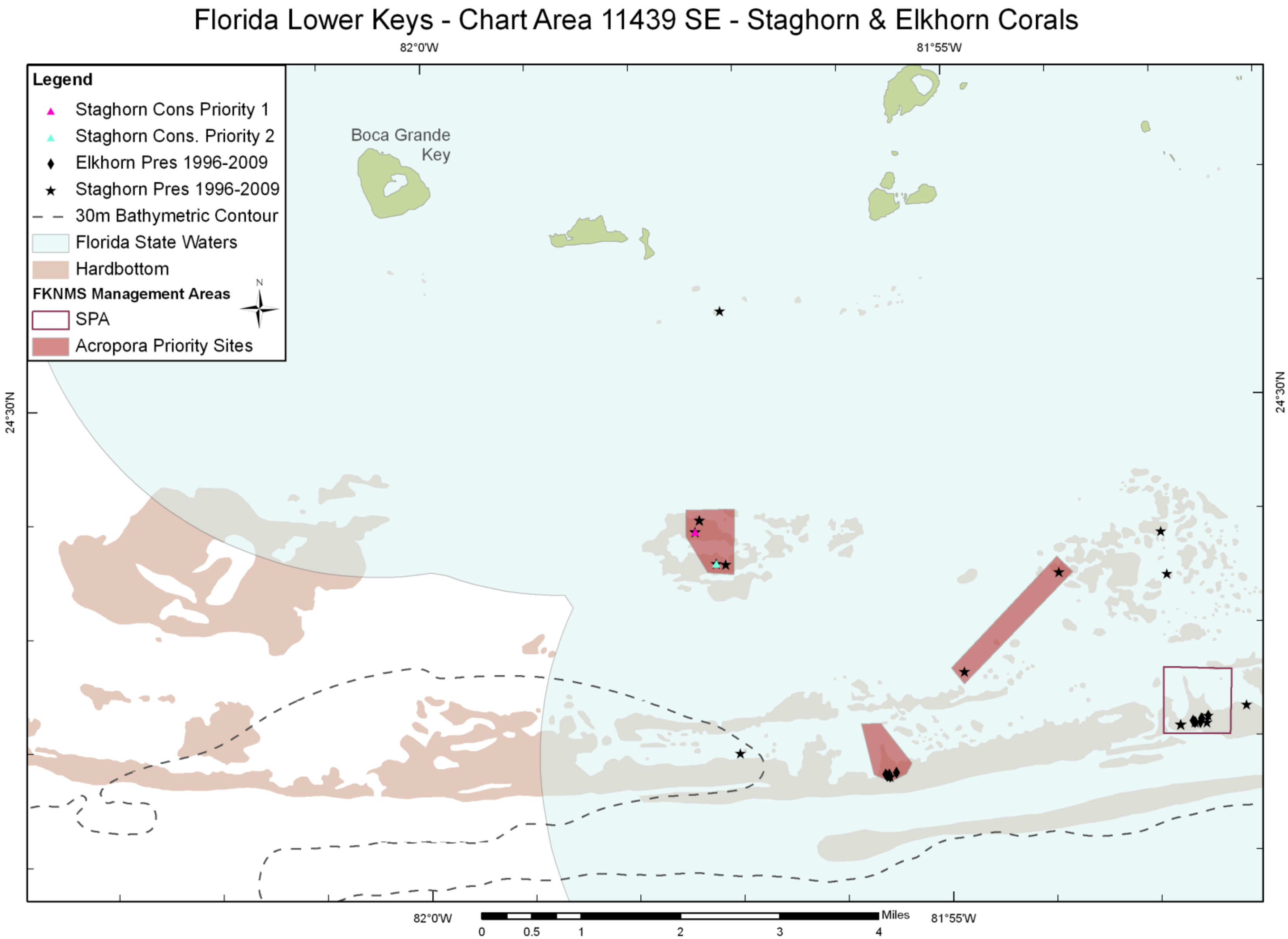


Figure 14 Map of known *Acropora* colony locations and conservation priorities west of Key West, Florida

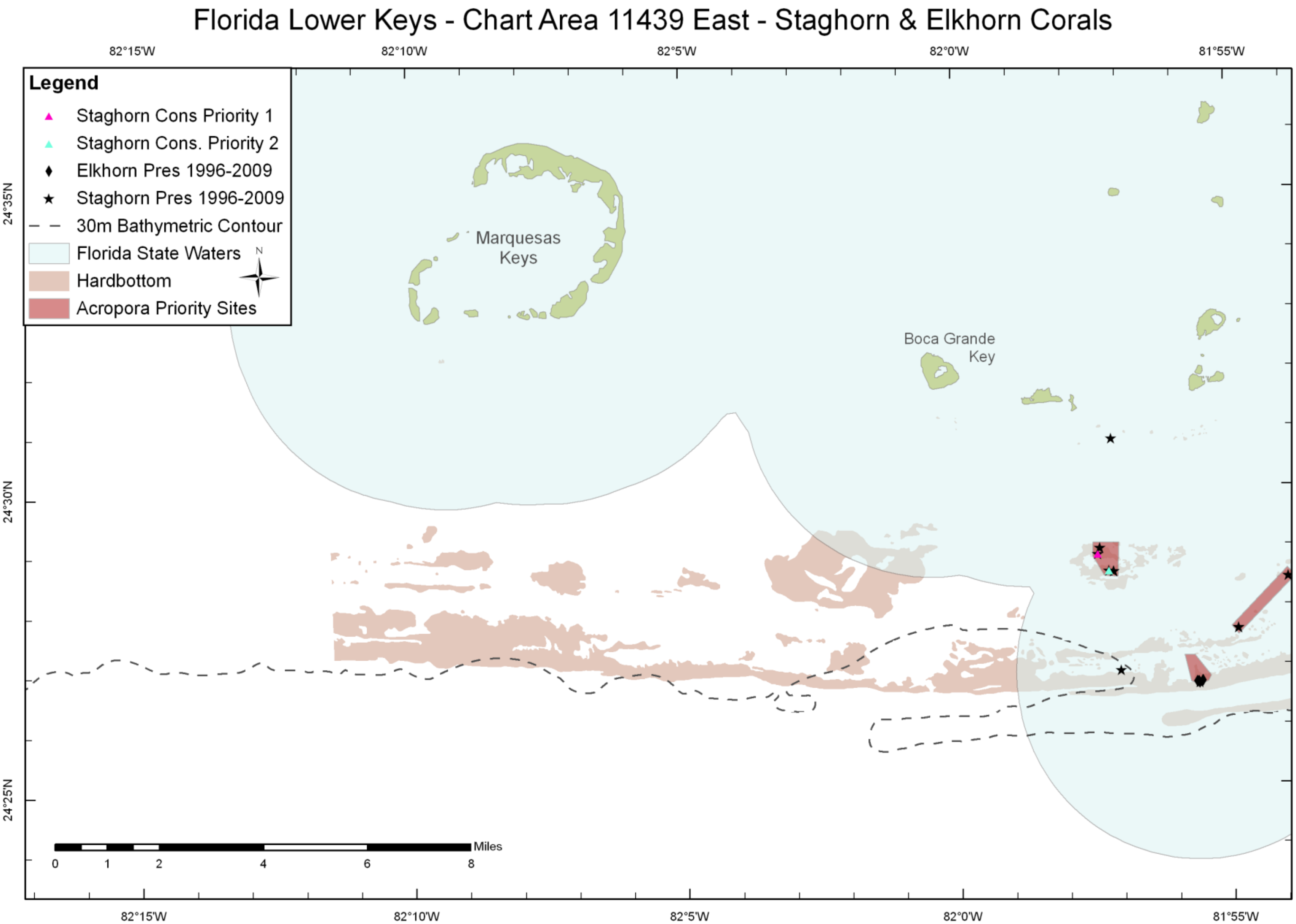


Figure 15 Map of known *Acropora* colonies and conservation priorities near the Marquesas Keys

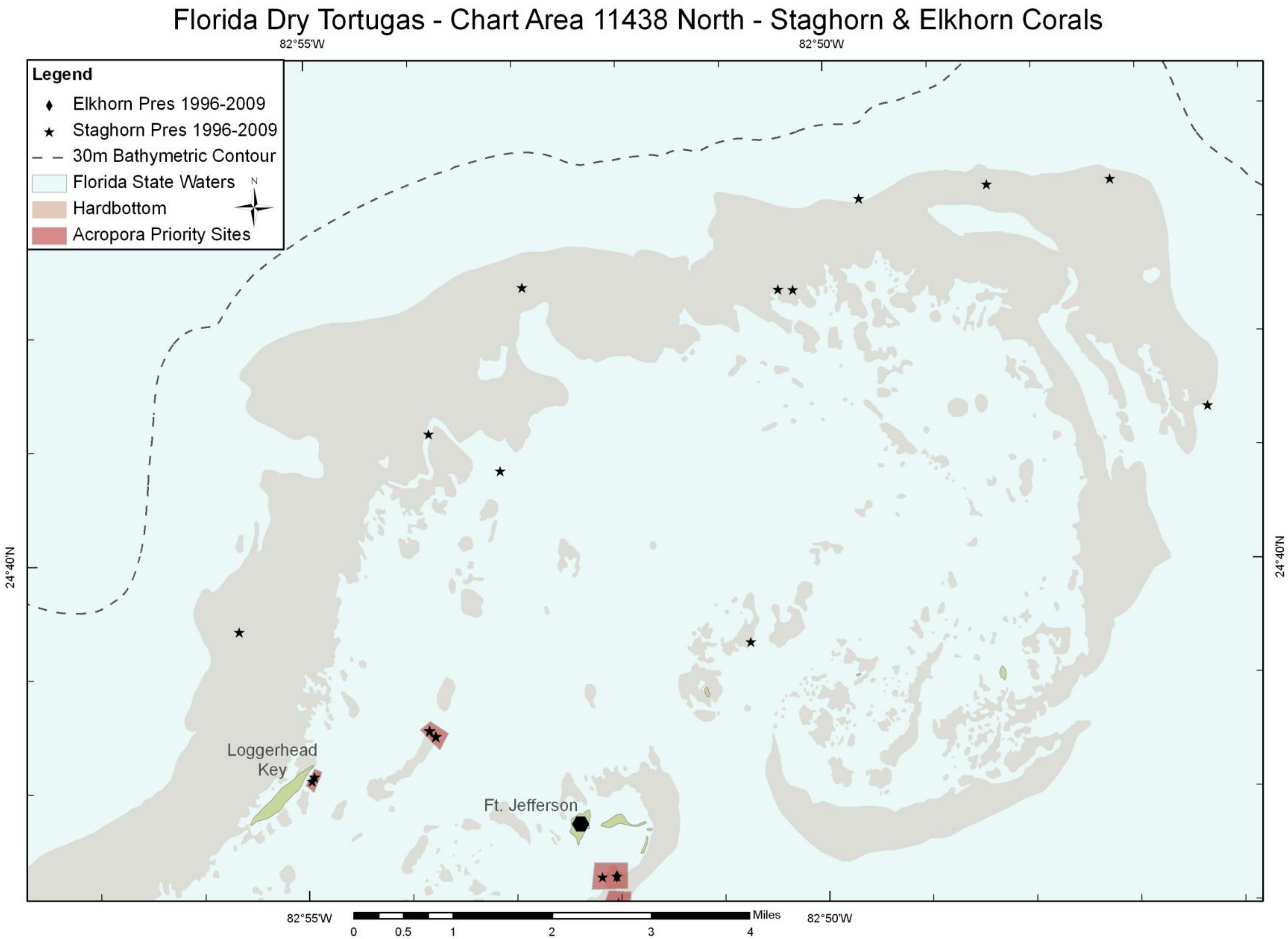


Figure 16 Map of known *Acropora* colonies north of Ft. Jefferson in the Dry Tortugas

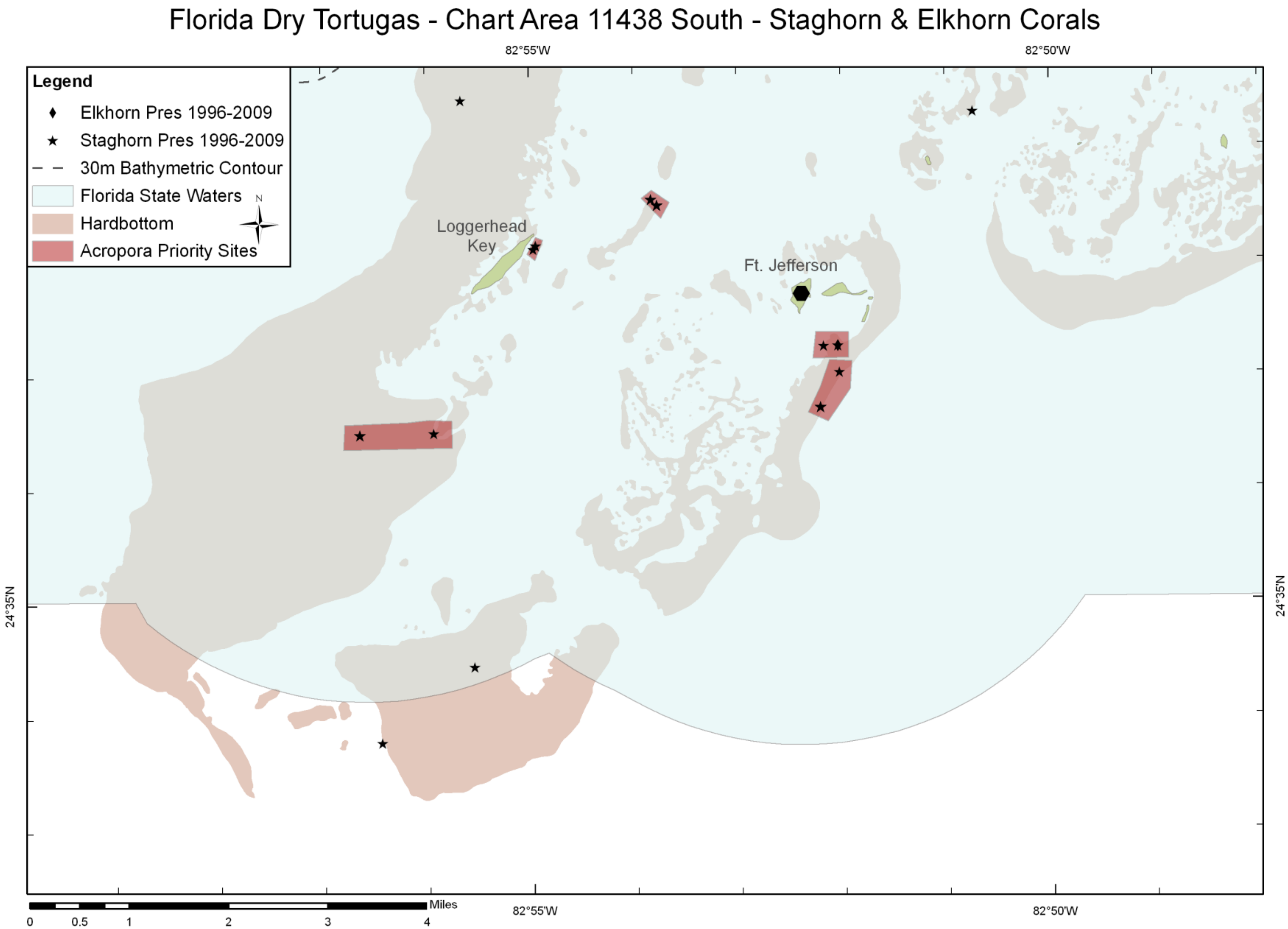


Figure 17 Map of known *Acropora* colonies south of Ft. Jefferson in the Dry Tortugas

Appendix I. Biological Opinion

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Southeast Regional Office (SERO), Sustainable Fisheries Division (F/SER2)
Activity:	The Continued Authorization of Fishing under the Fishery Management Plan (FMP) for Spiny Lobster in the South Atlantic and Gulf of Mexico (F/SER/2005/07518)
Consulting Agency:	NOAA, NMFS, SERO, Protected Resources Division (F/SER3)
Approved by:	________________________________ Roy E. Crabtree, Ph.D., Regional Administrator
Date Issued:	________________________________

Introduction

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), requires each federal agency to ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat of such species. When the action of a federal agency may affect an ESA-listed species or its critical habitat, that agency is required to consult with either NMFS or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected.

Consultations on most listed marine species and their critical habitat are conducted between the action agency and NMFS. These consultations are concluded after NMFS has determined that an action is not likely to adversely affect listed species or designated critical habitat, or issues a biological opinion (opinion) identifying whether the proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify any critical habitat. If jeopardy or destruction or adverse modification is found to be likely, NMFS must identify reasonable and prudent alternatives to the action, if any, that would avoid jeopardizing any listed species and avoid destruction or adverse modification of any designated critical habitat. The opinion establishes an incidental take statement (ITS) specifying the amount or extent of incidental take of the listed species that may occur, reasonable and prudent measures (RPMs) to reduce the effect of take, and may recommend conservation measures to further conserve the species. Notably, no incidental destruction or adverse modification of critical habitat can be authorized. Thus, there are no RPMs for critical habitat, only reasonable and prudent alternatives that must avoid destruction and adverse modification.

This document constitutes NMFS' opinion on the effects of the continued authorization of spiny lobster fishing in the U.S. South Atlantic and Gulf of Mexico Exclusive Economic Zones (EEZ) on threatened and endangered species and designated critical habitat, in accordance with section 7 of the ESA. This consultation considers the operation of the spiny lobster fishery as managed under the Joint Spiny Lobster Fishery Management Plan (SLFMP), including all amendments implemented to date. NMFS has dual responsibilities as both the action agency under the Magnuson-Stevenson Fishery Conservation and Management Act (MSFMCA) (16 U.S.C. §1801 *et seq*.) and the consulting agency under the ESA. For the purposes of this consultation, F/SER2 is considered the action agency and the consulting agency is F/SER3.

This opinion is based on information provided in: the Fishery Management Plan for Spiny Lobster (GMFMC and SAFMC 1982), Amendment 1 to the Spiny Lobster Fishery Management Plan, including an Environmental Assessment, Supplemental Regulatory Impact Review, and Initial Regulatory Flexibility Analysis (GMFMC and SAFMC 1987); sea turtle recovery plans; past and current sea turtle research and population modeling efforts; sea turtle stranding data; smalltooth sawfish encounter database entries; the *Acropora* status review document (*Acropora* BRT 2005); *Acropora cervicornis* and

A. palmata colonial density estimates (Miller et al. 2007); other relevant scientific data and reports; consultation with F/SER2 staff; and previous opinions on other fisheries.

1.0 Consultation History

An informal consultation was conducted on the impacts of the draft Council Fishery Management Plan for the lobster fishery in the Gulf of Mexico and South Atlantic Fishery Conservation Zone in 1979. It concluded the proposed action was not likely to jeopardize the continued existence of threatened of endangered sea turtles or marine mammals. The consultation did not analyze the effects of the fishery itself.

In 1981, a formal consultation was reinitiated on a new draft Council Fishery Management Plan for the lobster fishery in the Gulf of Mexico and South Atlantic Fishery Conservation Zone, after it was determined the previous "opinion did not adequately satisfy section 7 requirements." The formal opinion concluded the proposed action was not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of critical habitat.

The effects of the South Atlantic and Gulf of Mexico spiny lobster fishery on threatened and endangered species were examined again as part of a larger April 28, 1989, opinion, which analyzed the impacts of all commercial fishing activities in the Southeast Region. The opinion stated that there were no known records of threatened or endangered species incidentally taken in the spiny lobster trap fishery[9] at the time of opinion, and that "the fishery was not likely to impact threatened or endangered species." The opinion concluded that no commercial fishing activities in the Southeast Region were likely to jeopardize the continued existence of any threatened or endangered species. The incidental take of ten documented green, hawksbill, Kemp's ridley, or leatherback sea turtles; 100 loggerhead sea turtles; and 100 shortnose sturgeon was allotted to each fishery identified in the ITS. The amount of incidental take was later reduced in a July 5, 1989, opinion to only ten-documented green, hawksbill, Kemp's ridley, or leatherback sea turtles; 100 loggerhead sea turtles; and 100 shortnose sturgeon for all commercial fishing activities conducted in the South Atlantic and the Gulf of Mexico regions combined.

Amendments 1 through 7 and two regulatory amendments to the South Atlantic and Gulf of Mexico spiny lobster fishery management plan (FMP) were all either consulted on informally and found not likely to adversely affect threatened or endangered species, or were determined by F/SER2 to have no effect on ESA-listed species. These consultations determined that amendments to the FMP would not alter the prosecution of the spiny lobster fishery in ways that would cause effects to listed species not previously considered. Likewise, they determined there was no new information revealing effects to threatened and endangered species, or their designated critical habitats, not previously considered in the July 5, 1989, opinion.

[9] The impacts of other gear types in the spiny lobster fishery were not analyzed in this opinion.

Formal consultation on the South Atlantic and Gulf of Mexico Spiny Lobster Fishery was reinitiated on August 25, 2005. As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary involvement or control over the action has been retained (or is authorized by law) and: (1) the amount or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

In an August 25, 2005, memorandum F/SER2 evaluated the impacts of the implementation of Generic Amendment 3 to the South Atlantic and Gulf of Mexico spiny lobster fishery. Since NMFS considers the effects of the specific management measures proposed, and the effects of all discretionary fishing activity authorized under affected FMPs, the operation of the entire fishery was evaluated. The analysis concluded new data were available that revealed the fishery may be affecting ESA-listed species in a way not previously considered. Additionally, the impacts of spiny lobster fishing on the U.S. distinct population segment (DPS) of smalltooth sawfish and *Acropora* species were not analyzed in previous consultations.

The presence of these reinitiating factors led F/SER2 to request reinitiation of formal consultation on the Spiny Lobster FMP. An ESA section 7(a)(2) and 7(d) determination concluded the continued operation of the fishery during the reinitiation period is not likely to jeopardize the continued existence of any listed species; nor would it represent an irreversible or irretrievable commitment of resources by the agency. The appropriateness of the section 7(a)(2) and 7(d) determination has been monitored during the course of the consultation as data has been collected and its conclusion has remained valid.

2.0 Description of Proposed Action

F/SER2 is proposing to continue its authorization of the spiny lobster fishery in the Gulf of Mexico and South Atlantic regions. The Gulf of Mexico and South Atlantic spiny lobster fishery is currently managed jointly via the FMP for the Spiny Lobster in the Gulf of Mexico and South Atlantic (SLFMP), and implementing regulations at 50 CFR Part 640, under the authority of the Magnuson Stevens Fishery Management and Conservation Act (MSFMCA). The MSFMCA is the governing authority for all fishery management activities that occur in federal waters within the United States' 200-nautical-mile (nmi) EEZ. Responsibility for federal fishery management decision-making under the Joint SLFMP is divided between NMFS, the South Atlantic Fishery Management Council (SAFMC), and the Gulf of Mexico Fishery Management Council (GMFMC), with the GMFMC acting as the lead agency. This opinion analyzes the effects of all fishing activities prosecuted under the SLFMP, as amended to date.

When consulting on FMP actions, NMFS must consider not only the effects of specific management measures (described in Section 2.1 below) but also the effects of all fishing activity authorized under the FMP. A description of the Gulf of Mexico and South Atlantic spiny lobster fishery is provided below in Section 2.2. It provides a summary of the overall characteristics of the Gulf of Mexico and South Atlantic spiny lobster fishery authorized under the Joint SLFMP, which are relevant to the analysis of its potential effects on threatened and endangered species.

2.1 Overview of Management and Current Regulations

The joint jurisdiction of the GMFMC and SAFMC spans from the North Carolina/Virginia border in the South Atlantic to the Texas/Mexico border in the Gulf of Mexico. The spiny lobster fishery has been jointly managed by these Councils since the inception of the SLFMP in 1982. The original FMP was drafted to address five primary issues within the fishery: (1) an increase in the harvest and sale of undersized lobsters, (2) gear conflicts between lobster trappers and direct trawl and drift-net fishers, (3) concern over the mortality rate of undersized lobster used as attractants in the traps, (4) concern over an increasing number of traps in the fishery, and (5) harvest of lobsters during the spawning season. The original FMP established five management objectives aimed at addressing these issues: (1) protect the long-run yields and prevent depletion of lobster stocks, (2) increase yield by weight from the fishery, (3) reduce user group and gear conflicts in the fishery, (4) acquire the necessary information to manage the fishery, and (5) promote efficiency in the fishery (GMFMC and SAFMC 1982). Since its implementation, the original FMP has been amended seven times and undergone three regulatory amendments. Appendix 1 provides a brief summary of those amendments.

The federal fishery is currently managed through regulations affecting the EEZs off states in three areas: the South Atlantic states (North Carolina, South Carolina, and Georgia), not including Florida; the State of Florida; and the Gulf of Mexico states (Texas, Louisiana, Mississippi, and Alabama) not including Florida. Management measures have been structured this way to reflect differences in spiny lobster occurrence and fishing effort in these regions. Below is a brief summary of the management measures in place for these regions; Table 2.2 provides more specific information on these requirements.

EEZs Occurring off the South Atlantic States (not including Florida)
The regulations on commercial and recreational fishers are identical throughout the South Atlantic states. The fishery is managed through permit requirements, minimum size and bag limits, gear restrictions, and trap construction requirements.

EEZs Occurring off the Gulf of Mexico States (not including Florida)
The Gulf of Mexico states also have spiny lobster regulations separate from Florida's requirements. However, certain regulations are simultaneously in effect for both Florida and the Gulf of Mexico states. The fishery in the Gulf of Mexico is managed through minimum size limits, a special recreational season, an otherwise closed season for commercial and recreational fishing, gear restrictions, bag limits, and trap construction requirements.

State of Florida

The spiny lobster fishery off Florida is managed under a separate set of regulations due to the relatively high level of fishing effort, and because of the relatively high abundance of spiny lobsters in these waters. The spiny lobster fishery off Florida is primarily a state fishery, with approximately 80 percent of fishing effort occurring in state waters on average annually. In the early 1990s, the SLFMP was amended to establish compatible regulations between the federal and state fisheries. Thereafter, the State of Florida has taken the lead in spiny lobster fishery management, with NMFS establishing compatible regulations when applicable. The fishery is currently managed via bag limits, minimum size limits, regulated fishing seasons for the commercial and recreational sectors, gear restrictions, trap construction requirements, and a trap limitation and permitting program.[10]

The State of Florida implemented a Lobster Trap Certificate Program (LTC) in 1993 because the spiny lobster fishery was experiencing increased congestion and conflict on the water. Excessive mortality of undersized lobsters, a declining yield per trap, and an increasing concern over petroleum and debris pollution were also at issue. To legally fish spiny lobster traps in the State of Florida, fishers must have valid trap certificates. The rationale for the LTC was that the fishery was overcapitalized and fewer traps could maintain lobster harvest at historic catch levels. The LTC was expected to stabilize the fishery by reducing the total number of traps while maintaining or increasing overall landings, which would result in increased yield per trap (FFWCC 2006).

The main component of the LTC was the reduction of traps in the fishery to 250,000 traps, based on historic catch and effort information. Annual 10 percent reductions in the total number of trap permits available from Florida Fish and Wildlife Conservation Commission (FFWCC) were implemented to achieve this goal (referred to as active reductions). Intense resistance to the trap reduction policy caused periodic suspension of the annual reduction and ultimately the trap reduction policy was revised to a passive/active reduction policy. This policy dictated that 25 percent of those trap permits transferred between fishermen, outside of immediate family, were removed from the fishery (referred to as passive reductions). A supplemental reduction program was also established to reduce the number of traps issued by the state (referred to as active reductions) to achieve an annual reduction of at least four percent, if the passive reduction program did not meet that goal. Active and passive reductions were intended to continue until 400,000 traps remained in the fishery. Currently, there are approximately 480,000 trap certificates issued for the fishery. Each certificate entitles the holder to own an individual trap. Reductions in the number of traps in the fishery are currently suspended, pending a reevaluation of all lobster fishing regulations (FFWCC 2006). Table 2.1 summarizes the reductions for each fishing season and Figure 2.1 illustrates the reductions in traps available and issued.

[10] Due to shifts in historic harvest proportion among components of the commercial fishery and the recreational fishery, as well as other issues, the annual trap reductions under this program are currently suspended (FWCC 2005, 2006).

Table 2.1 Lobster Trap Reductions for the 1993/94-2006/07 Fishing Seasons (FFWCC 2007)

Fishing Season Reduction Effective	No. of Lobster Trap Certificates Available from FFWCC	Reduction Amount (%)	Type of Reduction
1993/94	750,327	10	Active
1994/95	674,081	10	Active
1995/96	606,190	10	Active
1996/97	613,428	0	Lottery Followed This Ruling
1997/98	605,973	0	No Active or Passive Reduction
1998/99	544,056	10	Active
1999/00	543,497	0	No Active or Passive Reduction
2000/01	542,704	0	No Active or Passive Reduction
2001/02	540,083	4/25	Active/Passive
2002/03	520,562	3.196/25	Active/Passive
2003/04	499,105	2.41/25	Active/Passive
2004-2005	498,409	2.41/25	Active/Passive
2005-2006	497,042	0	No Active or Passive Reduction
2006-2007	495,770	0	No Active or Passive Reduction
2007/08	N/A	0	No Active or Passive Reduction

Figure 2.1 Spiny Lobster Trap Tags Available and Issued, 1993/94-2006-2007 (FFWCC 2007)

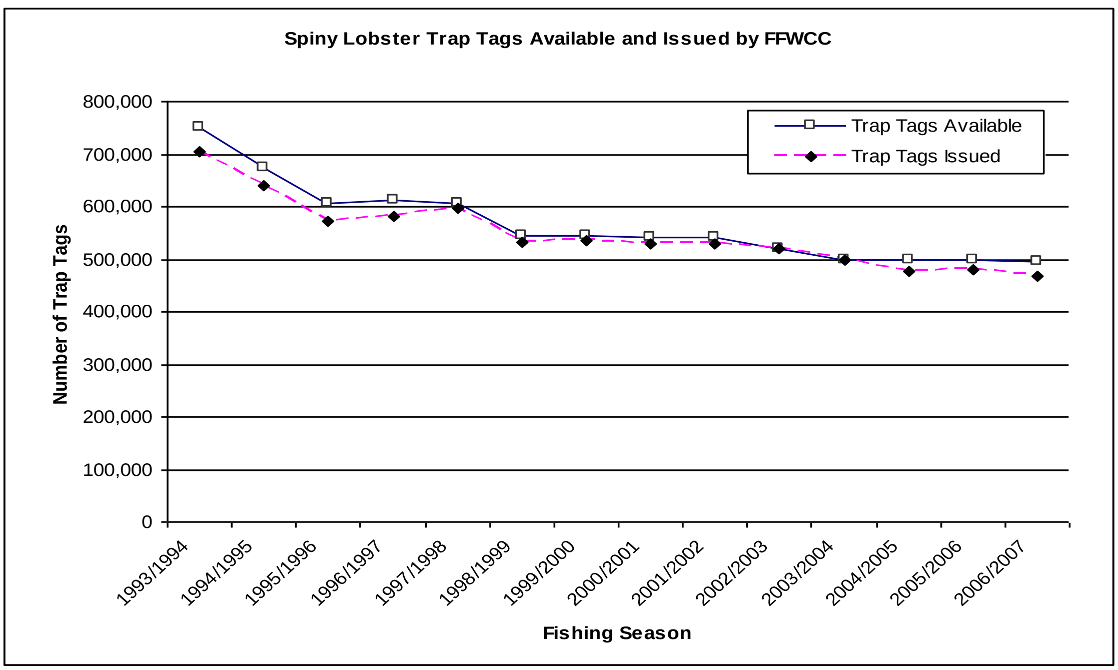


Table 2.2 Summary of Federal Spiny Lobster Fishing Regulations (50 CFR Part 640)

Fishing Area	Permit Requirement	Fishing Season	Size Limit	Daily Bag Limit	Trap Requirements	Gear Restrictions and Requirements
Commercial Regulations						
EEZ off South Atlantic states not including Florida	Federal Permit[1]	Year-Round (no closed season)	3-inch Carapace Length[2]	2 per person	Traps must meet construction requirements in 50 CFR 640.22 and may only be pulled or tended during daylight hours.	Divers must have a device with them to allow for the measurement of carapace length while in the water; no hooks, spears, poisons, dynamite, chemicals, or other such substance or device may be used to harvest lobster; directed use of trawls is also prohibited.
EEZ off Gulf of Mexico states not including Florida		August 6-March 31		6 per person[3]		
EEZ off Florida	State of Florida Permit[1,5]					
Recreational Regulations						
EEZ off South Atlantic states not including Florida	None	Year-Round (no closed season)	3-inch Carapace Length[2]	2 per person	Traps are not permitted for recreational use.	Divers must have a device with them to allow for the measurement of carapace length while in the water; no hooks, spears, poisons, dynamite, chemicals, or other such substance or device may be used to harvest lobster.
EEZ off Gulf of Mexico states not including Florida		August 6-March 31; last Saturday and Sunday of July		6 per person[3]		
EEZ off Florida	State of Florida Permit[1,5,7]	August 6-March 31; last Wednesday and Thursday of July		6 per person; 12 per person[6]		

[1] An additional tail-separation permit is required for anyone wishing to possess tails removed from the carapace while at sea.
[2] Separated tails must be at least 5.5inches in length.
[3] A person is exempt from these limits during the commercial fishing season if they harvest lobster via diving or by use of bully net, hoop net, or lobster trap, and if they possess the appropriate commercial federal/state permits.
[4] All fishing is prohibited inside the Tortugas Marine Reserve.
[5] Anyone landing lobster in Florida or harvesting and/or landing lobster from the EEZ off Florida must have a valid State of Florida spiny lobster permit.
[6] During the last Wednesday and Thursday of July the daily bag limit increases to 12 lobsters per person in the EEZ off Florida, excluding Monroe County. During that period, the daily bag limit remains six lobsters per person in Monroe County.
[7] An additional Special Recreational Crawfish license may be obtained to allow a fisher to harvest lobsters in excess of the recreational bag limit.

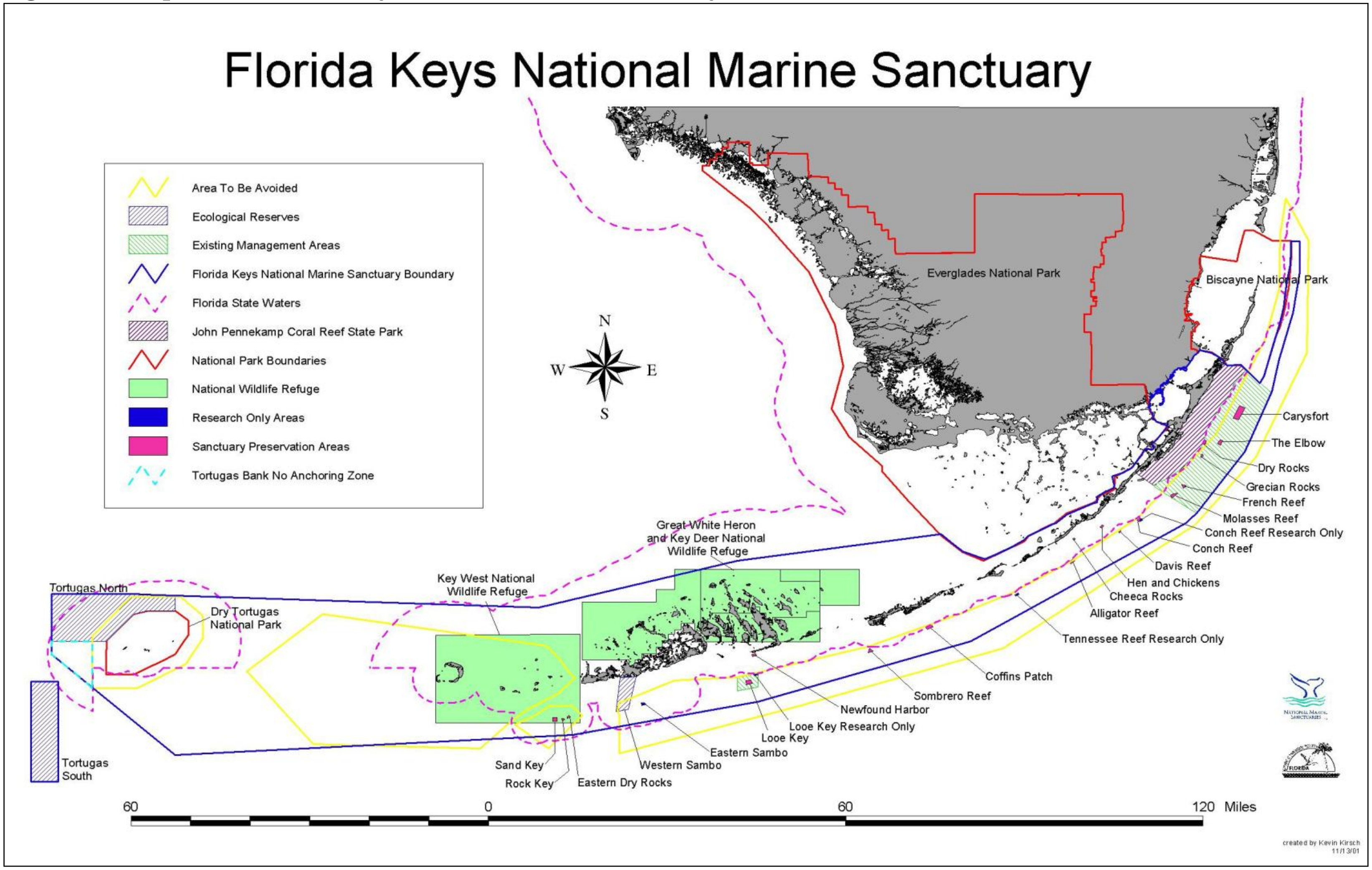
Florida Keys National Marine Sanctuary

The Florida Keys National Marine Sanctuary (FKNMS) encompasses a large portion of the Florida Reef Tract where the vast majority of spiny lobster fishing occurs. As such, the spiny lobster fishery is subject to applicable FKNMS regulations. Spiny lobster fishing is considered a "traditional fishing activity" and therefore, is allowed inside the FKNMS.[11] However, regulations at 15 CFR 922.163 prohibiting the removal of, injury to, or possession of coral or live rock are applicable to spiny lobster fishers. Prohibitions on adversely affecting corals also extend to the operation of vessels. FKNMS regulations prohibit the operation of a vessel in such a manner that will injure coral, as well as anchoring on live coral in water depths less than 40 ft when the bottom can be seen [15 CFR 922.163(i) and (ii)]. Likewise, take or possession of protected wildlife, including ESA-listed species, is prohibited within the FKNMS unless that take is otherwise authorized under the ESA or MMPA [15 CFR 922.163(10)].

Spiny lobster fishing is also subject to area closures established within the FKNMS. FKNMS regulations prohibit spiny lobster fishing inside ecological reserves and sanctuary preservation areas (SPAs) [15 CFR 922.164(d)]. The Director of the Office of Ocean and Coastal Resource Management, or their designee, can also establish "special use areas" (SUAs). Four specific SUA types have been developed, each with a specific purpose: (1) recovery areas, (2) restoration areas, (3) research-only areas, and (4) facilitated-use areas. Spiny lobster fishing is prohibited in the first three SUA types [15 CFR 922.134(e)]. Presently, just research-only SUAs have been designated in the FKNMS. Figure 2.2 displays the current management areas, SUAs, and boundaries of the FKNMS.

[11] Traditional fishing activities are those commercial and recreational activities that occurred in the Sanctuary prior to its designation [15 CFR 922.163(a)].

Figure 2.2 Map of the Florida Keys National Marine Sanctuary



2.1.1 Management of Gulf of Mexico and South Atlantic Spiny Lobster Exempted Fishing, Scientific Research, and Exempted Educational Activity

Regulations at 50 CFR 600.745 allow the Regional Administrator of NMFS' SERO to authorize the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited, for scientific research activity, limited testing, public display, data collection, exploratory health and safety, environmental cleanup, hazardous waste removal purposes, or educational purposes. Every year, the SERO may issue a small number (e.g., three were issued in 2005, one in 2006, and one in 2007) of exempted fishing permits (EFPs), scientific research permits (SRPs), and/or exempted educational activity authorizations (EEAAs). Such a permit would exempt the collection of a limited number of spiny lobster, occurring in Gulf of Mexico and South Atlantic federal waters, from regulations implementing the SLFMP. These EFPs, SRPs, and EEAAs involve fishing by commercial or research vessels, using fishing methods similar or identical to those used in the spiny lobster fishery. Under these circumstances, the types and rates of interactions with listed species from the EFP, SRP, and EEAA activities would be expected to be similar to those analyzed in this opinion. If the fishing methods are similar and the associated fishing effort does not represent a significant increase beyond the levels expected in the fishery considered herein, then issuance of some EFPs, SRPs, and EEAAs would be expected to fall within the level of effort and impacts considered in this opinion. For example, issuance of an EFP to an active commercial vessel is unlikely to add additional effects or increase fishing effort beyond what is otherwise likely to accrue from the vessel's normal commercial activities. Therefore, we consider SERO's issuance of EFPs, SRPs, and EEAAs for fishing that is consistent with the description of spiny lobster fishing in Section 2, and is not expected to increase fishing effort significantly, to be within the scope of this opinion.

2.2 Description of Gulf of Mexico/South Atlantic Spiny Lobster Fishery

2.2.1 Overview of the Federal Fishery off the South Atlantic States (Not Including Florida)

North Carolina
There is currently no commercial effort directed at harvesting spiny lobsters off North Carolina. The fishery is primarily opportunistic with very few commercial landings. From 1994-2005 only 35 pounds of spiny lobster were landed from the federal waters off North Carolina. Rod-and-reel and diving spears were used to harvest these landings. The spiny lobsters taken by rod-and-reel gear appear to be incidental catches by fishers targeting snapper-grouper species with bottom longline (A. Bianchi, North Carolina Department of Marine Fisheries, pers. comm. 2007).

South Carolina
There is currently no directed commercial fishery for spiny lobster off South Carolina, nor has there been for some time. There are no recorded commercial landings of spiny lobster going back 10 years. In the mid-1980s an offshore commercial trap fishery for spiny lobster was explored, but the landing amounts were too low to warrant a directed fishery (M. Bell, pers. comm. 2006).

Spiny lobsters are collected recreationally off South Carolina. Most fishing is conducted by divers operating from privately-owned vessels. These fishers generally travel 25 miles or more offshore and dive in waters 90 ft or deeper. Lobsters are most frequently taken from rocky outcroppings, artificial reefs, or shipwrecks. A small offshore dive charter industry does exist, but most of these operators discourage the collection of spiny lobsters during dives (M. Bell, pers. comm. 2006).

The numbers of participants in the recreational fishery is currently unknown. Given the depths involved, distances from shore, and the patchiness of ideal habitat, it is believed that the number of fishers participating in the fishery and overall effort are minimal. However, advances in navigational technology and diving equipment seem to be allowing an increasing number of recreational fishers access to offshore spiny lobster stocks (M. Bell, pers. comm. 2006).

Georgia
There is currently no directed commercial fishery for spiny lobster off Georgia, nor has there been for some time (J. Califf, Georgia Department of Natural Resources, pers. comm. 2007). The last commercial landings of spiny lobster from federal waters were recorded in 1969. The state of Georgia does not currently regulate spiny lobster fishing, presumably because the level of effort does not warrant regulation.

2.2.2 Overview of the Federal Fishery off the Gulf of Mexico States (Not Including Florida)

There is little commercial or recreational harvest of spiny lobster outside of Florida. Since the implementation of the Spiny Lobster FMP in 1983, only 7,214 pounds of lobster have been landed commercially in the Gulf States outside of Florida (NMFS unpublished data). Due to variability in the oceanic currents that carry spiny lobster larvae, the occurrence of adult spiny lobster in these areas is inconsistent. As a result, most fishing for spiny lobster in these areas is considered opportunistic with very little consistent directed effort. Lobsters that are landed tend to be large in size (nine pound or more [Moe 1991]) but are generally not landed in large quantities

2.3 Overview of the Federal Fishery off Florida

2.3.1 Description of the Florida Spiny Lobster Fishery

The distribution of the commercial and recreational spiny lobster harvest off Florida is almost exclusively limited to the waters off southern Florida (GMFMC and SAFMC 1982). The fishery here has been in existence since the early 1900s and fishing gears and techniques have changed little in that time. The overview of fishing practices and techniques in the original SLFMP and subsequent amendments still accurately depict the fishery's operation. The following sections summarize those discussions.

2.3.2 Commercial Fishery

Spiny lobster is an important fishery resource in southern Florida, especially the Florida Keys. Spiny lobsters are commercially harvested via traps (Figure 2.3) and divers collecting lobsters by hand, including bully nets. During the late 1980s and early 1990s, NMFS established regulations compatible with the State of Florida's management measures for spiny lobster. As a result, only one permit, issued by the State of Florida, is currently required to commercially harvest lobster in both federal and state waters. Trap fishing is the most common gear type used in the Florida Keys, while diving is utilized most frequently north of Dade County, Florida. The dockside value of the entire commercial fishery is estimated to be worth approximately $21 million annually since 1980 (Robson 2006).

Figure 2.3 Example of a Commercial Spiny Lobster Trap

Photo Credit: T Matthews, FFWCC

Commercial Bully Net
Bully nets (Figure 2.4) consist of a long pole with a bag of netting of varying mesh size. Fishers generally stand at the bow of the boat and lowered the net into the water when a lobster is seen on the bottom. Since lobsters must been seen from the surface bully net fishing requires relatively clear, shallow water. For these reasons, the likelihood of bycatch by this gear is extremely small.

Bully nets are occasionally used during the first few weeks of the commercial season (D. Gregory, Florida Sea Grant, pers. comm. 2006), though the commercial landings attributed to this gear type are very low. Bully net landings statewide account for less than one percent of all spiny lobster landings (FFWCC 2005). Since implementation of the LTC the number of fishers reporting bully net-caught landings has ranged from 34 to 84 (FFWCC 2005). Because bully nets can only be used effectively in very shallow water, the fishery is primarily confined to Monroe County. The vast majority bully net fishing occurs on seagrass and mud flats on the northern side of Florida Keys (T. Matthews, FFWCC, pers. comm. 2008).

Figure 2.4 Example of a Bully Net

Photo Credit: B. Sharp, FFWCC

Commercial Trapping
As of June 10, 2008, 1,301 fishers had a license/certificate to use traps to harvest lobsters commercially during the 2006-07 fishing season (FFWCC 2008). A trap limitation program initiated in 1993 has reduced the number of lobster traps available annually from approximately one million to 498,000 at the beginning of the 2006-07 fishing season. Trap fishers generally land about five million pounds of lobster, on average, during a fishing season. Due to major trap losses resulting from three major hurricanes striking the fishing grounds, only 2.5 million pounds of lobster were landed during the 2005-06 season. Over the last 10 years, commercial trap fishing has been the dominant gear type in the spiny lobster fishery, accounting for approximately 70 percent of all commercial landings (Robson 2006).

Wire traps are occasionally used, frequently in deeper water, but the majority of traps currently used by commercial trappers are made of wooden slats. Concrete is typically poured in the bottom of traps to weight them. A buoy is attached to the trap and floated at the surface. Fishing occurs from very nearshore areas out to water depths of 200 ft, although most fishing occurs in waters less than 100 ft. The type of bait used in traps depends on fisher preference. Some traps are set unbaited, some are baited with fish scraps, sardines, cat food or cowhide, while others are baited with undersized lobsters used to attract larger lobsters. This last practice is believed to be so effective at increasing trap efficiency that some fishers use legal sized lobsters as bait when undersized lobsters are not available. Regardless of how the trap is baited, soak times average from 8 to 28 days, with soak times increasing as the season progresses and catch rates decline (Matthews 2001).

Fishing vessels in the Lower Florida Keys (Marathon to Key West) are generally larger than those in operation in the Upper Florida Keys (Key Largo to Long Key) (GMFMC and SAFMC 1987). Vessels operating in the Lower Florida Keys tend to be 50 ft in length, operate with crews of two or three, and typically fish up to 2,000 traps, but a few fishers may use as many as 5,000 traps (D. Gregory, Florida Sea Grant, pers. comm. 2006). These vessels may set traps several miles apart and usually allow traps to soak for up to two weeks (Powers and Bannerot 1984). Vessels of this size are also capable of fishing five hundred traps a day (GMFMC and SAFMC 1982). Many of these vessels are capable of taking multiple-day trips. However, only a few fishers that fish the waters near the Dry Tortugas actually make multi-day trips, and they maintain iced storage areas on board. Ice storage allows the crew to separate and ice the tails while at sea, to preserve the quality of the catch, since, unlike the typical day boat, they cannot keep the lobsters alive for the entire fishing trip (D. Gregory, Florida Sea Grant, pers. comm. 2007).

Vessels fishing off the Upper Florida Keys are generally smaller day crafts with crews of one. These vessels tend to be 30 ft on average, carrying no more than 500-800 traps per craft. Unlike the larger vessels fishing in the Lower Keys, these fishers tend to pull 100-300 traps per day. They also stay closer to shore and the duration of their trips is shorter than the larger vessels operating out of the Lower Keys (GMFMC and SAFMC 1987).

Commercial Diving

As of June 10, 2008, 335 fishers had licenses/endorsements to commercially harvest lobster via diving during the 2006-07 fishing season (FFWCC 2008). A fisher in possession of a license/certificate to fish traps is not eligible for a commercial dive permit unless they relinquish their trap certificate (Chapter 68B-24.0055(2)(b), F.A.C.). In the years immediately following the 1993 implementation of the trap limitation program, the proportion of landings attributed to the commercial dive component of the fishery increased steadily. That increase continued until 2003 when a commercial dive endorsement program was instituted that required an additional fee and license. During the 2005-06 fishing season, commercial divers landed approximately 250,000 pounds of lobster. Over the last year 10 years, commercial divers have accounted for approximately six percent of total lobster landings on average (Robson 2006).

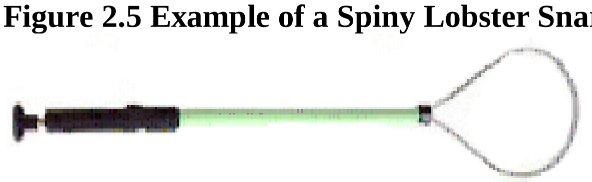
Commercial diving is most common off the Florida Keys and frequently occurs in the channels under the Overseas Highway. Divers also utilize shallow natural and artificial habitats occurring between shore and the offshore reef break. Significant harvest of spiny lobster by commercial diving also occurs in the Florida Bay south of the Everglades National Park and out into the Gulf of Mexico. Commercial divers collect lobsters by hand. The use of spears, hooks, or other gear types that would otherwise pierce the carapace are prohibited. Some of the shallow areas targeted by commercial divers also attract fishers harvesting lobsters with bully nets (GMFMC and SAFMC 1987).

2.3.3. Recreational Fishery

The magnitude of the recreational fishery was unknown until 1991 when a recreational permit requirement was implemented. An average of 130,000 recreational harvest permits are sold annually, though not all permits holders engage in lobster fishing (Robson 2006). Estimating the overall effort in the recreational fishery is difficult. Mail surveys, randomly dispatched to 5,000 individuals holding recreational lobster permits, are currently used to estimate recreational effort (see Eaken 2001 for survey details). Those surveys provide estimates of recreational landings during the 2-day special recreational season, and the first month of the regular commercial season. The two-day special recreational season is held during the last Wednesday and Thursday of July. The regular recreational fishing season otherwise coincides with the commercial season running from August 6 through March 31. During the 2005 2-day special recreational season, approximately 291,000 pounds of spiny lobster were harvested (R. Beaver, Florida Fish and Wildlife Conservation Commission, pers. comm. 2006).

Recreational fishing for spiny lobsters is primarily conducted by divers using scuba equipment, hookah rigs or freediving to collect lobsters by hand (GMFMC and SAFMC 1987). Snares are commonly used by recreational divers targeting lobsters. A snare consists of a long, thin pole that has a loop of coated wire on the end. The loop is placed around a lobster that may be residing in a tight overhang or other inaccessible location, and then tightened by a pull toggle at the base of the pole to capture and extract the lobster (Figure 2.4) (Barnette 2001). Bully nets are also used to collect lobster on shallow flats but the recreational catch attributed to this gear is very small. Traps are prohibited for recreational use, as are spears, hooks, or other gear types that would otherwise pierce the carapace. Lobsters taken in the recreational fishery are generally kept for personal consumption and not sold (GMFMC and SAFMC 1982).

Figure 2.5 Example of a Spiny Lobster Snare



From: Barnette 2001

There is little difference in the techniques and gears used by recreational and commercial divers targeting spiny lobsters. Like the commercial fishery, most recreational fishing effort occurs in Monroe County. Most recreational divers use their own boats or rent a boat from a local vendor while in Monroe County. Three to four divers per boat is common during the 2-day special recreational season (GMFMC and SAFMC 1982). Most divers stay in relatively shallow water (no deeper than 30 ft), though a few are believed to dive below 80 ft (Austin et al. 1977). Recreational divers target spiny lobsters in the same natural and artificial habitats commercial divers utilize and tend to also fish the same shelf areas, from shore seaward to the reef tract. Outside of Monroe County, the majority of recreationally harvested spiny lobsters are landed in Dade and Broward Counties, Florida. Recreational divers in these areas tend to fish the channels and flats between Cape Florida and Ragged Keys, as well as the creeks from Ragged Keys to Key Largo. Some recreational diving occurs as far north as West Palm Beach (GMFMC and SAFMC 1987).

2.4 Action Area

The action area for a biological opinion is defined as the area affected, directly or indirectly, by the fishery and not merely the immediate area where the action is occurring. The federal spiny lobster fishery, managed jointly by the GMFMC and SAFMC under the SLFMP, occurs throughout the South Atlantic and Gulf of Mexico regions. The SAFMC has jurisdiction throughout the South Atlantic states' EEZs, which extends from 3 nmi seaward of Florida, Georgia, South Carolina and North Carolina to 200 nmi.[12] The GMFMC has jurisdiction over the Gulf of Mexico states' EEZs, which include the waters 9 nmi seaward of the states of Florida and Texas, and 3 nmi seaward of the states of Alabama, Mississippi, and Louisiana, to 200 nmi from the seaward boundary of each coastal state. Gears likely to affect one or more of the listed species known to occur within these regions (detailed discussion to follow in Section 3) are only used off Florida. However, because the fishery is authorized to occur anywhere in the South Atlantic and Gulf of Mexico EEZs, the federal action indirectly affects both areas. Therefore, the action area of this consultation includes all of the U.S. South Atlantic and Gulf of Mexico EEZ.

[12] The EEZ off Florida does not extend all the way out 200 nm due to the close proximity of the Bahamas and Cuba.

3.0 Status of Species and Critical Habitat

Marine Mammals	**Status**
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
North Atlantic right whale (*Eubalaena glacialis*)	Endangered
Sea Turtles	
Green sea turtle (*Chelonia mydas*)	Endangered/Threatened*
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened
Invertebrates	
Elkhorn coral (*Acropora palmata*)	Threatened
Staghorn coral (*Acropora cervicornis*)	Threatened
Fish	
Smalltooth sawfish (*Pristis pectinata*)	Endangered**
Gulf sturgeon (*Acipencer oxyrinchus desotoi*)	Threatened

**Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered.*
***The U.S. distinct population segment (DPS).*

Critical Habitat

Acropora critical habitat has been designated in the action area. The Florida area contains three sub-areas: (1) The shoreward boundary for Florida sub-area A begins at the 6-ft (1.8 m) contour at the south side of Boynton Inlet, Palm Beach County at 26° 32' 42.5" N; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with latitude 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due west to the point of intersection with the 6-ft (1.8 m) contour, then follows the 6-ft (1.8 m) contour to the beginning point; (2) The shoreward boundary of Florida sub-area B begins at the MLW line at 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with longitude 82° W; then runs due north to the point of intersection with the South Atlantic Fishery Management Council (SAFMC) boundary at 24° 31' 35.75" N; then follows the SAFMC boundary to a point of intersection with the MLW line at Key West, Monroe County; then follows the MLW line, the SAFMC boundary (see 50 CFR 600.105(c)), and the COLREGS line (see 33 CFR 80.727. 730, 735, and 740) to the beginning point; and (3) The seaward boundary of Florida sub-area C (the Dry Tortugas) begins at the northern intersection of the 98-ft (30 m) contour and longitude 82° 45’ W; then follows the 98-ft (30 m) contour west around the Dry Tortugas, to the southern point of intersection with longitude 82° 45’ W; then runs due north to the beginning point.

We have determined that the proposed action being considered in this opinion is not likely to adversely affect the following species or critical habitat listed under the ESA: blue whales, sei whales, sperm whales, fin whales, humpback whales, North Atlantic right whales, Gulf sturgeon, North Atlantic right whale and *Acropora* critical habitat**.** These species and critical habitat are therefore excluded from further analysis and consideration in this opinion. The following discussion summarizes our rationale for these determinations and conclusions.

Blue, Sei, and Sperm Whales
The proposed action is not likely to adversely affect blue, sei, or sperm whales. In the Gulf of Mexico and South Atlantic region, blue, sei, and sperm whales are predominantly found seaward of the continental shelf. Sightings of sperm whales are almost exclusively in the continental shelf edge and continental slope areas (Scott and Sadove 1997). Sei and blue whales also typically occur in deeper waters and neither is commonly observed in the waters of the Gulf of Mexico or off the East Coast (CETAP 1982, Wenzel et al. 1988, Waring et al. 2002 and 2006). The depth at which these species are found makes any interaction with the spiny lobster fishery extremely unlikely. There are no documented take of these species by the spiny lobster fishery. For these reasons, NMFS believes the likelihood of these species being adversely affected by the proposed action is extremely low and therefore discountable.

Fin Whales
The proposed action is not likely to adversely affect fin whales. Fin whales are frequently found along the U.S. east coast, north of Cape Hatteras, North Carolina. They are also closely associated with the 100-m isobath, with sightings also spread over deeper water including canyons along the shelf break (Waring et al. 2006). The geographic range of the fin whale does not overlap areas of spiny lobster trap fishing as described above in Section 2. Some fishing effort for spiny lobster does occur off North Carolina, but the gears and techniques prosecuted there (see Section 2.2.1) make any interaction between the fishery and the fin whale extremely unlikely. Additionally, the 2008 List of Fisheries (72 FR 227; November 27, 2007) lists the Florida Spiny Lobster Trap/Pot fishery as a Category III Fishery under the MMPA. Category III fisheries are those where annual mortality and serious injury of a stock resulting from a fishery is less than or equal to one percent of the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. There has never been documented interaction or take of a large whale with a spiny lobster trap since the List of Fisheries was implemented in 1996. For these reasons, NMFS believes the likelihood of this species being adversely affected by the proposed action is extremely low and therefore discountable.

Humpback Whales

The proposed action is not likely to adversely affect humpback whales. Humpback whales are considered coastal whale species and are sighted most frequently in the South Atlantic along the southeastern U.S. from November through March on their migration south. December and January are peak times for humpbacks to occur off North Carolina as they migrate southward through coastal waters to their wintering grounds, with a second peak occurrence in March and April as they migrate north again to their summer feeding grounds.

There is no directed commercial fishing effort for spiny lobster in North Carolina. The gears used (rod-and-reel and diving spear) to take spiny lobster opportunistically are extremely unlikely to interact with humpbacks. There are no documented takes of this species by the spiny lobster fishery. For these reasons, NMFS believes the likelihood of this species being adversely affected by the proposed action is extremely low and therefore discountable.

North Atlantic Right Whales

The continued authorization of the Gulf of Mexico and South Atlantic Spiny Lobster Fishery is not likely to adversely affect right whales. North Atlantic right whales are likely to occur in the action area, from approximately November through March. These animals rarely migrate far enough to the south to overlap the areas where the majority of spiny lobster harvest occurs. The hand harvest methods used in the fishery (scuba and bully nets) will not affect right whales. Bully nets require an active fishing technique only used when target prey can be seen and the nets must be tended constantly. Due to the dynamic nature of this fishing technique, it is highly unlikely that a right whale would be accidentally entangled in this gear. Scuba diving is also extremely unlikely to adversely affect right whales. We believe any right whales coming in close proximity to divers would change their route to avoid them and any behavioral effects resulting from the presence of divers will be insignificant.

Traps used to commercially harvest spiny lobsters are also not likely to adversely affect right whales. Trap fishing within the action area occurs primarily in the Florida Keys (GMFMC and SAFMC 1987). Right whales occur only very rarely in areas where the trap fishery may occur. From 1935-2006, 820 right whales sightings have been documented off Florida, only 11 have occurred south of Cape Canaveral, Florida, and none were sighted in the Florida Keys (Read et al. 2007). Likewise, NMFS' List of Fisheries has never documented an interaction between a large whale and a spiny lobster trap since the List of Fisheries was implemented in 1996. For these reasons, NMFS believes the likelihood of this species being adversely affected by trap gear is extremely low and therefore discountable.

Gulf Sturgeon

Gulf sturgeon are not likely to be adversely affected by the proposed action. The Gulf sturgeon is an anadromous fish, inhabiting coastal rivers from Louisiana to Florida during the warmer months and over-wintering in estuaries, bays, and the Gulf of Mexico. Available data indicates Gulf sturgeon in the estuarine and marine environment show a preference for sandy shoreline habitats with water depths less than 3.5 m and salinity less than 6.3 parts per thousand (ppt) (Fox and Hightower 1998, Parauka et al. 2001). The federal spiny lobster fishery in the Gulf of Mexico operates well outside of the preferred habitat and salinity ranges of Gulf sturgeon. For these reasons, NMFS believes the likelihood of this species being adversely affected by the proposed action is extremely low and therefore discountable.

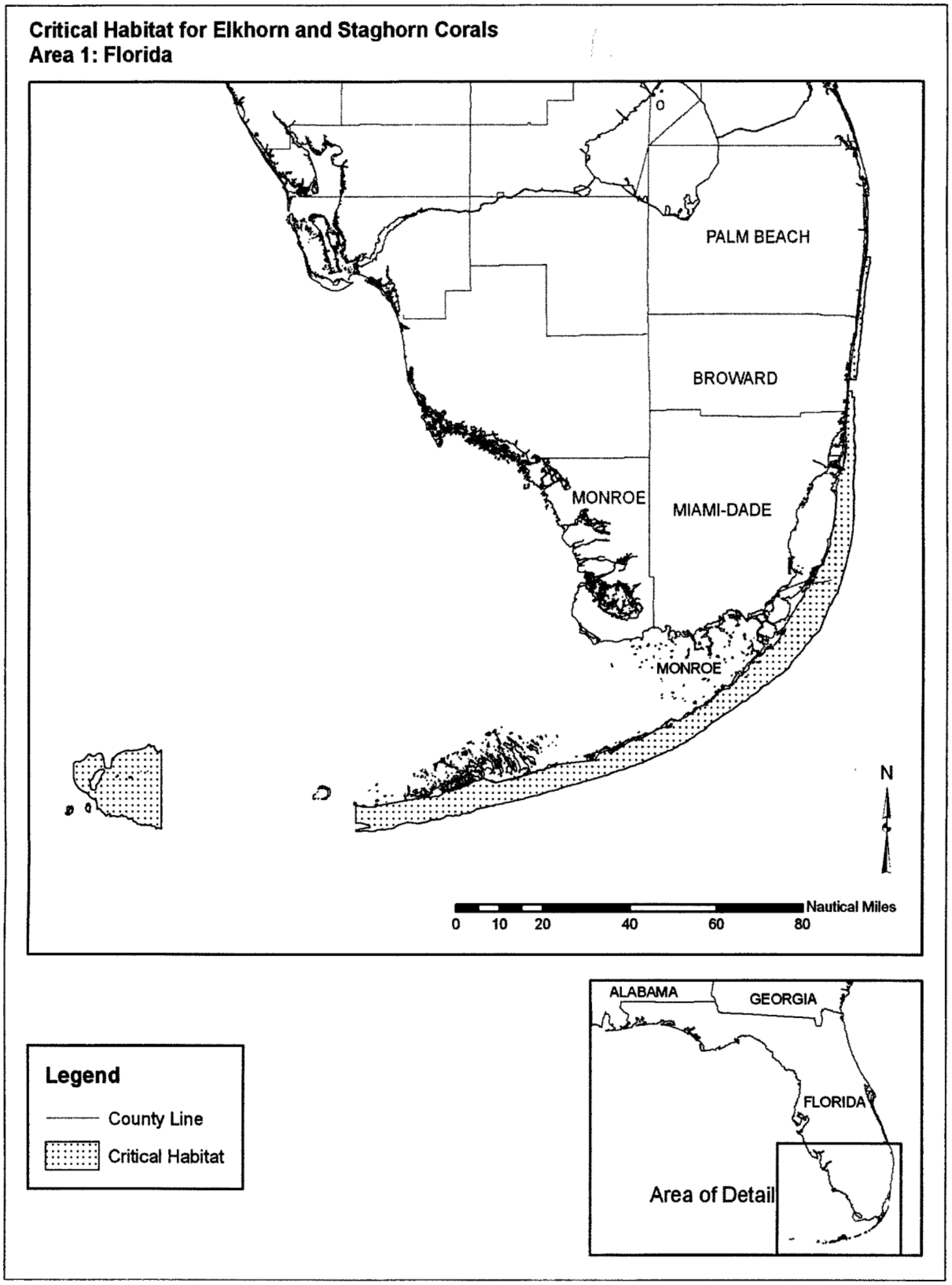
Acropora Critical Habitat

The physical or biological feature of *Acropora* critical habitat essential to their conservation (typically referred to as the primary constituent element, PCE) is substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. Substrate of suitable quality and availability is defined as consolidated hardbottom or dead coral skeleton that is free from fleshy macroalgae cover and sediment cover, occurring in water depths from the mean high water (MHW) line to 30 meters (98 feet). This feature has been identified in four locations within the jurisdiction of the United States: Florida, Puerto Rico, St. Thomas/St. John, and St. Croix. Only the Florida area falls within the action area. The Florida area contains three sub-areas: (1) The shoreward boundary for Florida sub-area A begins at the 6-ft (1.8 m) contour at the south side of Boynton Inlet, Palm Beach County at 26° 32' 42.5" N; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with latitude 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due west to the point of intersection with the 6-ft (1.8 m) contour, then follows the 6-ft (1.8 m) contour to the beginning point; (2) The shoreward boundary of Florida sub-area B begins at the MLW line at 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with longitude 82° W; then runs due north to the point of intersection with the South Atlantic Fishery Management Council (SAFMC) boundary at 24° 31’ 35.75” N; then follows the SAFMC boundary to a point of intersection with the MLW line at Key West, Monroe County; then follows the MLW line, the SAFMC boundary (see 50 CFR 600.105(c)), and the COLREGS line (see 33 CFR 80.727. 730, 735, and 740) to the beginning point; and (3) The seaward boundary of Florida sub-area C (the Dry Tortugas) begins at the northern intersection of the 98-ft (30 m) contour and longitude 82° 45’ W; then follows the 98-ft (30 m) contour west around the Dry Tortugas, to the southern point of intersection with longitude 82° 45’ W; then runs due north to the beginning point (Figure 3.1)(73 FR 72210; November 26, 2008).

Commercial/recreational bully netting and commercial/recreational diving for spiny lobster does not affect the PCE identified for *Acropora* critical habitat, or occurs so rarely that any affect on the PCE is discountable. Commercial trapping may affect *Acropora* critical habitat, but any affects will be temporary and insignificant. While commercial trapping does occur in areas where the PCE is present, the proposed action will not adversely affect the physical or biological features essential for conservation. Traps do not cause consolidated hardbottom to become unconsolidated, nor do they cause growth of macroalgae or cause sedimentation. For these reasons, we believe the annual deployment of traps will have no effect on consolidated hardbottom, macroalgal growth, or sedimentation, and we do not expected cumulative effects from trap deployment year after year. A trap could temporarily cover an area with the desired physical or biological characteristics. However, once a trap is retrieved the area it covered immediately becomes available. Therefore, we believe that trap impacts to *Acropora* critical habitat will be temporary and of such limited scope, that any adverse affects will be insignificant.

Likewise, any adverse affects to dead coral skeletons from spiny lobster trap fishing are discountable. No estimates are available regarding the area of dead coral skeletons in the action area. Therefore, to evaluate the impact of trap fishing on dead coral skeletons, we assumed dead coral skeletons suitable for *Acropora* larvae settlement covered each square meter of critical habitat. While we believe this circumstance is extremely unlikely to exist, this allowed us to make the most conservative estimate of impacts. Even under this highly unlikely set of conditions, only 0.25 percent of dead coral skeletons would be adversely impacted annually by traps mobilization and fishing, based on our estimate of trap impacts to ASH calculated in Section 5.0. This suggests that the rates of interaction between traps and dead coral skeletons are incredibly low even in this unlikely, but conservative, scenario. Under conditions more representative of the natural environment, we believe trap impacts to dead coral skeletons would be orders of magnitude lower. Thus, we believe any adverse affects to dead coral skeletons from spiny lobster trap fishing are discountable.

Figure 3.1 Map of the Elkhorn and Staghorn Critical Habitat Designated in Florida



3.2 Analysis of the Species Likely to be Adversely Affected

The following subsections are synopses of the best available information on the life history, distribution, population trends, and current status of the five species of sea turtles that are likely to be adversely affected by one or more components of the proposed action. Additional background information on the status of sea turtle species can be found in a number of published documents, including: recovery plans for the Atlantic green sea turtle (NMFS and USFWS 1991a), hawksbill sea turtle (NMFS and USFWS 1993), Kemp's ridley sea turtle (USFWS and NMFS 1992), leatherback sea turtle (NMFS and USFWS 1992), loggerhead sea turtle (NMFS and USFWS 2008); Pacific sea turtle recovery plans (NMFS and USFWS, 1998a-e); and sea turtle status reviews and biological reports (NMFS and USFWS 1995, Marine Turtle Expert Working Group (TEWG) 1998, 2000, and 2007, NMFS SEFSC 2001). Information on life history and threats to *Acropora* corals comes primarily for the *Acropora* status review document (*Acropora* BRT 2005). Sources of background information on the smalltooth sawfish include the smalltooth sawfish status review (NMFS 2000), the proposed and final listing rules, and several publications (Simpfendorfer 2001, Seitz and Poulakis 2002, Simpfendorfer and Wiley 2004, Poulakis and Seitz 2004).

3.2.1 Green Sea Turtle

Green turtles are distributed circumglobally, and can be found in the Pacific, Indian and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991a; Seminoff 2004; NMFS and USFWS 2007a). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered.

3.2.1.1 Pacific Ocean

Green turtles occur in the eastern, central, and western Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998a). Nesting is known to occur in the Hawaiian archipelago, American Samoa, Guam, and various other sites in the Pacific. The only major population (>2,000 nesting females) of green turtles in the western Pacific occurs in Australia and Malaysia, with smaller colonies throughout the area. Green turtles have generally been thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Seminoff 2002). Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. Historically, green turtles were used in many areas of the Pacific for food. They were also commercially exploited and this, coupled with habitat degradation led to their decline in the Pacific (NMFS and USFWS 1998a). Green turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis (NMFS and USFWS 1998a, NMFS 2004a).

Hawaiian green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka 2003). The East Island nesting beach in Hawaii is showing a 5.7 percent annual growth rate over 25 plus years (Chaloupka et al. 2007). In the eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacán, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007a). However, historically, greater than 20,000 females per year are believed to have nested in Michoacán, alone (Cliffton et al. 1982, NMFS and USFWS 2007a). Thus the current number of nesting females is still far below what has historically occurred. There is also sporadic green turtle nesting along the Pacific coast of Costa Rica. However, at least a few of the non-Hawaiian nesting stocks in the Pacific have recently been found to be undergoing long-term increases. Data sets over 25 years in Chichi-jima, Japan, Heron Island, Australia, and Raine Island, Australia, show increases (Chaloupka et al. 2007). These increases are thought to be the direct result of long-term conservation measures.

3.2.1.2 Indian Ocean

There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997, Ferreira et al. 2003). Based on a review of the 32 index sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green turtle nesting were evident for many of the Indian Ocean index sites. While several of these had not demonstrated further declines in the more recent past, only the Comoros Island index site in the western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

3.2.1.3 Atlantic Ocean

Life History and Distribution
The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs 1982, Frazer and Ehrhart 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. At approximately 20- to 25-cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or seagrasses. This includes areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991a). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957, Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Population Dynamics and Status
Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito Lagoon and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Caribbean coast of Panama, the Miskito Coast in Nicaragua, and scattered areas along Colombia and Brazil (Hirth 1997). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 5-year status review for the species identified eight geographic areas considered primary sites for green sea turtle nesting in the Atlantic/Caribbean and reviewed the trend in nest count data for each (NMFS and USFWS 2007a). These include: (1) Yucatán Peninsula, Mexico, (2) Tortuguero, Costa Rica, (3) Aves Island, Venezuela, (4) Galibi Reserve, Suriname, (5) Isla Trindade, Brazil, (6) Ascension Island, United Kingdom, (7) Bioko Island, Equatorial Guinea, and (8) Bijagos Archipelago (Guinea-Bissau) (NMFS and USFWS 2007a). Nesting at all of these sites was considered stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either site (NMFS and USFWS 2007a). Seminoff (2004) likewise reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007a).

By far, the most important nesting concentration for green turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007a). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007a). The number of females nesting per year on beaches in the Yucatán, Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007a). In the United States, certain Florida nesting beaches have been designated index beaches. Index beaches were established to standardize data collection methods and effort on key nesting beaches. The pattern of green turtle nesting shows biennial peaks in abundance with a generally positive trend during the ten years of regular monitoring since establishment of the index beaches in 1989, perhaps due to increased protective legislation throughout the Caribbean (Meylan et al. 1995). An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006, with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Data from index nesting beaches program in Florida support the dramatic increase in nesting. In 2007, there were 9,455 green turtle nests found just on index-nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008, but that is thought to be part of the normal biennial nesting cycle for green turtles (FWCC Index Nesting Beach Survey Database). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan et al. 1995). More recently, green turtle nesting occurred on Bald Head Island, North Carolina; just east of the mouth of the Cape Fear River; on Onslow Island; and on Cape Hatteras National Seashore. Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). Recent modeling by Chaloupka et al. (2007) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida), show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002). Ehrhart et al. (2007) has also documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area. It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the over-exploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, Southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson 1990, Jacobson et al. 1991).

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot be predicted, for the most part, with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may have significant impacts to the hatchling sex ratios of green turtles (NMFS and USFWS 2007a). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007a). Green sea turtle hatchling size also appears to be influenced by incubation temperatures, with smaller hatchlings produced at higher temperatures (Glenn et al. 2003).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, forage fish, etc., which could ultimately affect the primary foraging areas of green sea turtles.

3.2.1.4 Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the anthropogenic threats described above. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the almost 20 years of regular monitoring since establishment of index beaches in Florida in 1989. However, given the species' late sexual maturity, caution is warranted about over-interpreting nesting trend data collected for less than 20 years.

3.2.2 Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered under the precursor of the ESA on June 2, 1970, and is considered Critically Endangered by the International Union for the Conservation of Nature (IUCN). The hawksbill is a medium-sized sea turtle, with adults in the Caribbean ranging in size from approximately 62.5 to 94.0 cm straight carapace length. The species occurs in all ocean basins, although it is relatively rare in the Eastern Atlantic and Eastern Pacific, and absent from the Mediterranean Sea. Hawksbills are the most tropical sea turtle species, ranging from approximately 30°N latitude to 30°S latitude. They are closely associated with coral reefs and other hardbottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons (NMFS and USFWS 1993). There are only five remaining regional nesting populations with more than 1,000 females nesting annually. These populations are in the Seychelles, Mexico, Indonesia, and two in Australia (Meylan and Donnelly 1999). There has been a global population decline of over 80 percent during the last three generations (105 years) (Meylan and Donnelly 1999).

3.2.2.1 Indian Ocean

Approximately 83 nesting rookeries have been identified for hawksbill sea turtles, 31 occur in the Indian Ocean. Many of those nesting areas are relatively small hosting 100 or fewer nesting females annually. However, some nesting rookeries in Madagascar, Iran, and Western Australia may have as many as 1,000 to 2,000 nesting females annually. Based on the number of nesting females the population trends at the 31 nesting rookeries over the recent past (last 20 years) have remained stable in 2 locations, declined at 5, and are unknown for 24. Historically (20 to 100 years ago), populations trends at these nesting rookeries have been in decline at 17 sites and are unknown for 14 (NMFS and USFWS 2007b).

3.2.2.2 Pacific Ocean

Anecdotal reports throughout the Pacific indicate that the current Pacific hawksbill population is well below historical levels (NMFS 2004a). It is believed that this species is rapidly approaching extinction in the Pacific because of harvesting for its meat, shell, and eggs as well as destruction of nesting habitat (NMFS 2004a). Hawksbill sea turtles nest in the Hawaiian Islands as well as the islands and mainland of Southeast Asia, from China to Japan, and throughout the Philippines, Malaysia, Indonesia, Papua New Guinea, the Solomon Islands, and Australia (NMFS 2004a). However, along the eastern Pacific Rim where nesting was common in the 1930s, hawksbills are now rare or absent (Cliffton et al. 1982, NMFS 2004a).

3.2.2.3 Atlantic Ocean

In the western Atlantic, the largest hawksbill nesting population occurs on the Yucatán Peninsula of Mexico (Garduño-Andrade et al. 1999). With respect to the United States, nesting occurs in Puerto Rico, the U.S. Virgin Islands, and along the southeast coast of Florida. Nesting also occurs outside of the United States and its territories, in Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999a). Outside of the nesting areas, hawksbills have been seen off the U.S. Gulf of Mexico states and along the Eastern Seaboard as far north as Massachusetts, although sightings north of Florida are rare (NMFS and USFWS 1993).

Life History and Distribution
The best estimate of age at sexual maturity for hawksbill sea turtles is about 20-40 years (Chaloupka and Limpus 1997, Crouse 1999a). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to their nesting beach or to courtship stations along the migratory corridor (Meylan 1999b). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999, Richardson et al. 1999). Clutch size is larger on average (up to 250 eggs) than that of other sea turtles (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites.

The life history of hawksbills consists of a pelagic stage that lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm in straight carapace length (Meylan 1988, Meylan and Donnelly 1999), followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over several years (van Dam and Díez 1998).

The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (van Dam and Díez 1997, Mayor et al. 1998, León and Díez 2000).

Population Dynamics and Status
Nesting within the southeastern United States and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr), and, rarely, Florida (0-4 nests/yr) (Eckert 1995, Meylan 1999a, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute's Statewide Nesting Beach Survey data 2002). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999a).

Threats
As with other sea turtle species, hawksbill sea turtles are affected by habitat loss, habitat degradation, marine pollution, marine debris, fishery interactions, and poaching in some parts of their range. A complete list of other indirect factors can be found in NMFS SEFSC (2001). There continues to be a black market for hawksbill shell products ("tortoiseshell"), which likely contributes to the harvest of this species.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot be predicted, for the most part, with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may have affected the hatchling sex ratios of hawksbill sea turtles (NMFS and USFWS 2007b). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007b).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, coral reefs, forage fish, etc. Since hawksbills are typically associated with coral reef ecosystems, increases in global temperatures leading to coral death (Sheppard 2006) could adversely affect the foraging habitats of this species.

3.2.2.4 Summary of Status for Hawksbill Sea Turtles

Worldwide, hawksbill sea turtle populations are declining. They face many of the same threats affecting other sea turtle species. In addition, there continues to be a commercial market for hawksbill shell products, despite protections afforded to the species under U.S. law and international conventions.

3.2.3 Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977, Groombridge 1982, TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico's Tamaulipas State. This species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the United States.

Life History and Distribution
The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatchling stage (pelagic stage) within the Gulf of Mexico. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's ridleys have been found along the Eastern Seaboard of the U.S. and in the Gulf of Mexico. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). A 2005 dietary study of immature Kemp's ridleys off southwest Florida documented predation on benthic tunicates, a previously undocumented food source for this species (Witzell and Schmid 2005). These pelagic stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the Gulf of Mexico.

Population Dynamics and Status
Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999 (TEWG 2000). These trends are further supported by 2004-2007 nesting data from Mexico. The number of nests over that period has increased from 7,147 in 2004, to 10,099 in 2005, to 12,143 in 2006, and 15,032 during the 2007 nesting season (Gladys Porter Zoo 2007). An unofficial estimate for 2008 stands at 17, 882 nests (S. Epperly, NMFS, SEFSC, pers. comm.). A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, and a record 195 in 2008 (National Park Service data).

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of TEDs in the United States' and Mexico's shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015. Recent calculations of nesting females determined from nest counts show that the population trend is increasing towards that recovery goal, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (NMFS and USFWS 2007c, Gladys Porter Zoo 2007).

Next to loggerheads, Kemp's ridleys are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath et al. 1987, Musick and Limpus 1997). The juvenile population of Kemp's ridley sea turtles in Chesapeake Bay is estimated to be 211 to 1,083 sea turtles (Musick and Limpus 1997). These juveniles frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Kemp's ridleys consume a variety of crab species, including *Callinectes* spp., *Ovalipes* spp., *Libinia* spp., and *Cancer* spp. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and

New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Musick and Limpus 1997, Epperly et al. 1995a, Epperly et al. 1995b).

Threats

Kemp's ridleys face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold stunning. Although cold stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green sea turtles were found on Cape Cod beaches (R. Prescott, NMFS, pers. comm. 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stun events may be associated with numbers of sea turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned sea turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality. A complete list of other indirect factors can be found in NMFS SEFSC (2001).

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed in previous sections. For example, in the spring of 2000, a total of five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the sea turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured because of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot be predicted, for the most part, with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may have significant impacts to the hatchling sex ratios of Kemp's ridley sea turtles (Wibbels 2003, NMFS and USFWS 2007c). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007c).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, forage fish, etc., which could ultimately affect the primary foraging areas of Kemp's ridley sea turtles.

3.2.3.1 Summary of Kemp's Ridley Status

The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased from 1985 to 2008. Nesting has also exceeded 12,000 nests per year from 2004-2008 (Gladys Porter Zoo database). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids; thus, 'lag effects' as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches has allowed the species to begin to recover. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

3.2.4 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world and are found in waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to relatively low temperatures allows them to occur in northern waters such as off Labrador and in the

Barents Sea (NMFS and USFWS 1995). Adult leatherbacks forage in temperate and subpolar regions from 71ºN to 47ºS latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). That number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, the global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996), and felt they may be somewhat low, because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. However, the most recent population estimate for leatherback sea turtles from just the North Atlantic breeding groups is a range of 34,000-90,000 adult individuals (20,000-56,000 adult females) (TEWG 2007).

3.2.4.1 Indian Ocean

Long-term leatherback nesting data for many areas of the Indian Ocean are not available. In locations where data do exist, the number of nesting females is variable. In Sri Lanka, Andaman and Nicobar Islands (India) current nesting populations range from 100 to 600 females annually. Nesting beach populations are far less than that in Thailand, Mozambique, South Africa, and Meru Betiri (Java), where no more than 40 females nest annually at each location. Alas Perwo (Java) appears to be increasing in significance as a nesting beach in the Indian Ocean. The number of eggs recorded annually doubled from 500 to 1000, from the 1980s through the early 2000s (Hamann et al. 2006, NMFS and USFWS 2007d).

Population trends of leatherbacks in the Indian Ocean are difficult to ascertain. Annual fluctuations in the number of nest observed in South Africa over the last 42 years makes it difficult to estimates populations trends for this region. No nesting beach population trends are available for Sri Lanka, Thailand, and Andaman and Nicobar Islands (India). Nesting trends have increased in Alwas Perwo (Java) from the 1980s to the early 2000s, but a declining trend has been seen in Meru Betiri (Java) during the same period. The nesting trend in Mozambique appears stable (Hamann et al 2006, NMFS and USFWS 2007d).

3.2.4.2 Pacific Ocean

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (Spotila et al. 1996, NMFS and USFWS 1998c, Sarti et al. 2000, Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia – which was one of the most significant nesting sites in the western Pacific Ocean – has declined severely from an estimated 3,103 females in 1968 to two nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands, a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East

Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting assemblage has remained relatively abundant in the Pacific basin. The largest extant leatherback nesting assemblage in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 3,000 nests recorded annually (Putrawidjaja 2000, Suárez et al. 2000). During the early-to-mid 1980s, the number of female leatherback turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. More recently, this population has come under increasing threats that could cause this population to experience a collapse that is similar to what occurred at Terengganu, Malaysia. In 1999, for example, local Indonesian villagers started reporting dramatic declines in sea turtle populations near their villages (Suárez 1999). Unless hatchling and adult turtles on nesting beaches receive more protection, this population will continue to decline. Declines in nesting assemblages of leatherback turtles have been reported throughout the western Pacific region, with nesting assemblages well below abundance levels observed several decades ago (e.g., Suárez 1999).

In the western Pacific Ocean and South China Seas, leatherback turtles are captured, injured, or killed in numerous fisheries, including Japanese longline fisheries. The poaching of eggs, killing of nesting females, human encroachment on nesting beaches, beach erosion, and egg predation by animals also threaten leatherback turtles in the western Pacific.

In the eastern Pacific Ocean, nesting populations of leatherback turtles are declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches on the Pacific coast of Mexico supported as many as half of all leatherback turtle nests for the eastern Pacific. Since the early 1980s, the eastern Pacific Mexican population of adult female leatherback turtles has declined to slightly more than 200 individuals during 1998-99 and 1999-2000 (Sarti et al. 2000). Spotila et al. (2000) reported the decline of the leatherback turtle population at Playa Grande, Costa Rica, which had been the fourth largest nesting colony in the world. Between 1988 and 1999, the nesting colony declined from 1,367 to 117 female leatherback turtles. Based on their models, Spotila et al. (2000) estimated that the colony could fall to less than 50 females by 2003-2004. Leatherback turtles in the eastern Pacific Ocean are captured, injured, or killed in commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru, and purse seine fisheries for tuna in the eastern tropical Pacific Ocean, and California/Oregon drift gillnet fisheries. Because of the limited data, we cannot provide high-certainty estimates of the number of leatherback turtles captured, injured, or killed through interactions with these fisheries. However, between 8-17 leatherback turtles were estimated to have died annually between 1990 and 2000 in interactions with the California/Oregon drift gillnet fishery; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; 200 leatherback turtles are estimated to die in direct harvests in Indonesia; and before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them each year.

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and sub-adult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000) reported that female leatherback turtles have been killed for meat on nesting beaches like Píedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico, occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996, Spotila et al. 2000). The NMFS assessment of three nesting aggregations in its February 23, 2004, opinion supports this conclusion: If no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (for example, nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (e.g., Irian Jaya) (NMFS 2004a).

3.2.4.3 Atlantic Ocean

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS SEFSC 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NMFS SEFSC 2001). Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) resulted in an earlier determination that within the Atlantic basin there are at least three genetically different nesting populations: the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). Further genetic analyses using microsatellite markers in nuclear DNA along with the mtDNA data and tagging data has resulted in Atlantic Ocean leatherbacks now being divided into seven groups or breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the *Sargassum* areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Eckert et al. 1989, Hayes et al. 2004).

Life History and Distribution
Leatherbacks are a long-lived species, living for well over 30 years. It has been thought that they reach sexual maturity somewhat faster than other sea turtles (except Kemp's

ridley), with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). However, some recent research using sophisticated methods of analyzing leatherback ossicles has cast doubt on the previously accepted age to maturity figures, with leatherbacks in the western North Atlantic possibly not reaching sexual maturity until as late as 29 years of age (Avens and Goshe 2007). Continued research in this area is vitally important to understanding the life history of leatherbacks and has important implications in management of the species.

Female leatherbacks nest frequently (up to 10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30 percent) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26ºC until they exceed 100 ccl.

Although leatherbacks are the most pelagic of the sea turtles, they enter coastal waters on an irregular basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia, showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1 to 4,151 m, but 84.4 percent of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads - from 7º to 27.2ºC (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada to Cape Hatteras, North Carolina at approximately 300-600 animals.

General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages, but data is limited. Per TEWG (2007):

> Marked or satellite tracked turtles from the Florida and North Caribbean assemblages have been re-sighted off North America, in the Gulf of Mexico and along the Atlantic coast and a few have moved to western Africa, north of the equator. In contrast, Western Caribbean and Southern Caribbean/Guianas animals have been found more commonly in the eastern Atlantic, off Europe and northern Africa, as well as along the

> North American coast. There are no reports of marked animals from the Western North Atlantic assemblages entering the Mediterranean Sea or the South Atlantic Ocean, though in the case of the Mediterranean this may be due more to a lack of data rather than failure of Western North Atlantic turtles moving into the Sea. The tagging data coupled with the satellite telemetry data indicate that animals from the western North Atlantic nesting subpopulations use virtually the entire North Atlantic Ocean. In the South Atlantic Ocean, tracking and tag return data follow three primary patterns. Although telemetry data from the West African nesting assemblage showed that all but one remained on the shallow continental shelf, there clearly is movement to foraging areas of the south coast of Brazil and Argentina. There is also a small nesting aggregation of leatherbacks in Brazil, and while data are limited to a few satellite tracks, these turtles seem to remain in the southwest Atlantic foraging along the continental shelf margin as far south as Argentina. South African nesting turtles apparently forage primarily south, around the tip of the continent.

Population Dynamics and Status

The status of the Atlantic leatherback population has been less clear than the Pacific population. This uncertainty has been a result of inconsistent beach and aerial surveys, cycles of erosion and reformation of nesting beaches in the Guianas (representing the largest nesting area), a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species, and inconsistencies in the availability and analyses of data. However, recent coordinated efforts at data collection and analyses by the Leatherback Turtle Expert Working Group have helped to clarify the understanding of the Atlantic population status (TEWG 2007).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with the vast majority of the nesting occurring in the Guianas and Trinidad. Past analyses had shown that the nesting aggregation in French Guiana had been declining at about 15 percent per year since 1987 (NMFS SEFSC 2001). However, from 1979-1986, the number of nests was increasing at about 15 percent annually which could mean that the current decline could be part of a nesting cycle which coincides with the erosion cycle of Guiana beaches described by Schultz (1975). It is thought that the cycle of erosion and reformation of beaches has resulted in shifting nesting beaches throughout this region. This was supported by the increased nesting seen in Suriname, where leatherback nest numbers have shown large recent increases concurrent with declines elsewhere (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population was thought to possibly show an increase (Girondot 2002 in Hilterman and Goverse 2003). In the past many sea turtle scientists have agreed that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart et al. 2001). Genetics studies have added support to this notion and have resulted in the designation of the Southern Caribbean/Guianas stock. Using both Bayesian modeling and regression analyses, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate (using nesting females as a proxy for population). This positive growth was seen within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007).

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. The most intense nesting in that area occurs in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coast of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth-largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from three index nesting beaches in the region (Tortuguero, Gandoca, and Pacuare, in Costa Rica) using various Bayesian and regression analyses indicated that the nesting population was likely not growing over the 1995-2005 time series of available data (TEWG 2007), though modeling of the nesting data for Tortuguero indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng et al. 2007).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, the U.S. Virgin Islands (St. Croix), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1 percent (TEWG 2007). At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has fluctuated from a few hundred nests to a high of 1008 in 2001, and the average annual growth rate has been approximately 1.1 percent from 1986-2004 (TEWG 2007). Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2 percent between 1994 and 2004 (TEWG 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. In 2007, a record 517-leatherback nests were observed on the index beaches in Florida, with 265 in 2008 (FWCC Index Nesting Beach database). The reduction in nesting from 2007 to 2008 is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting.

The West African nesting stock of leatherbacks is a large, important, but mostly unstudied aggregation. Nesting occurs in various countries along Africa's Atlantic coast, but much of the nesting is undocumented and the data is inconsistent. However, it is known that Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in one season (Fretey et al. in press). Fretey et al. (in press) also provide detailed information about other known nesting beaches and survey efforts along the Atlantic African coast. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

Two other small but growing nesting stocks utilize the beaches of Brazil and South Africa. For the Brazilian stock, the TEWG (2007) analyzed the available data and determined that between 1988 and 2003 there was a positive annual average growth rate of 1.07 percent using regression analyses, and 1.08 percent using Bayesian modeling. The South African stock has an annual average growth rate of 1.06 based on regression modeling and 1.04 percent using the Bayesian approach (TEWG 2007).

Estimates of total population size for Atlantic leatherbacks are difficult to ascertain due to the inconsistent nature of the available nesting data. In 1996, the entire western Atlantic population was characterized as stable at best (Spotila et al. 1996), with numbers of nesting females reported to be about 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females. Spotila et al. (1996) estimated that the leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007).

Threats
Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, possibly their method of locomotion, and perhaps their attraction to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are typically foul-hooked by longline gear (e.g., on the flipper or shoulder area) rather than getting mouth-hooked or swallowing the hook (NMFS SEFSC 2001). A total of 24 nations, including the United States (accounting for 5-8 percent of the hooks fished), have fleets participating in pelagic longline fisheries in the area. Basin-wide, Lewison et al. (2004) estimated that 30,000-60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured may not be as high). Genetic studies performed within the Northeast Distant Fishery Experiment indicate that the leatherbacks captured in the Atlantic highly migratory species pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95 percent); individuals from West African stocks were surprisingly absent (Roden et al. in press).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill in NMFS SEFSC 2001). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the southeast Atlantic shrimp fishery, which operates predominately from North Carolina through southeast Florida (NMFS 2002a), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida, to the Virginia/North Carolina border. Leatherbacks also interact with the Gulf of Mexico shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles.

Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center (NEFSC) observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

Gillnet fisheries operating in the nearshore waters of the Mid-Atlantic States are also suspected of capturing, injuring, and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54 to 92 percent.

Poaching is not known to be a problem for nesting populations in the continental United States. However, in 2001 the NMFS Southeast Fishery Science Center (SEFSC) noted that poaching of juveniles and adults was still occurring in the U.S. Virgin Islands and the Guianas. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13 percent) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response in leatherbacks.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS SEFSC 2001, for a description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994, Graff 1995). Gillnets are one of the suspected causes of the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lageux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). A study by the Trinidad and Tobago's Institute for Marine Affairs (IMA) in 2002 confirmed that bycatch of leatherbacks is high in Trinidad. IMA estimated that more than 3,000 leatherbacks were captured incidental to gillnet fishing in the coastal waters of Trinidad in 2000. As much as one-half or more of the gravid turtles in Trinidad and Tobago waters may be killed (Lee Lum 2003). However, many of the turtles do not die because of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS SEFSC 2001).

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot be predicted, for the most part, with any degree of certainty. However, leatherback sea turtles are speculated to be the most capable of coping with climate change because they have the widest geographical distribution of any sea turtle and show relatively weak beach nesting site fidelity (Dutton et al. 1999).

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may alter the hatchling sex ratios of leatherback sea turtles (Mrosovsky et al. 1984, Hawkes et al. 2007, NMFS and USFWS 2007d). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). However, unlike other sea turtles species, leatherbacks tend to select nest locations in the cooler tidal zone of beaches (Kamel and Mrosovsky 2003). This preference may help mitigate the effects from increased beach temperature (Kamel and Mrosovsky 2003).

Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Global climate change is likely to influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007d). Several studies have shown leatherback distribution is influenced by jellyfish abundance (e.g., Houghton et al. 2006, Witt et al. 2006, Witt et al. 2007). How these changes in jellyfish abundance and distribution will affect leatherback sea turtle foraging behavior and distribution is currently unclear (Witt et al. 2007).

3.2.4.4 Summary of Leatherback Status

In the Pacific Ocean, the abundance of leatherback turtle nesting individuals and colonies has declined dramatically over the past 10 to 20 years. Nesting colonies throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females. In addition, egg poaching has reduced the reproductive success of the remaining nesting females. At current rates of decline, leatherback turtles in the Pacific basin are a critically endangered species with a low probability of surviving and recovering in the wild.

In the Atlantic Ocean, our understanding of the status and trends of leatherback turtles is somewhat more confounded, although the overall trend appears to be stable to increasing. The data indicates increasing or stable nesting populations in all of the regions except West Africa (no long-term data are available) and the Western Caribbean (TEWG 2007). Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic (i.e., leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal, and international waters). Poaching is also a problem that affects leatherbacks occurring in U.S. waters. Leatherbacks are also more susceptible to death or injury from ingesting marine debris than other turtle species.

3.2.5 Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. The majority of loggerhead nesting occurs in the western Atlantic Ocean (south Florida, United States), and the western Indian Ocean (Masirah, Oman); in both locations nesting assemblages have more than 10,000 females nesting each year (NMFS and USFWS 2008). Loggerhead sea turtles are the most abundant species of sea turtle in U.S. waters.

3.2.5.1 Pacific Ocean

In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. Within the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in eastern Australia (Great Barrier Reef and Queensland) and New Caledonia (NMFS SEFSC 2001). There are no reported loggerhead nesting sites in the eastern or central Pacific Ocean basin. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead sea turtles (Bolten et al. 1996). Information that is more recent suggests that nest numbers have increased somewhat over the period 1998-2004 (NMFS and USFWS 2007e). However, this period is too short to make a determination of the overall trend in nesting (NMFS and USFWS 2007e). Recent genetic analyses on female loggerheads nesting in Japan suggest that this “subpopulation” is comprised of genetically distinct nesting colonies (Hatase et al. 2002) with precise natal homing of individual females. As a result, Hatase et al. (2002) indicate that loss of one of these colonies would decrease the genetic diversity of Japanese loggerheads; recolonization of the site would not be expected on an ecological time scale. In Australia, long-term census data have been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting populations since the mid-1980s (Limpus and Limpus 2003). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off Baja California, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. In Australia, where turtles are taken in bottom trawl and longline fisheries, efforts have been made to reduce fishery bycatch (NMFS and USFWS 2007e).
In addition, the abundance of loggerhead sea turtles in nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Loggerhead turtle colonies in the western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (e.g., due to egg poaching).

In July 2007, NMFS received a petition requesting that loggerhead sea turtles in the North Pacific be classified as a distinct population segment (DPS) with endangered status and critical habitat designated. The petition also requested that if the North Pacific loggerhead is not determined to meet the DPS criteria, that loggerheads throughout the Pacific Ocean be designated as a DPS and listed as endangered. A thorough review by the Loggerhead Turtle Biological Review Team determined that Pacific loggerheads could be divided into two DPSs, the North Pacific DPS and South Pacific DPS (Conant et al. 2009).

3.2.5.2 Indian Ocean

Loggerhead sea turtles are distributed throughout the Indian Ocean, along most mainland coasts and island groups (Baldwin et al. 2003). Throughout the Indian Ocean, loggerhead sea turtles face many of the same threats as in other parts of the world including loss of nesting beach habitat, fishery interactions, and turtle meat and/or egg harvesting.

In the southwestern Indian Ocean, loggerhead nesting has shown signs of recovery in South Africa where protection measures have been in place for decades. However, in other southwestern areas (e.g., Madagascar and Mozambique) loggerhead nesting groups are still affected by subsistence hunting of adults and eggs (Baldwin et al. 2003). The largest known nesting group of loggerheads in the world occurs in Oman in the northern Indian Ocean. An estimated 20,000-40,000 females nest each year at Masirah, the largest nesting site within Oman (Baldwin et al. 2003). In the eastern Indian Ocean, all known nesting sites are found in Western Australia (Dodd 1988). As has been found in other areas, nesting numbers are disproportionate within the area, with the majority of nesting occurring at a single location. However, this may be the result of fox predation on eggs at other Western Australia nesting sites (Baldwin et al. 2003). A thorough review by the Loggerhead Turtle Biological Review Team determined that Indian Ocean loggerheads could be divided into three DPSs, the North Indian Ocean DPS, Southeast Indo-Pacific Ocean DPS, and Southwest Indian Ocean DPS (Conant et al. 2009).

3.2.5.3 Mediterranean Sea

Nesting in the Mediterranean is confined almost exclusively to the eastern basin. The highest level of nesting in the Mediterranean occurs in Greece, with an average of 3,050 nests per year. There is a long history of exploitation of loggerheads in the Mediterranean. Although much of this is now prohibited, some directed take still occurs. Loggerheads in the Mediterranean also face the threat of habitat degradation, incidental fishery interactions, vessel strikes, and marine pollution (Margaritoulis et al. 2003). Longline fisheries, in particular, are believed to catch thousands of juvenile loggerheads each year (NMFS and USFWS 2007e), although genetic analyses indicate that only a portion of the loggerheads captured originate from nesting groups in the Mediterranean (Laurent et al. 1998). A thorough review by the Loggerhead Turtle Biological Review Team determined that Mediterranean loggerheads could comprise a separate DPS, denoted the Mediterranean Sea DPS (Conant et al. 2009).

3.2.5.4 Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. Previous section 7 analyses have recognized at least five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a south Florida nesting subpopulation, occurring from 29ºN on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001). The recently published Recovery Plan for the northwest Atlantic population of loggerhead sea turtles concluded, based on recent advances in genetic analyses, that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula, and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the Plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: the (1) Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The Recovery Plan concluded that all recovery units are essential to the recovery of the species. The Loggerhead Biological Review Team determined that loggerhead turtles in the Atlantic meet the required characteristics for listing as three separate DPSs, the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009).

Life History and Distribution

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985, Frazer et al. 1994) with the benthic immature stage lasting at least 10-25 years. However, based on new data from tag returns, strandings, and nesting surveys NMFS SEFSC (2001) estimated ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests per individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length, they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico.

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year-round in offshore waters off North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 1995a-c), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority of loggerheads leave the Gulf of Maine by mid-September but some may remain in mid-Atlantic and Northeast areas until late fall. By December, loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles ($\geq$ 11°C) (Epperly et al. 1995a-c). Loggerhead sea turtles are year-round residents of central and south Florida.

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hardbottom habitats.

Studies that are more recent are revealing that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002, Blumenthal et al. 2006, Hawkes et al. 2006, McClellan and Read 2007). One of the studies tracked the movements of adult females post-nesting and found a difference in habitat use was related to body size, with larger turtles staying in coastal waters and smaller turtles traveling to oceanic waters (Hawkes et al. 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse, with some remaining in neritic waters while others moved off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes et al. study (2006), there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007). In either case, the research not only supports the need to revise the life history model for loggerheads but also demonstrates that threats to loggerheads in both the neritic and oceanic environments are likely affecting multiple life stages of this species.

Population Dynamics and Status
A number of stock assessments and similar reviews (TEWG 1998, TEWG 2000, NMFS SEFSC 2001, Heppell et al. 2003, NMFS and USFWS 2008, Conant et al. 2009, TEWG 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size.

Numbers of nests and nesting females can vary widely from year to year. However, nesting beach surveys can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of females turtles, as long as such studies are sufficiently long, and effort and methods are standardized (see, e.g., NMFS and USFWS 2008; Meylan 1982). NMFS and USFWS (2008) concluded that the lack of change in two important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population. Recent analysis of available data for the Peninsular Florida Recovery Unit has led to the conclusion that the observed decline in nesting for that unit over the last several years can best be explained by an actual decline in the number of adult female loggerheads in the population (Witherington et al. 2009).

Annual nest totals from beaches within what NMFS and USFWS have defined as the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data), representing approximately 1,272 nesting females per year (4.1 nests per female, Murphy and Hopkins 1984). The loggerhead-nesting trend from daily beach surveys showed a significant decline of 1.3 percent annually. Nest totals from aerial surveys conducted by SCDNR showed a 1.9 percent annual decline in nesting in South Carolina since 1980. Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. Data in 2008 has shown improved nesting numbers, but future nesting years will need to be analyzed to determine if a change in trend is occurring. In 2008, 841 loggerhead nests were observed compared to the 10-year average of 715 nests in North Carolina. In South Carolina, 2008 was the seventh-highest nesting year on record since 1980, with 4,500 nests, but this did not change the long-term trend line indicating a decline on South Carolina beaches. Georgia beach surveys located 1,648 nests in 2008. This number surpassed the previous statewide record of 1,504 nests in 2003. According to analyses by Georgia DNR, the 40-year time-series trend data shows an overall decline in nesting, but the shorter comprehensive survey data (20 years) indicates a stable population (SCDNR 2008, GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data).

Another consideration that may add to the importance and vulnerability of the NRU is the sex ratios of this subpopulation. NMFS scientists have estimated that the Northern subpopulation produces 65 percent males (NMFS SEFSC 2001). However, research conducted over a limited period has found opposing sex ratios (Wyneken et al. 2004), so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the Northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the northwest Atlantic. A near-complete nest census undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (from NMFS and USFWS 2008). An analysis of index nesting beach data shows a decline in nesting by the PFRU between 1989 and 2008 of 26 percent over the period, and a mean annual rate of decline of 1.6 percent (Witherington et al. 2009, NMFS and USFWS 2008).

The remaining three recovery units—the Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages but still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2004 (although the 2002 year was missed). Nest counts ranged from 168-270, with a mean of 246, but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data; NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. The 12-year dataset (1997-2008) of index nesting beaches in the area shows a significant declining trend of 4.7 percent annually (NMFS and USFWS 2008). Similarly, nesting survey effort has been inconsistent among the GCRU nesting beaches and no trend can be determined for this subpopulation. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. However, nesting has declined since 2001 and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008)

Determining the meaning of the nesting decline data is confounded by various in-water research that suggest the abundance of neritic juvenile loggerheads is steady or increasing (Ehrhart et al. 2007; M. Bersette pers. comm. regarding captures at the St. Lucie Power Plant; SCDNR unpublished SEAMAP-SA data; Epperly et al. 2007). Ehrhart et al. (2007) found no significant regression-line trend in the long-term dataset. However, notable increases in recent years and a statistically significant increase in CPUE of 102.4 percent from the 4-year period of 1982-1985 to the 2002-2005 periods were found. Epperly et al. (2007) determined the trends of increasing loggerhead catch rates from all the aforementioned studies in combination provide evidence that there has been an increase in neritic juvenile loggerhead abundance in the southeastern United States in the recent past. A study led by the South Carolina Department of Natural Resources found that standardized trawl survey CPUEs for loggerheads from South Carolina to north Florida was 1.5 times higher in summer 2008 than summer 2000. However, even though there were persistent inter-annual increases from 2000-2008, the difference was not statistically significant, likely due to the relatively short time-series. Comparison to other data sets from the 1950s through 1990s showed much higher CPUEs in recent years regionally and in the South Atlantic Bight, leading SCDNR to conclude that it is highly improbable that CPUE increases of such magnitude could occur without a real and substantial increase in actual abundance (Arendt et al. 2009). Whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence is not clear. NMFS and USFWS (2008), citing Bjorndal et al. 2005, caution about extrapolating localized in-water trends to the broader population, and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest Stage III individuals (oceanic/neritic juveniles, historically referred to as small benthic juveniles), which could indicate a relatively large cohort that will recruit to maturity in the near future. However, the increase in adults may be temporary, as in-water studies throughout the eastern United States also indicate a substantial decrease in the abundance of the smallest Stage III loggerheads, a pattern also corroborated by stranding data (TEWG 2009).

The NMFS Southeast Fishery Science Center has developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS SEFSC 2009). This model does not incorporate existing trends in the data (such as nesting trends), but relies on utilizing the available information on the relevant life-history parameters for sea turtles and then predicts future population trajectories based upon model runs using those parameters. Therefore, the model results do not build upon, but instead are complementary to, the trend data obtained through nest counts and other observations. The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Model runs were done for each individual recovery unit as well as the western North Atlantic population as a whole, and the resulting trajectories were found to be very similar. One of the most robust results from the model was an estimate of the adult female population size for the western North Atlantic over the 2004-2008 period. The distribution resulting from the model runs suggest the adult female population size to be likely between approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000. A much less robust estimate for total benthic females in the western North Atlantic ranged from approximately 30,000-300,000 individuals, up to less than 1 million.

The results of one set of model runs suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. This example was run to predict the distribution of projected population trajectories for benthic females using a range of starting population numbers from the estimated minimum of 30,000 to the greater than 300,000 upper end of the range and declining trajectories were estimated for all of the population estimates. After 10,000 simulation runs of the models using the parameter ranges, 14 percent of the runs resulted in growing populations, while 86 percent resulted in declining populations. While this does not translate to an equivalent statement that there is an 86 percent chance of a declining population, it does illustrate that given the life history parameter information currently thought to comprise the likely range of possibilities, it appears most likely that with no changes to those parameters the population is projected to decline. Additional model runs using the range of values for each life history parameter, the assumption of non-uniform distribution for those parameters, and a 5 percent natural (non-anthropogenic) mortality for the benthic stages, resulted in a determination that a 60-70 percent reduction in anthropogenic mortality in the benthic stages would be needed to bring 50 percent of the model runs to a static (zero growth or decline) or increasing trajectory (NMFS SEFSC 2009).

Predicting the future populations or population trajectories of loggerhead sea turtles with precision is currently very difficult because of the large uncertainty in our knowledge of loggerhead life history. Therefore, fine-scale examinations of how individual fisheries or actions affect the population trajectories cannot be resolved. However, the model results are useful in guiding future research needs to better understand the life history parameters that have the most significant impact in the model. Additionally, the model results provide valuable insights into the likely overall declining status of the species and in the impacts of large-scale changes to various life history parameters (such as mortality rates for given stages) and how they may change the trajectories. The results of the model, in conjunction with analyses conducted on nest count trends (such as Witherington et al. 2009), which have suggested that the population decline is real, provides a strong basis for the conclusion that the western North Atlantic loggerhead population is in decline. NMFS also convened a new Turtle Expert Working Group (TEWG) for loggerhead sea turtles that is gathering available data and examining the potential causes of the nesting decline and what the decline means in terms of population status. The TEWG ultimately could not determine whether or not decreasing annual numbers of nests among the Western North Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of the adult females, decreasing numbers of adult females, or a combination of those factors. Past and present mortality factors that could affect current loggerhead nest numbers are many, and it is likely that several factors compound to create the current decline. Regardless of the source of the decline, it is clear that the reduced nesting will result in depressed recruitment to subsequent life stages over the coming decades (TEWG 2009).

Threats

The 5-year status review of loggerhead sea turtles recently completed by NMFS and the USFWS provides a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007e). The Loggerhead Recovery Team also undertook a comprehensive evaluation of threats to the species, and described them separately for the terrestrial, neritic, and oceanic zones (NMFS and USFWS 2008). The diversity of sea turtles' life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms, as well as wave action, can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). In addition, many nests were destroyed during the 2004 and 2005 hurricane seasons. Other sources of natural mortality include cold-stunning and biotoxin exposure.

Anthropogenic factors that affect hatchlings and adult female sea turtles on land, or the success of nesting and hatching include: beach erosion, beach armoring and nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach driving, coastal construction and fishing piers, exotic dune and beach vegetation, and poaching. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g., raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high-density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the highly migratory species' Atlantic pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea (Aguilar et al. 1995, Bolten et al. 1994, Crouse 1999b). Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook-and-line, gillnet, pound net, longline, and trap fisheries. The sizes and reproductive values of sea turtles taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles if the fishery removes a higher overall reproductive value from the population (Wallace et al. 2008). The Loggerhead Biological Review Team determined that the greatest threats to the Northwest Atlantic DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009). Attaining a more thorough understanding of the characteristics, as well as the quantity, of sea turtle bycatch across all fisheries is of great importance.

Loggerheads may also be facing a new threat that could be either natural or anthropogenic. A little understood disease may pose a new threat to loggerheads sea turtles. From October 5, 2000, to March 24, 2001, 49 debilitated loggerheads associated with the disease were found in southern Florida from Manatee County on the west coast through Brevard County on the east coast (Foley 2002). From the onset of the epizootic through its conclusion, affected sea turtles were found throughout south Florida. Most (N=34) were found in the Florida Keys (Monroe County). The number of dead or debilitated loggerheads found during the epizootic (N=189) was almost six times greater than the average number found in south Florida from October to March during the previous ten years. After determining that no other unusual mortality factors appeared to have been operating during the epizootic, 156 of the strandings were likely to be attributed to disease outbreak. These numbers may represent only 10 to 20 percent of the sea turtles that were affected by this disease because many dead or dying sea turtles likely never wash ashore. Overall mortality associated with the epizootic was estimated between 156 and 2,229 loggerheads (Foley 2002). Scientists were unable to attribute the illness and epidemic to any one specific pathogen or toxin. If the agent responsible for debilitating these sea turtles re-emerges in Florida, and if the agent is infectious, nesting females could spread the disease throughout the range of the adult loggerhead population.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot be predicted, for the most part, with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may have significant impacts to the hatchling sex ratios of loggerhead sea turtles (NMFS and USFWS 2007e). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007e). Modeling suggests that an increase of 2°C in air temperature would result in a sex ratio of over 80 percent female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100 percent female offspring. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most clutches, leading to death (Hawkes et al. 2007).

Warmer sea surface temperatures have been correlated to an earlier onset of loggerhead nesting in the spring (Weishampel et al. 2004, Hawkes et al. 2007), as well as short inter-nesting intervals (Hays et al. 2002), and shorter nesting season (Pike et al. 2006).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). Alternatively, nesting females may nest on the seaward side of the erosion control structures, potentially exposing them to repeated tidal over wash (NMFS and USFWS 2007e). Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc., which could ultimately affect the primary foraging areas of loggerhead sea turtles.

Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of pelagic immatures, benthic immatures, and sexually mature age classes in various fisheries and other marine activities. Recent actions have taken significant steps towards reducing the environmental baseline and improving the status of all loggerhead subpopulations. For example, the TED regulation published on February 21, 2003, (68 FR 8456) represents a significant improvement in the baseline affecting loggerhead sea turtles. Shrimp trawling is considered the largest source of anthropogenic mortality on loggerheads.

3.2.5.5 Summary of Status for Loggerhead Sea Turtles

In the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in Australia (Great Barrier Reef and Queensland) and New Caledonia. The abundance of loggerhead sea turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead sea turtles (Bolten et al. 1996), but it has probably declined since 1995 and continues to decline (Tillman 2000). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. The NMFS recognizes five recovery units of loggerhead sea turtles in the western north Atlantic based on genetic studies and management regimes. Cohorts from all of these are known to occur within the action area of this consultation. There are long-term declining nesting trends for the two largest western Atlantic recovery units: the PFRU and the NRU. Furthermore, no long-term data suggest any of the loggerhead subpopulations throughout the entire North Atlantic are increasing in annual numbers of nests (TEWG 2009). Additionally, using both computation of susceptibility to quasi-extinction and stage-based deterministic modeling to determine the effects of known threats to the Northwest Atlantic DPS, the Loggerhead Biological Review Team determined that this DPS is likely to decline in the foreseeable future, driven primarily by the mortality of juvenile and adult loggerheads from fishery bycatch throughout the North Atlantic Ocean. These computations were done for each of the recovery units, and all of them resulted in an expected decline (Conant et al. 2009). Because of its size, the PFRU may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991b). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown. On March 5, 2008, NMFS and USFWS published a 90-day finding that a petitioned request to reclassify loggerhead turtles in the western North Atlantic Ocean as a distinct population segment may be warranted (73 FR 11849). NMFS and USFWS have formed a biological review team to assess the data and will complete the petition findings and plan of action by May 1, 2009. The Loggerhead Biological Review Team determined that loggerhead sea turtles in the Atlantic meet the required characteristics to be separated into three DPSs, the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009). NMFS and USFWS will use the information in that review, along with other available information, to determine the listing status (threatened or endangered) for each DPS.

All loggerhead subpopulations are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur because of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

3.2.6 Elkhorn Coral

Elkhorn coral was listed as threatened under the ESA on May 9, 2006. The Atlantic *Acropora* Status Review presents a summary of published literature and other currently available scientific information regarding the biology and status of both elkhorn and staghorn corals. The following discussion summarizes those findings relevant to elkhorn coral and our evaluation of the proposed action.

Elkhorn coral is one of major reef-building corals in the wider Caribbean. Colonies are flattened to nearly round, with frond-like branches that typically radiate outward from a central trunk, firmly attached to the sea floor. Historically, this species formed dense thickets at shallow (<5 m) and intermediate (10 to 15 m) depths in many reef systems, including some locations in the Florida Keys, western Caribbean (e.g., Jamaica, Cayman Islands, Caribbean Mexico, Belize), and eastern Caribbean. Early descriptions of Florida Keys reefs referred to reef zones, of which the elkhorn zone was described for many shallow-water reefs (Figure 3.3) (Jaap 1984, Dustan 1985, Dustan and Halas 1987). However, the structural and ecological roles of elkhorn coral in the wider Caribbean are unique and cannot be filled by other reef-building corals in terms of accretion rates and the formation of structurally complex reefs (Bruckner 2002).

Life History

The maximum range in depth reported for elkhorn coral is <1 m to 30 m, but the optimal depth range for this coral is considered to be 1 to 5 m (Goreau and Wells 1967). Currently, the deepest known colonies of elkhorn coral occur at 21 m in the Flower Garden Banks National Marine Sanctuary (Hickerson pers. comm.) and at Navassa National Wildlife Refuge (Miller pers. comm.). The preferred habitat of elkhorn coral is the seaward face of a reef (turbulent shallow water), including the reef crest, and the shallow spur-and-groove zone (Shinn 1963, Cairns 1982, Rogers et al. 1982). Colonies are occasionally exposed during low tide. Colonies of elkhorn coral often grow in nearly monospecific,[13] dense stands and form interlocking frameworks, known as thickets, in fringing and barrier reefs (Jaap 1984, Tomascik and Sander 1987, Wheaton and Jaap 1988). Colonies generally do not form a thicket below 5 m depth, with maximum water depths of framework construction ranging from 3 to 12 m (see Table 1 in Lighty et al. 1982).

Typical water temperatures for elkhorn coral range from 21°-29°C, although colonies in the U.S.V.I. have been known to tolerate short-term temperatures around 30°C without obvious bleaching.[14] Jaap (1979) and Roberts et al. (1982) note an upper temperature tolerance of 35.8°C for elkhorn coral. All *Acropora* species are susceptible to bleaching due to adverse environmental conditions (Ghiold and Smith 1990, Williams and Bunkley-Williams 1990). Major mortality of elkhorn corals occurred in the Dry Tortugas, Florida, in 1977 due to a winter cold front that depressed surface water temperatures to 14°-16°C. All *Acropora* species require near-oceanic salinities (34 to 37 ppt).

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[13] Monospecific stands refer to stands made up of only one species of coral.
[14] Bleaching refers to the loss of zooxanthellae.

Elkhorn coral, like many stony coral species, employ both sexual and asexual reproductive propagation. Elkhorn corals reproduce sexually by broadcast spawning. During these spawning events, colonies are simultaneously hermaphroditic[15] and coral larvae develop externally to the parental colonies (Szmant 1986). The spawning season for elkhorn coral is relatively short, with gametes released only during a few nights in July, August, and/or September. In some populations, spawning is synchronous after the full moon during any of these three months. Annual egg production by elkhorn coral populations studied in Puerto Rico was estimated to be 600 to 800 eggs per cm^2 of living coral tissue (Szmant 1986).

Fertilization and development of elkhorn corals is exclusively external. Embryonic development culminates with the development of planktonic larvae called planulae. Little is known about the settlement patterns of planulae (Bak et al. 1977, Sammarco 1980, Rylaarsdam 1983). In general, upon proper stimulation, coral larvae, whether released from parental colonies or developed in the water column external to the parental colonies, settle and metamorphose on appropriate substrates, in this case preferably coralline algae. Unlike most other coral larvae, elkhorn planulae appear to prefer to settle on upper, exposed surfaces, rather than in dark or cryptic ones (Szmant and Miller 2006), at least in a laboratory setting. Initial calcification ensues with the forming of the basal plate and the initial protosepta, followed by the theca or polyp wall and axial skeletal members. Buds that form on the initial corallite develop into daughter corallites.

Studies of elkhorn corals on the Caribbean coast of Panama indicated that larger colonies[16] had higher fertility rates than smaller colonies (Soong and Lang 1992). For example, over 80 percent of the elkhorn colonies larger than 4000 cm^2 were fertile. The estimated size at puberty for elkhorn coral was 1600 cm^2 and the smallest reproductive colony observed was 16 x 8 cm^2 (128 cm^2)(Soong and Lang 1992).

The growth rate of elkhorn coral, expressed as the linear extension of branches, is reported to range from 4 to 11 cm annually (Vaughan 1915, Jaap 1974). The 4-cm annual growth rate cited by Vaughan (1915) undoubtedly underestimates growth. Annual linear extension was estimated to be 8.8 cm; basal extension was 2.3 mm/month, and tissue growth was 200 cm^2 per month at Quintana Roo, Puerto Morelos, Mexico (Padilla and Lara 1996). Wells (1933) reported from observations in 1932 that colonies of elkhorn coral were eight feet high (2.4 m) and 15 feet (4.5 m) in diameter at Bird Key Reef, Dry Tortugas; this is probably the maximum size that this species can attain.

Few data on the genetic population structure of elkhorn coral exist; however, due to recent advances in technology, the genetic population structure of the current, depleted population is beginning to be characterized. Baums et al. (2005) examined the genetic exchange in elkhorn coral by sampling and genotyping colonies from 11 locations throughout its geographic range using microsatellite markers. Results indicate that

[15] Simultaneously hermaphroditic refers to colonies with both female and male reproductive parts. Gametes (eggs and sperm) of these colonies are located in different mesenteries of the same polyp (Soong 1991). However, gametes from the same colony cannot combine to produce viable recruits.

[16] As measured by surface area of the live colony.

elkhorn populations in the eastern Caribbean (St. Vincent and the Grenadines, U.S.V.I., Curacao, and Bonaire) have experienced little or no genetic exchange with populations in the western Caribbean (Bahamas, Florida, Mexico, Panama, Navassa, and Mona Island). Mainland Puerto Rico is an area of mixing where elkhorn populations show genetic contribution from both regions, though it is more closely connected with the western Caribbean. Within these regions, the degree of larval exchange appears to be asymmetrical, with some locations being entirely self-recruiting and some receiving immigrants from other locations within their region.

Status and Distribution

Historically, elkhorn coral comprised the elkhorn zone (Figure 3.3) at 1 to 8 m depths (reef flat, wave zone, reef crest) throughout much of the wider Caribbean. These corals populated these reefs zones in areas like Jamaica (Goreau 1959); Alacrán Reef, Yucatán Peninsula (Kornicker and Boyd 1962); Abaco Island, Bahamas (Storr 1964); the southwestern Gulf of Mexico; Bonaire (Scatterday 1974); and the Florida Keys (Jaap 1984, Dustan and Halas 1987). Elkhorn coral also formed extensive barrier-reef structures in Belize (Cairns 1982); the greater and lesser Corn Islands, Nicaragua (Gladfelter 1982, Lighty et al. 1982); and Roatan, Honduras. The predominance of elkhorn coral in shallow reef zones is related to the degree of wave energy. In areas with strong wave energy conditions only isolated colonies may occur, while thickets may develop in areas of intermediate wave energy conditions (Geister 1977). Storm-generated fragments are often found occupying back reef areas immediately landward of the reef flat/reef crest, while colonies are rare on lagoonal patch reefs (Dunne and Brown 1979). Although considered a turbulent water species, elkhorn coral is sensitive to breakage by wave action and is often replaced by coralline algae in heavy surf zones (Adey 1977).

Studies of historical distribution and abundance patterns focus on percent coverage, density, and relative size of the corals during three periods: pre-1980, the 1980-1990 decades, and recent (since 2000). Few data are present before 1980, likely due in part to researchers' tendencies to neglect careful measurement of abundance for ubiquitous species.

Both species underwent precipitous declines in the early 1980s throughout their ranges and this decline has continued. Although quantitative data on former distribution and abundance are scarce, in the few locations where quantitative data are available (e.g., Florida Keys, Dry Tortugas, Belize, Jamaica, and the U.S.V.I.), declines in abundance (coverage and colony numbers) are estimated at >97 percent. Although this decline has been documented as on-going during in the late 1990s, and even in the past five years in some locations, local extirpations (i.e., at the island or country scale) have not been rigorously documented.

Figure 3.4 summarizes the abundance trends of specific locations throughout the wider Caribbean where quantitative data exist, illustrating the overall trends of decline for elkhorn corals since the 1980s. It is important to note that the data are from the same geographic area, not repeated measures at an exact reef/site that would indicate more general trends. The overall regional trend depicted is a >97 percent loss of coverage (area of substrate the species occupy).

Threats

Elkhorn corals are facing a myriad of threats that are in some cases acting synergistically. Diseases, temperature-induced bleaching, and physical damage from hurricanes are deemed the greatest threats to elkhorn corals. The threat from disease, though clearly severe, is poorly understood in terms of etiology and possible links to anthropogenic stressors. Threats from anthropogenic physical damage (e.g., vessel groundings, anchors, divers/snorkelers, etc.), coastal development, competition, and predation are deemed moderate (*Acropora* BRT 2005). Table 3.2 summarizes the factors affecting the status of elkhorn coral and the identified sources of those threats.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities – frequently referred to in layman's terms as “global warming.” Some of the likely effects to elkhorn coral are: increased water temperature and frequency of bleaching events, elevated CO_2 levels and reduced calcification for coral skeletal growth, sea-level rise, and changes in the frequency or intensity of storms (*Acropora* BRT 2005). The Environmental Protection Agency’s climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on elkhorn coral currently cannot be predicted, for the most part, with any degree of certainty.

Increased temperatures resulting from global climate change could allow reef distribution to shift to more northern latitudes; however, Buddemeier et al. (2004) argued that such migration would be impeded because humans have negatively altered the coastal areas where future reefs might form. If global climate change alters the northward flowing warm oceanic currents, high latitude reefs may be threatened.

Coral bleaching patterns are complex and seasonal cycles in symbiotic dinoflagellate density occur in many species (Fitt et al. 2001), but there is general agreement that thermal stress leading to bleaching and mass mortality has increased during the past 25 years (Brown 1997). Most corals are able to withstand seasonal variations in water temperatures though an increase of 1° to 2°C above the normal seasonal maximum can induce bleaching (Fitt and Warner 1995). Bleaching events lasting for more than a few weeks may cause mortality (Jaap 1979, Jaap 1985). Trends in global sea surface temperatures show an increase in the frequency of warm-season temperature extremes during the past two decades. These increases have caused more frequent episodes of coral bleaching (*Acropora* BRT 2005). Using global climate models, Hoegh-Guldberg (1999) predict the frequency of thermal events in the future exceeding the bleaching threshold for a given area will become more commonplace within 15 years and will occur annually in about 40 years.

Although both *Acropora* species may be somewhat more resistant to bleaching than other stony corals, they are still susceptible. Bleaching of *A. palmata* was observed during a mass bleaching event in 1998 at Looe Key, Coffins Patch, and Western Sambo Reefs in the Florida Keys (Causey pers. comm., in *Acropora* BRT 2005) and at several sites in the upper Florida Keys where substantial mortality (largely partial mortality of colonies) ensued (Miller et al. 2002).

Increases in atmospheric carbon dioxide (CO_2) can also affect elkhorn coral. Atmospheric CO_2 has increased from about 280 parts per million (ppm) in the early 1800s to current levels of about 380 ppm (Prentice 2001). As atmospheric CO_2 is dissolved in surface seawater, it becomes more acidic, shifting the balance of inorganic carbon away from CO_2 and carbonate (CO_3^{-2}) toward bicarbonate (HCO_3^{-1}). These changes affect corals' ability to create new skeletal material because corals are thought to use CO_3^{-2} as the source of carbonate to build their aragonite ($CaCO_3$) skeletons. Numerous experiments have shown a relationship between elevated CO_2 and decreased calcification rates in corals and other $CaCO_3$ secreting organisms (Reibesell et al. 2000, Barker and Elderfield 2002, Hoegh-Guldberg et al. 2007). Kleypas et al. (1999) calculated that coral calcification could be reduced by 30 percent in the tropics by the middle of the 21st century. Corals grown during laboratory experiments that doubled atmospheric CO_2 manifested an 11 to 37 percent reduction in calcification (Gattuso et al. 1999, Langdon 2003, Marubini et al. 2003).

Rapid rises in sea level will likely affect elkhorn coral by both submerging it below its common depth range and by degrading water quality through coastal erosion or enlargement of lagoons and shelf areas. Blanchon and Shaw (1995) argued that a sustained sea-level rise of more than 14 mm/yr will displace elkhorn coral from its framework range (0 to 5 m) into its remaining habitat range (5 to 10 m) where a mixed framework is likely to develop. Sea-level change is unlikely to lead to extinction in the next several hundred years by this process because sea level is not predicted to rise that rapidly in the near future (Church and Gregory 2001).

Elkhorn coral would likely be affected by decreased water quality because of shoreline erosion and flooding of shallow banks and lagoons caused by sea-level rise. Where topography is low and/or shoreline sediments are easily eroded, corals may be stressed by degrading water quality as sea-level rise proceeds. Flooded shelves and banks at higher latitudes (greater than 15°N) may alter the temperature or salinity of seawater to extremes that can then affect corals during offshore flows. Although this process could be widespread, there will be many areas, particularly on the windward side of rocky islands, where erosion and lagoon formation will be minimal (*Acropora* BRT 2005).

The impacts of global climate change on the severity and frequency of tropical weather events (e.g., typhoons and hurricanes) are currently being debated. The Intergovernmental Panel on Climate Change stated that based on a range of models it was likely that future tropical weather events will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures (IPCC 2007). However, a statement on tropical cyclones and climate change developed by the participants of the World Meteorological Organization states that while "there is evidence both for and against the existence of a detectable anthropogenic signal in the tropical cyclone climate record to date, no firm conclusion can be made on this point" (WMO 2006).

3.2.6.1 Summary of Elkhorn Coral

Many factors, including both life history characteristics and external threats, are important to consider in assessing the status and vulnerability of elkhorn coral. Recovery of elkhorn coral from its current level of decreased abundance depends upon rates of recruitment and growth outpacing rates of mortality. This species has a rapid growth rate and high potential for propagation via fragmentation. However, while fragmentation is an excellent life history strategy for recovery from physical disturbance, it is not as effective when fragment sources (i.e., large extant colonies) are scarce.

Thus, it is anticipated that successful sexual reproduction will need to play a major role in elkhorn coral recovery (Bruckner 2002). Meanwhile, there is substantial evidence to suggest that sexual recruitment of elkhorn corals is currently compromised. Reduced colony density in this broadcast spawning, compounded in some geographic areas with low genetic diversity, suggests that fertilization success and consequently, larval availability, has been reduced. In addition, appropriate substrate available for fragments to attach to is likely reduced due to changes in benthic community structure on many Caribbean reefs. Coupled with impacts from coastal development (i.e., dominance by macroalgal, turf, and/or sediment-coated substrates), these factors are expected to further reduce successful larval recruitment below a threshold that can compensate for observed rates of ongoing mortality.

Species at reduced abundance are at a greater risk of extinction due to stochastic environmental and demographic factors (e.g., episodic recruitment factors). Elkhorn corals have persisted at extremely reduced abundance levels (in most areas with quantitative data available, less than 3 percent of prior abundance) for at least two decades.

The major threats (e.g., disease, elevated sea surface temperature, and hurricanes) to elkhorn coral are severe, unpredictable, likely to increase in the foreseeable future, and currently unmanageable. However, managing some of the less severe stressors (e.g., nutrients, sedimentation) may help slow the rate of elkhorn coral decline by enhancing coral condition and decreasing synergistic stress effects.

The impacts on elkhorn coral from all of the above-mentioned threats could be exacerbated by reduced genetic diversity, which often results when species undergo rapid decline like elkhorn coral has in recent decades. This expectation is heightened when the decline is due to a potentially selective factor such as disease, in contrast to a less selective factor such as hurricane damage, which will likely cause disturbance independent of genotype. If the species remains at low densities for prolonged periods, genetic diversity may be significantly reduced. Thus, given the current dominance of asexual reproduction, the rapid abundance decline (largely from a selective factor), and the lack of rapid recovery, it is plausible that these populations have suffered a loss of genetic diversity that could compromise their ability to adapt to future changes in environmental conditions. No quantitative information is available regarding genetic diversity for this species.

3.2.7 Staghorn coral

Staghorn coral was listed with elkhorn coral as threatened under the ESA on May 9, 2006. The Atlantic *Acropora* Status Review presents a summary of published literature and other currently available scientific information regarding the biology and status of both elkhorn and staghorn corals. The following discussion summarizes those findings relevant to staghorn coral and our evaluation of the proposed action.

Staghorn coral is one of the major reef-building corals in the wider Caribbean. Staghorn coral is characterized by staghorn-antler-like colonies, with cylindrical, straight, or slightly curved branches. Early descriptions of Florida Keys reefs referred to reef zones, of which the staghorn zone was described for many shallow-water reefs (Figure 3.3) (Jaap 1984, Dustan 1985, Dustan and Halas 1987). Like elkhorn coral, the structural and ecological roles of staghorn are unique and cannot be filled by other reef-building corals (Bruckner 2002).

Life History

Historically, staghorn coral was reported from depths ranging from <1 to 60 m (Goreau and Goreau 1973). It is suspected that 60 m is an extreme situation and that the coral is relatively rare below 20 m depth. The common depth range is currently observed at 5 to 15 m. In southeastern Florida, this species historically occurred on the outer reef platform (16 to 20 m) (Goldberg 1973), on spur-and-groove bank reefs and transitional reefs (Jaap 1984, Wheaton and Jaap 1988), and on octocoral-dominated hardbottom (Davis 1982). Colonies have been common in back- and patch-reef habitats (Gilmore and Hall 1976, Cairns 1982). Although staghorn coral colonies are sometimes found interspersed among colonies of elkhorn coral, they are generally in deeper water or seaward of the elkhorn zone and, hence, more protected from waves. Historically, staghorn coral was also the primary constructor of mid-depth (10 to 15 m) reef terraces in the western Caribbean, including Jamaica, the Cayman Islands, Belize, and some reefs along the eastern Yucatán peninsula (Adey 1978).

Staghorn coral is considered environmentally sensitive, requiring relatively clear, well-circulated water (Jaap et al. 1989). These corals have the same sunlight requirements as noted above for elkhorn corals and are subsequently susceptible to similar increases in turbidity (see Section 3.2.6). As a result, staghorn coral is susceptible to long-term reductions in water clarity and may not be able to compensate with an alternate food source, such as zooplankton and suspended particulate matter, like other corals.

Staghorn coral also has the same optimal water temperature range as elkhorn corals. Bleaching of staghorn coral will also occur under the same environmental conditions that precipitate these events in elkhorn corals. Staghorn corals were also affected during the major mortality event that occurred in the Dry Tortugas, Florida, in 1977, which also affect elkhorn corals. Some reduction in growth rates of staghorn coral was reported in Florida when temperatures dropped to less than 26°C (Shinn 1966).

Staghorn coral employs the same reproductive propagation strategy as elkhorn coral (see Section 3.2.6). Likewise, the fertilization and development of staghorn coral follow the same patterns noted above for elkhorn corals (see Section 3.2.6).

Studies of elkhorn and staghorn corals on the Caribbean coast of Panama indicated that larger colonies have higher fertility rates (Soong and Lang 1992). Only colonies of staghorn coral with a branch length greater than 9 cm were fertile and over 80 percent of colonies with branches longer than 17 cm (n=18) were fertile. The estimated size at puberty for staghorn coral was 17 cm in branch length and the smallest reproductive colony observed was 9 cm in branch length (Soong and Lang 1992).

The growth rate for staghorn coral has been reported to range from 3 to 11.5 cm/yr. This growth rate is relatively fast compared to other corals and historically enabled the species to construct significant reefs in several locations throughout the wider Caribbean (Adey 1978). Growth in staghorn coral is also expressed in expansion, occurring as a result of fragmenting and forming new centers of growth (Bak and Criens 1982, Tunnicliffe 1981). A broken branch may be carried by waves and currents to a distant location or may land in close proximity to the original colony. If the location is favorable, branches grow into a new colony, expanding and occupying additional area. Fragmenting and expansion, coupled with a relatively fast growth rate, facilitates potential spatial competitive superiority for staghorn coral relative to other corals and other benthic organisms (Shinn 1976, Neigel and Advise 1983, Jaap et al. 1989).

Few data on the genetic population structure of staghorn coral exist; however, due to recent advances in technology, the genetic population structure of the current, depleted population is beginning to be characterized. Vollmer and Palumbi (2007) examined multilocus sequence data from 276 colonies of staghorn coral spread across 22 populations from 9 regions in the Caribbean, Florida, and the Bahamas. Their data were consistent with the Western-Eastern Caribbean subdivision observed in elkhorn coral populations by Baums et al. (2005).

Status and Distribution

Historically, throughout much of the wider Caribbean, staghorn coral so dominated the reef within the 7- to 15-m depth that the area became known as the staghorn zone (Figure 3.3). It was documented in several reef systems such as the north coast of Jamaica (Goreau 1959) and the leeward coast of Bonaire (Scatteryday 1974). In many other reef systems in the wider Caribbean, most notably the western Caribbean areas of Jamaica, Cayman Islands, Belize, and eastern Yucatán (Adey 1977), staghorn coral was a major mid-depth (10 to 25 m) reef-builder. Principally due to wind conditions and rough seas, staghorn coral has not been known to build extensive reef structures in the Lesser Antilles and southwestern Caribbean.

Like elkhorn corals, few data on historical distribution and abundance patterns of staghorn coral are present before the 1980 baseline, likely due in part to researchers' tendencies to neglect careful measurement of abundance for ubiquitous species. Similarly, staghorn corals underwent a decline in abundance very similar to the one noted above for elkhorn coral (see Section 3.2.6).

Figure 3.4 summarizes the abundance trends of specific locations throughout the wider Caribbean where quantitative data exist illustrating the overall trends of decline of elkhorn and staghorn corals since the 1980s. It is important to note that the data are from the same geographic area, not repeated measures at an exact reef/site that would indicate more general trends. The overall regional trend depicted is a >97 percent loss of coverage (area of substrate the species occupy).

Threats
Staghorn corals face the same threats as elkhorn corals (see Table 3.2). Diseases, temperature-induced bleaching, and physical damage from hurricanes are the greatest threats to staghorn corals. The threat from disease, though clearly severe, is poorly understood in terms of etiology and possible links to anthropogenic stressors. Threats from anthropogenic physical damage (e.g., vessel groundings, anchors, divers/snorkelers, etc.), coastal development, competition, and predation are deemed moderate (*Acropora* BRT 2005). Table 3.2 summarizes the factors affecting the status of staghorn coral and the identified sources of those threats.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities – frequently referred to in layman's terms as "global warming." Some of the likely effects to staghorn coral are: increased water temperature and frequency of bleaching events, elevated CO_2 levels and reduced calcification for coral skeletal growth, sea-level rise, and changes in the frequency or intensity of storms (*Acropora* BRT 2005). The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on staghorn coral currently cannot be predicted, for the most part, with any degree of certainty.

Increased temperatures resulting from global climate change could allow reef distribution to shift to more northern latitudes; however, Buddemeier et al. (2004) argued that such migration would be impeded because humans have negatively altered the coastal areas where future reefs might form. If global climate change alters the northward flowing warm oceanic currents, high latitude reefs may be threatened.

Coral bleaching patterns are complex and seasonal cycles in symbiotic dinoflagellate density occur in many species (Fitt et al. 2001), but there is general agreement that thermal stress leading to bleaching and mass mortality has increased during the past 25 years (Brown 1997). Most corals are able to withstand seasonal variations in water temperatures though an increase of 1º to 2°C above the normal seasonal maximum can induce bleaching (Fitt and Warner 1995). Though bleaching events lasting for more than a few weeks may cause mortality (Jaap 1979, Jaap 1985). Trends in global sea surface temperatures show an increase in the frequency of warm-season temperature extremes during the past two decades. These increases have caused more frequent episodes of coral bleaching (*Acropora* BRT 2005). Using global climate models, Hoegh-Guldberg (1999) predict the frequency of thermal events in the future exceeding the bleaching threshold for a given area will become more commonplace within 15 years and will occur annually in about 40 years.

Although both *Acropora* species may be somewhat more resistant to bleaching than other stony corals, they are still susceptible. However, bleaching in staghorn coral has rarely been described (Ghiold and Smith 1990, Williams and Bunkley-Williams 1990) and most of the documented loss during the past two decades is apparently due to disease (Peters 1984).

Increases in atmospheric carbon dioxide (CO_2) can also affect staghorn coral. Atmospheric CO_2 has increased from about 280 parts per million (ppm) in the early 1800s to current levels of about 380 ppm (Prentice 2001). As atmospheric CO_2 is dissolved in surface seawater, it becomes more acidic, shifting the balance of inorganic carbon away from CO_2 and carbonate (CO_3^{-2}) toward bicarbonate (HCO_3^{-1}). These changes affect corals' ability to create new skeletal material because corals are thought to use CO_3^{-2} as the source of carbonate to build their aragonite ($CaCO_3$) skeletons. Numerous experiments have shown a relationship between elevated CO_2 and decreased calcification rates in corals and other $CaCO_3$ secreting organisms (Reibesell et al. 2000, Barker and Elderfield 2002, Hoegh-Guldberg et al. 2007). Kleypas et al. (1999) calculated that coral calcification could be reduced by 30 percent in the tropics by the middle of the 21st century. Corals grown during laboratory experiments that doubled atmospheric CO_2 manifested an 11 to 37 percent reduction in calcification (Gattuso et al. 1999, Langdon 2003, Marubini et al. 2003).

Rapid rises in sea level will likely affect staghorn coral by degrading water quality through coastal erosion or enlargement of lagoons and shelf areas. Blanchon and Shaw (1995) argued that a sustained sea-level rise of more than 14 mm/yr would displace elkhorn coral. This is less of a concern for staghorn coral given its deeper depth range preference._However, sea-level change is unlikely to lead to extinction in the next several hundred years by this process because sea level is not predicted to rise that rapidly in the near future (Church and Gregory 2001).

Staghorn coral would also likely be affected by decreased water quality because of shoreline erosion and flooding of shallow banks and lagoons caused by sea-level rise. Where topography is low and/or shoreline sediments are easily eroded, corals may be stressed by degrading water quality as sea-level rise proceeds. Flooded shelves and banks at higher latitudes (greater than 15°N) may alter the temperature or salinity of seawater to extremes that can then affect corals during offshore flows. Although this process could be widespread, there will be many areas, particularly on the windward side of rocky islands, where erosion and lagoon formation will be minimal (*Acropora* BRT 2005).

The impacts of global climate change on the severity and frequency of tropical weather events (e.g., typhoons and hurricanes) are currently being debated. The Intergovernmental Panel on Climate Change stated that based on a range of models it was likely that future tropical weather events will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures (IPCC 2007). However, a statement on tropical cyclones and climate change developed by the participants of the World Meteorological Organization states that while “there is evidence both for and against the existence of a detectable anthropogenic signal in the tropical cyclone climate record to date, no firm conclusion can be made on this point” (WMO 2006).

3.2.7.1 Summary of Staghorn Coral Status

Many factors, including both life history characteristics and external threats are important to consider in assessing the status and vulnerability of staghorn coral. Recovery of staghorn coral from its current level of decreased abundance depends upon rates of recruitment and growth outpacing rates of mortality. This species has a rapid growth rate and high potential for propagation via fragmentation. However, while fragmentation is an excellent life history strategy for recovery from physical disturbance, it is not as effective when fragment sources (i.e., large extant colonies) are scarce.

Thus, it is anticipated that successful sexual reproduction will need to play a major role in recovery (Bruckner 2002). Meanwhile, there is substantial evidence to suggest that sexual recruitment of staghorn corals is currently compromised. Reduced colony density in this broadcast spawning, compounded in some geographic areas with low genotypic diversity, suggests that fertilization success and consequently, larval availability, has been reduced. In addition, appropriate substrate available for fragments to attach to is likely reduced due to changes in benthic community structure on many Caribbean reefs. Coupled with impacts from coastal development (i.e., dominance by macroalgal, turf, and/or sediment-coated substrates), these factors are expected to further reduce successful larval recruitment below a threshold that can compensate for observed rates of ongoing mortality.

Species at reduced abundance are at a greater risk of extinction due to stochastic environmental and demographic factors (e.g., episodic recruitment factors). Both acroporids have persisted at extremely reduced abundance levels (in most areas with quantitative data available, less than 3 percent of prior abundance) for at least two decades.

Although the major threats (e.g., disease, elevated sea surface temperature, and hurricanes) to staghorn coral’s persistence are severe, unpredictable, likely to increase in the foreseeable future, and, at current levels of knowledge, unmanageable, managing some of the stressors identified as less severe (e.g., nutrients, sedimentation) may assist in decreasing the rate of elkhorn and staghorn corals’ decline by enhancing coral condition and decreasing synergistic stress effects.

The impacts on staghorn coral from all of the above-mentioned threats could be exacerbated by reduced genetic diversity, which often results when species undergo rapid decline like staghorn coral has in recent decades. This expectation is heightened when the decline is due to a potentially selective factor such as disease, in contrast to a less selective factor such as hurricane damage, which will likely cause disturbance independent of genotype. If the species remains at low densities for prolonged periods, genetic diversity may be significantly reduced. Thus, given the current dominance of asexual reproduction, the rapid decline (largely from a selective factor), and the lack of rapid recovery of elkhorn and staghorn corals, it is plausible that these populations have suffered a loss of genetic diversity that could compromise their ability to adapt to future changes in environmental conditions. No quantitative information is available regarding genetic diversity for either species.

Figure 3.3 Reef zonation schematic example modified from several reef zonation-descriptive studies (Goreau 1959, Kinzie 1973, Bak 1977)

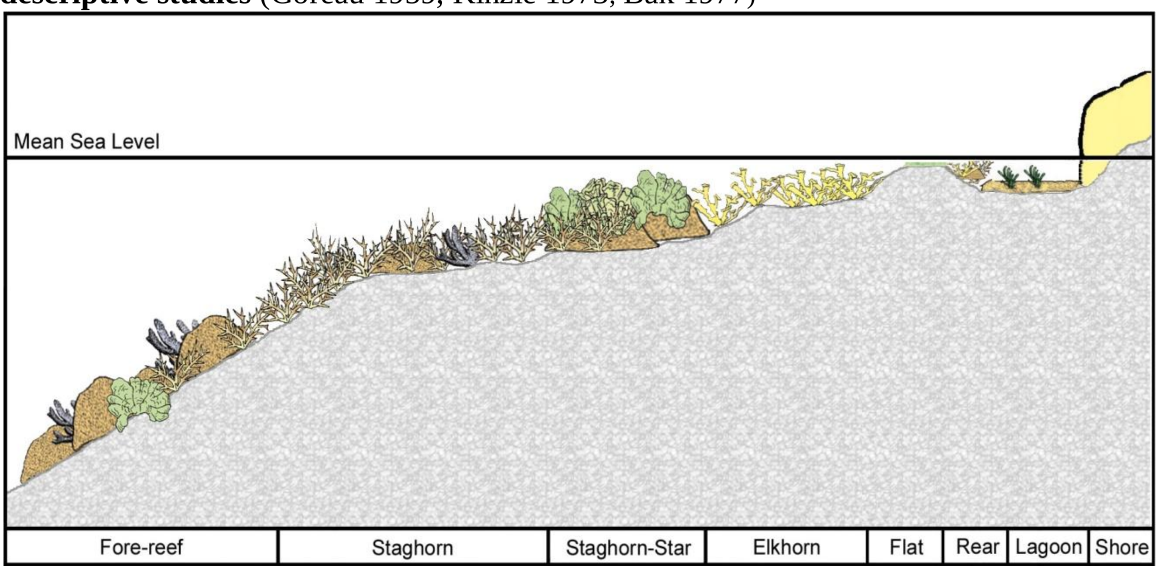
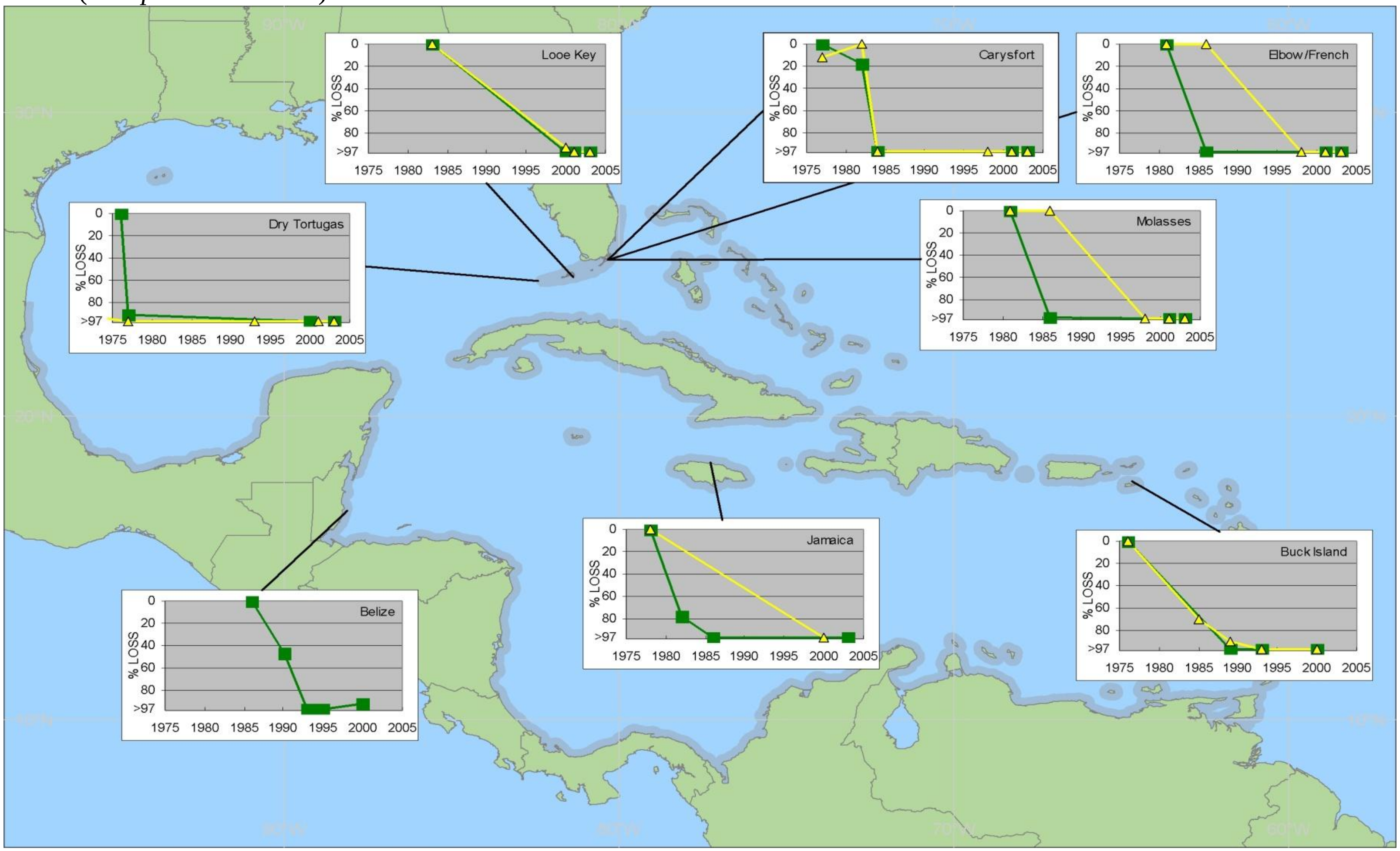


Table 3.2 Factors Affecting the Species

Natural abrasion and breakage Source: storm events	**Disease** Source: undetermined/understudied
Sedimentation Source: land development/run-off dredging/disposal sea level rise major storm events	**Anthropogenic abrasion and breakage** Source: divers vessel groundings anchor impact fishing debris
Temperature Source: hypothermal events global climate change power plant effluents ENSO* events	**Predation** Source: overfishing natural trophic reef interactions **Loss of genetic diversity** Source: population decline/bottleneck
Nutrients Source: point-source non-point-source	**Contaminants** Source: point-source non-point-source
Competition Source: overfishing	**CO_2** Source: fossil fuel consumption
Sea level rise Source: global climate change	**Sponge boring** Source: undetermined/understudied

* El Niño-Southern Oscillation

Figure 3.4 Percent loss of staghorn coral (green squares) and elkhorn coral (yellow triangles) throughout the Caribbean for all locations (n=8) where quantitative trend data exist. Shaded areas on map illustrate the general range of elkhorn and staghorn corals (*Acropora* BRT 2005)



3.2.8 Smalltooth Sawfish

The U.S. smalltooth sawfish distinct population segment (DPS) was listed as endangered under the ESA on April 1, 2003 (68 FR 15674). The smalltooth sawfish is the first marine fish to be listed in the United States. On November 20, 2008, NMFS proposed to designate critical habitat for smalltooth sawfish (73 FR 70290). The proposed critical habitat would comprise of two units off southwestern Florida – the Charlotte Harbor Estuary and the Ten Thousand Island/Everglades unit – comprising approximately 619,013 acres. Historically, smalltooth sawfish occurred commonly in the inshore waters of the Gulf of Mexico and the U.S. Eastern Seaboard up to North Carolina, and more rarely as far north as New York. Based on smalltooth sawfish encounter data, the current core range for the smalltooth sawfish is currently from the Caloosahatchee River to Florida Bay (Simpfendorfer and Wiley 2004).

All extant sawfish belong to the Suborder Pristoidea, Family Pristidae, and Genus Pristis. Although they are rays, sawfish appear to more resemble sharks, with only the trunk and especially the head ventrally flattened. Smalltooth sawfish are characterized by their “saw,” a long, narrow, flattened rostral blade with a series of transverse teeth along either edge.

Life History and Distribution
Life history information on smalltooth sawfish is limited. Small amounts of data exist in old taxonomic works and occurrence notes (e.g., Breder 1952, Bigelow and Schroeder 1953, Wallace 1967, Thorson et al. 1966). However, as Simpfendorfer and Wiley (2004) note, these relate primarily to occurrence and size. Recent research and sawfish public encounter information is now providing new data and hypotheses about smalltooth sawfish life history (e.g., Simpfendorfer 2001 and 2003, Seitz and Poulakis 2002, Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004), but more data are still needed to confirm many of these new hypotheses.

As in all elasmobranchs, fertilization is internal. Bigelow and Schroeder (1953) report the litter size as 15 to 20. However, Simpfendorfer and Wiley (2004), caution that this may be an overestimate, with recent anecdotal information suggesting smaller litter sizes (~10). Smalltooth sawfish mating and pupping seasons, gestation, and reproductive periodicity are all unknown. Gestation and reproductive periodicity, however, may be inferred based on that of the largetooth sawfish, sharing the same genus and having similarities in size and habitat. Thorson (1976) reported the gestation period for largetooth sawfish was approximately five months and concluded that females probably produce litters every second year.

Bigelow and Schroeder (1953) describe smalltooth sawfish as generally about two feet long (61 cm) at birth and growing to a length of 18 feet (549 cm) or greater. Recent data from smalltooth sawfish caught off Florida, however, demonstrate young are born at 75-85 cm , with males reaching maturity at approximately 270 cm and females at approximately 360 cm (Simpfendorfer 2002, Simpfendorfer and Wiley 2004). The maximum reported size of a smalltooth sawfish is 760 cm (Last and Stevens 1994), but the maximum size normally observed is 600 cm (Adams and Wilson 1995). No formal studies on the age and growth of the smalltooth sawfish have been conducted to date, but growth studies of largetooth sawfish suggest slow growth, late maturity (10 years) and long lifespan (25-30 years) (Thorson 1982, Simpfendorfer 2000). These characteristics suggest very a low intrinsic rate of increase (Simpfendorfer 2000).

Smalltooth sawfish feed primarily on fish, with mullet, jacks, and ladyfish believed to be their primary food resources (Simpfendorfer 2001). By moving its saw rapidly from side to side through the water, the relatively slow-moving sawfish is able to strike at individual fish (Breder 1952). The teeth on the saw stun, impale, injure, or kill the fish. Smalltooth sawfish then rub their saw against bottom substrate to remove the fish, which are then eaten. In addition to fish, smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs), which are located by disturbing bottom sediment with their saw (Norman and Fraser 1938, Bigelow and Schroeder 1953).

Smalltooth sawfish are euryhaline, occurring in waters with a broad range of salinities from freshwater to full seawater (Simpfendorfer 2001). Their occurrence in freshwater is suspected to be only in estuarine areas temporarily freshwater from receiving high levels of freshwater input. Many encounters are reported at the mouths of rivers or other sources of freshwater inflows, suggesting estuarine areas may be an important factor in the species distribution (Simpfendorfer and Wiley 2004).

The literature indicates that smalltooth sawfish are most common in shallow coastal waters less than 25 m (Bigelow and Schroeder 1953, Adams and Wilson 1995). Indeed, the distribution of the smallest size classes of smalltooth sawfish indicate that nursery areas occur throughout Florida in areas of shallow water, close to shore and typically associated with mangroves (Simpfendorfer and Wiley 2004). However, encounter data indicate there is a tendency for smalltooth sawfish to move offshore and into deeper water as they grow. An examination of the relationship between the depth at which sawfish occur and their estimated size indicates that larger animals are more likely to be found in deeper waters. Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001). Mature animals are known to occur in water depths of 100 m or more (C. Simpfendorfer pers. comm. 2006).

Data collected by Mote Marine Laboratory indicate smalltooth sawfish occur over a range of temperatures but appear to prefer water temperatures greater than 64.4°F (18°C) (Simpfendorfer 2001). The data also suggest that smalltooth sawfish may utilize warm water outflows of power stations as thermal refuges during colder months to enhance their survival or become trapped by surrounding cold water from which they would normally migrate. Almost all occurrences of smalltooth sawfish in warm water outflows were during the coldest part of the year, when water temperatures in these outfalls are typically well above ambient temperatures. Further study of the importance of thermal refuges to smalltooth sawfish is needed. Significant use of these areas by sawfish may disrupt their normal migratory patterns (Simpfendorfer and Wiley 2004).

Smalltooth sawfish historically occurred commonly in the shallow waters of the Gulf of Mexico and along the Eastern Seaboard as far north as North Carolina, with rare records of occurrence as far north as New York. The smalltooth sawfish range has subsequently contracted to areas predominantly around peninsular Florida and, within that area, they can only be found with any regularity off the extreme southern portion of the state. Historic records of smalltooth sawfish indicate that some large mature individuals migrate north along the U.S. Atlantic coast as temperatures warmed in the summer and then south as temperatures cooled (Bigelow and Schroeder 1953). However, recent Florida encounter data do not suggest such migration. One smalltooth sawfish has been recorded north of Florida since 1963 - captured off Georgia in July 2000 - but it is unknown whether this individual resided in Georgia waters annually or had migrated north from Florida. Given the very limited number of encounter reports from the east coast of Florida, Simpfendorfer and Wiley (2004) hypothesize the population previously undertaking the summer migration has declined to a point where the migration is undetectable or does not occur. NMFS observers have been collecting data in the Atlantic longline fishery since 1992 and have no documented interactions between the HMS pelagic longline fishery and smalltooth sawfish, which provides some additional support to these range estimates. Further research focusing on states north of Florida or using satellite telemetry is needed to test this hypothesis.

Population Dynamics, Status, and Trends

Despite being widely recognized as common throughout their historic range up until the middle of the 20th century, the smalltooth sawfish population declined dramatically during the middle and later parts of the century. The decline in the population of smalltooth sawfish is attributed to fishing (both commercial and recreational), habitat modification, and sawfish life history. Large numbers of smalltooth sawfish were caught as bycatch in the early part of this century. Smalltooth sawfish were historically caught as bycatch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, handline. Frequent accounts in earlier literature document smalltooth sawfish being entangled in fishing nets from areas where smalltooth sawfish were once common but are now rare (Everman and Bean 1898). Loss and degradation of habitat contributed to the decline of many marine species and is expected to have affected the distribution and abundance of smalltooth sawfish.

Estimates of the magnitude of the decline in the smalltooth sawfish are difficult to make. Because of the species' limited importance in commercial and recreational fisheries and its large size and toothed rostrum, making it difficult to handle, it was not well studied before incidental bycatch severely reduced its numbers. However, based on the contraction of the species' range, and other anecdotal data, Simpfendorfer (2001) estimated that the U.S. population size is currently less than five percent of its size at the time of European settlement.

Seitz and Poulakis (2002) and Poulakis and Seitz (2004) document recent (1990 to 2002) occurrences of sawfish along the southwest coast of Florida, and in Florida Bay and the Florida Keys, respectively. The information was collected by soliciting information from anyone who would possibly encounter these fish via posters displaying an image of a sawfish and requesting anyone with information on these fish since 1990 to contact the authors. Posters were distributed beginning in January 1999 and continue to be maintained from Charlotte County to Monroe County in places where anglers and boaters would likely encounter them (e.g., bait and tackle shops, boat ramps, fishing tournaments). In addition to circulating posters, information was obtained by contacting other fishery biologists, fishing guides, guide associations, rod and gun clubs, recreational and commercial fishers, scuba divers, mosquito control districts, and newspapers. At least 2,620 smalltooth sawfish encounters have been reported (G. Poulakis, pers. comm. 2005).

Mote Marine Laboratory also maintains a smalltooth sawfish public encounter database, established in 2000 to compile information on the distribution and abundance of sawfish. Encounter records are collected using some of the same outreach tactics as above in Florida statewide. To ensure the requests for information are spread evenly throughout the state, awareness-raising activities were divided into six regions and focused in each region on a biannual basis between May 2002 and May 2004. Prior to 2002, awareness-raising activities were organized on an ad-hoc basis because of limited resources. The records in the database extend back to the 1950s, but are mostly from 1998 to the present. The data are validated using a variety of methods (photographs, video, directed questions). As of October 2006, 754 sawfish encounters have been reported since 1998, most from recreational fishers (Simpfendorfer and Wiley 2004).

The Florida Museum of Natural History is in the process of creating the National Sawfish Encounter Database to act as the single repository for all smalltooth sawfish encounter records. As of July 2008, this consolidation was still underway.

The majority of smalltooth sawfish encounters today are from the southwest coast of Florida between the Caloosahatchee River and Florida Bay. Outside of this core area, the smalltooth sawfish appears more common on the west coast of Florida and in the Florida Keys than on the east coast, and occurrences decrease the greater the distance from the core area (Simpfendorfer and Wiley 2004). The capture of a smalltooth sawfish off Georgia in 2003 is the first record north of Florida since 1963. New reports during 2004 extend the current range of the species from Panama City, offshore Louisiana (south of Timbalier Island in 100 ft of water), southern Texas, and the northern coast of Cuba. The Texas sighting was not confirmed to be a smalltooth sawfish so might have been a largetooth sawfish.

There are no data available to estimate the present population size. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, conclusions about the abundance of smalltooth sawfish now cannot be made because outreach efforts and observation effort is not expanded evenly across each study period. Dr. Simpfendorfer reluctantly gives an estimate of 2,000 individuals based on his four years of field experience and data collected from the public, but cautions that actual numbers may be plus or minus at least 50 percent.

Recent encounters with neonates (young of the year), juveniles, and sexually mature sawfish indicate that the population is reproducing (Seitz and Poulakis 2002, Simpfendorfer 2003). The abundance of juveniles encountered, including very small individuals, suggests that the population remains reproductively active and viable (Simpfendorfer and Wiley 2004). In addition, the declining numbers of individuals with increasing size is consistent with the historic size composition data (G. Burgess, pers. comm. in Simpfendorfer and Wiley 2004). This information and recent encounters in new areas beyond the core abundance area suggest that the population may be increasing. However, smalltooth sawfish encounters are still rare along much of their historical range and absent from areas historically abundant such as the Indian River Lagoon and Johns Pass (Simpfendorfer and Wiley 2004). With recovery of the species expected to be slow based on the species' life history and other threats to the species remaining (see below), the population's future remains tenuous.

Threats

Smalltooth sawfish are threatened today by the loss of southeastern coastal habitat through such activities as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff. Dredging, canal development, seawall construction, and mangrove clearing have degraded a significant proportion of the coastline. Smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity to shallow, estuarine systems (NMFS 2000).

Fisheries also still pose a threat to smalltooth sawfish. Although changes over the past decade to U.S. fishing regulations such as Florida's net ban have started to reduce threats to the species over parts of its range, smalltooth sawfish are still occasionally incidentally caught in commercial shrimp trawls, bottom longlines, and recreational rod-and-reel. The current and future abundance of the smalltooth sawfish is limited by its life history characteristics (NMFS 2000). Slow growing, late maturing, and long-lived, these combined characteristics result in a very low intrinsic rate of population increase and are associated with the life history strategy known as "k-selection". K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment (Musick 1999). Simpfendorfer (2000) demonstrated that the life history of this species makes it impossible to sustain any significant level of fishing and makes it slow to recover from any population decline. Thus, the species is susceptible to population decline, even with relatively small increases in mortality.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on smalltooth sawfish currently cannot, for the most part, be predicted with any degree of certainty.

Changes in water temperature because of global climate change may affect prey distribution and/or abundance, habitat suitability, and other biological and ecological processes important to smalltooth sawfish. Stochastic events such as hurricanes are also common throughout the range of the smalltooth sawfish, especially in the current core of its range (i.e., south and southwest Florida). The effects global climate change will have on the frequency and/or severity of tropical weather events, such as hurricanes, is currently being debated. These events are by nature unpredictable and their effects on the smalltooth sawfish are currently unknown.

4.0 Environmental Baseline

This section contains an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, their habitat, and ecosystem, within the action area. The environmental baseline is a snapshot of a species' health at a specified point in time and includes state, tribal, local, and private actions already affecting the species, or that will occur contemporaneously with the consultation in progress. Unrelated federal actions affecting the same species or critical habitat that have completed formal consultation are also part of the environmental baseline, as are federal and other actions within the action area that may benefit listed species or critical habitat.

The environmental baseline for this biological opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The activities that shape the environmental baseline in the action area of this consultation are primarily federal fisheries. Other environmental impacts include effects of vessel operations, additional military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution.

4.1 Status of Sea Turtles in the Action Area

The five species of sea turtles that occur in the action area are all highly migratory. NMFS believes that no individual members of any of the species are likely to be year-round residents of the action area. Individual animals will make migrations into near shore waters as well as other areas of the North Atlantic Ocean, including the Gulf of Mexico and the Caribbean Sea. Therefore, the status of the five species of sea turtles in the Atlantic (see Section 3) most accurately reflects the species status within the action area.

4.2 Factors Affecting Sea Turtles in the Action Area

In recent years, NMFS has undertaken several section 7 consultations to address the effects of federally permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on sea turtles. Similarly, NMFS has undertaken recovery actions under the ESA to address sea turtle takes in the fishing and shipping industries and other activities such as Army Corps of Engineers (COE) dredging operations. The summaries below address anticipated sources of incidental take of sea turtles and include only those federal actions in the U.S. Atlantic and Gulf of Mexico EEZ, which have already concluded formal section 7 consultation.

4.2.1 Fisheries

Threatened and endangered sea turtles are adversely affected by several types of fishing gears used throughout the action area. Gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. Available information suggests sea turtles can be captured in any of these gear types when the operation of the gear overlaps with the distribution of sea turtles. For all fisheries for which there is an FMP or for which any federal action is taken to manage that fishery, impacts have been evaluated under section 7. Formal section 7 consultation have been conducted on the following fisheries, occurring at least in part within the action area, found likely to adversely affect threatened and endangered sea turtles: Atlantic bluefish, Atlantic mackerel/squid/butterfish, Atlantic swordfish/tuna/shark/billfish, coastal migratory pelagic, dolphin-wahoo, Gulf of Mexico reef fish, monkfish, Northeast multispecies, South Atlantic snapper-grouper, Southeast shrimp trawl, spiny dogfish, and summer flounder/scup/black sea bass fisheries. An Incidental Take Statement (ITS) has been issued for the take of sea turtles in each of these fisheries (Appendix 2).

In a July 2, 1999, biological opinion on the *Atlantic bluefish fishery,* NMFS found the operation of the fishery was likely to adversely affect Kemp's ridley and loggerhead sea turtles, but not likely to jeopardize their continued existence (NMFS 1999a). The Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council jointly manage bluefish under Amendment 5 to the Bluefish FMP (NEFSC 2005a). The majority of commercial fishing activity in the North and Mid-Atlantic occurs in the late spring to early fall, when bluefish (and sea turtles) are most abundant in these areas (NEFSC 2005a). In 2006, gillnet gear accounted for 32.4 percent of the total commercial trips targeting bluefish, and landed 72 percent of the commercial catch for that year. Bottom otter trawls accounted for 44 percent of the total commercial trips targeting bluefish and landed 20.4 percent of the catch (MAFMC 2007). Based on documented take in gillnets targeting bluefish and bottom otter trawls catching bluefish, NMFS provided an ITS for Kemp's ridley and loggerhead sea turtles.

Atlantic mackerel/squid/butterfish fisheries are managed under a single FMP, which was first implemented on April 1, 1983. The most recent biological opinion completed on these federal fisheries was completed on April 28, 1999. The opinion concluded that the continued authorization of the FMP was likely to adversely affect sea turtles, but not jeopardize their continued existence (NMFS 1999b). Trawl gear is the primary fishing gear for these fisheries, but several other types of gear may also be used, including hook-and-line, pot/trap, dredge, pound net, and bandit gear. Entanglements or entrapments of sea turtles have been recorded in one or more of these gear types. An ITS for sea turtles was provided with the opinion. In August 2007, NMFS received a new estimate of loggerhead sea turtle takes in bottom otter trawl gear used in the mackerel, squid, butterfish fisheries (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using vessel trip report (VTR) data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the mackerel, squid, and butterfish fisheries was estimated to be 62 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). NMFS has determined that this new information on the capture of loggerhead sea turtles in the mackerel, squid, butterfish fisheries triggers the need to reinitiate section 7 consultation on the Mackerel, Squid, Butterfish FMP.

Atlantic pelagic fisheries for swordfish, tuna, and billfish are known to incidentally capture large numbers of sea turtles, particularly in the pelagic longline component. Pelagic longline, pelagic driftnet, bottom longline, and/or purse seine gear have all been documented taking sea turtles. The Northeast swordfish driftnet portion of the fishery was prohibited during an emergency closure that began in December 1996, and was subsequently extended. A permanent prohibition on the use of driftnet gear in the swordfish fishery was published in 1999. NMFS reinitiated consultation on the pelagic longline component of this fishery (NMFS 2004b) because of exceeded incidental take levels for loggerheads and leatherbacks sea turtles. The resulting biological opinion stated the long-term continued operation this sector of the fishery was likely to jeopardize the continued existence of leatherback sea turtles, but RPAs were implemented allowing for the continued authorization of the pelagic longline fishing that would not jeopardize leatherback sea turtles.

NMFS has completed a section 7 consultation on the continued authorization of *HMS Atlantic shark fisheries* (NMFS 2008). The commercial fishery uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect declining shark stocks the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

NMFS recently completed a section 7 consultation on the continued authorization of the *coastal migratory pelagic* fishery in the Gulf of Mexico and South Atlantic (NMFS 2007). In the Gulf of Mexico, hook-and-line, gillnet, and cast net gears are used. Gillnets are the primary gear type used by commercial fishermen in the South Atlantic regions as well, while the recreational sector uses hook-and-line gear. The hook-and-line effort is primarily trolling. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

The South Atlantic FMP for the *dolphin-wahoo fishery* was approved in December 2003. The stated purpose of the Dolphin and Wahoo FMP is to adopt precautionary management strategies to maintain the current harvest level and historical allocations of dolphin (90 percent recreational) and ensure no new fisheries develop. NMFS conducted a formal section 7 consultation to consider the effects on sea turtles of authorizing fishing under the FMP (NMFS 2003a). The August 27, 2003, opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by the longline component of the fishery, but it was not expected to jeopardize their continued existence. An ITS for sea turtles was provided with the opinion. In addition, pelagic longline vessels can no longer target dolphin-wahoo with smaller hooks because of hook size requirements in the pelagic longline fishery.

NMFS requested reinitiation of ESA section 7 consultation on the *Gulf of Mexico reef fish fishery*, on September 3, 2008. Reinitiation was triggered because recent observer data indicate the overall amount and extent of incidental take for sea turtles specified in the incidental take statement of the February 25, 2005, biological opinion on the reef fish fishery had been substantially exceeded by the bottom longline component of the fishery. The 2005 biological opinion (NMFS 2005a) authorized 113 hardshell sea turtle takes by the longline component of the reef fish fishery cumulative over a three-year period to account for the variability in the sea turtle takes between years. However, operation of the longline fishery resulted in an estimated take of 967 hardshell sea turtle take from July 2006 through December 2008, more than 8 times the number of hardshell sea turtle takes authorized by the opinion. On May 1, 2009, NMFS published an emergency rule, which, effective May 18, 2009, prohibits the use of bottom longline gear to harvest reef fish east of 85°30'W longitude in waters less than 50 fathoms as long as the 2009 deepwater grouper and tilefish quotas are unfilled. Once these quotas have been filled, the use of bottom longline gear to harvest reef fish in water of all depths east of 85°30'W longitude is prohibited. The emergency rule is intended to reduce the number of sea turtle takes by the reef fish fishery in the short-term while the Gulf of Mexico Fishery Management Council develops long-term measures in Amendment 31 to the Reef Fish Fishery Management Plan (RFFMP). The new biological opinion, which will consider the continued authorization of reef fish fishing under the RFFMP, including any measures proposed in Amendment 31, is expected to be completed in the fall of 2009.

The federal *monkfish fishery* occurs from Maine to the North Carolina/South Carolina border and is jointly managed by the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC), under the Monkfish FMP (NEFSC 2005b). A section 7 consultation conducted in 2001 concluded that the operation of the fishery may adversely affect sea turtles, but was not likely to jeopardize their continued existence. In 2003, proposed changes to the Monkfish FMP led to reinitiation of consultation to determine the effects of those actions on ESA-listed species. The resulting biological opinion concluded the proposed changes were likely to adversely affect green, Kemp's ridley, loggerhead and leatherback sea turtles, but were not likely to jeopardize their continued existence (NMFS 2003b). Although the estimated capture of sea turtles in monkfish gillnet gear is relatively low, there is concern that much higher levels of interaction could occur. Following an event in which over 200 sea turtle carcasses washed ashore in an area where large-mesh gillnetting had been occurring, NMFS published new restrictions for the use of gillnets with larger than 8-inch stretched mesh, in the EEZ off of North Carolina and Virginia (67 FR 71895, December 3, 2002). The rule was subsequently modified on April 26, 2006, by modifying the restrictions to the use of gillnets with greater than or equal to 7-inch stretched mesh when fished in federal waters from the North Carolina/South Carolina border to Chincoteague, Virginia.

A section 7 consultation on the *South Atlantic snapper-grouper fishery* (NMFS 2006a) has also recently been completed by NMFS. The fishery uses spear and powerhead, black sea bass pot, and hook-and-line gear. Hook-and-line gear used in the fishery includes commercial bottom longline gear and commercial and recreational vertical line gear (e.g., handline, bandit gear, and rod-and-reel). The consultation found only hook-and-line gear likely to adversely affect, green, hawksbill, Kemp's ridley leatherback, and loggerhead sea turtles. The consultation concluded the proposed action was not likely to jeopardize the continued existence of any of these species, and an ITS was provided.

The *Southeast shrimp trawl fishery* affects more sea turtles than all other activities combined (NRC 1990). On December 2, 2002, NMFS completed the biological opinion for shrimp trawling in the southeastern United States (NMFS 2002) under proposed revisions to the TED regulations (68 FR 8456, February 21, 2003). This opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. This determination was based, in part, on the opinion’s analysis that shows the revised TED regulations are expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks. Interactions between sea turtles and the shrimp fishery may also be declining because of reductions of fishing effort unrelated to fisheries management actions. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacting the shrimp fleets; in some cases reducing fishing effort by as much as 50 percent for offshore waters of the Gulf of Mexico (GMFMC 2007).

The primary gear types for the *spiny dogfish fishery* are sink gillnets, otter trawls, bottom longline, and driftnet gear (NEFSC 2003). NMFS reinitiated consultation on the Spiny Dogfish FMP on May 4, 2000, to reevaluate, in part, the effects of the spiny dogfish gillnet fishery on sea turtles (NMFS 2001b). The FMP for spiny dogfish called for a 30 percent reduction in quota allocation levels for 2000 and a 90 percent reduction in 2001. Although there have been delays in implementing the plan, quota allocations are expected to be substantially reduced over the 4.5-year rebuilding schedule; this should result in a substantial decrease in effort directed at spiny dogfish. The reduction in effort should be of benefit to protected species by reducing the number of gear interactions that occur. A new ITS was provided for the take of sea turtles in the fishery.

The *summer flounder, scup, and black sea bass fisheries* are known to interact with sea turtles. The most recent opinion on the fishery (NMFS 2001c) found it was likely to adversely affect green and Kemp’s ridley sea turtles, but would not jeopardize their continued existence. An ITS was provided for these species. In the Mid-Atlantic, summer flounder, scup, and black sea bass are managed under one FMP since these species occupy similar habitat and are often caught at the same time. Otter trawl gear is used in the commercial fisheries for all three species. Floating traps and pots/traps are used in the scup and black sea bass fisheries, respectively (MAFMC 2007). Significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass). TEDs are required throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, North Carolina, and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, North Carolina, and Cape Charles, Virginia. In August 2007, NMFS received an estimate of loggerhead sea turtle takes in bottom otter trawl gear used in the summer flounder, scup, black sea bass fisheries (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the summer flounder, scup, black sea bass fisheries was estimated to be 200 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). This information represents new information on the capture of loggerhead sea turtles in the summer flounder, scup, black sea bass fisheries.

4.2.2 Vessel Operations

Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Navy (USN) and Coast Guard (USCG), the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), and the COE. NMFS has conducted formal consultations with the USCG, the USN, and NOAA on their vessel operations. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. At the present time, however, they present the potential for some level of interaction. Refer to the biological opinions for the USCG (NMFS 1995) and the USN (NMFS 1997) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

The USN consultation only covered operations out of Mayport, Florida, and the potential exists for USN vessels to adversely affect sea turtles when they are operating in other areas within the range of these species. Similarly, operations of vessels by other federal agencies within the action area (NOAA, EPA, COE) may adversely affect sea turtles. However, the in-water activities of those agencies are limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk.

4.2.3 Additional Military Activities

Additional activities including ordnance detonation, also affect listed species of sea turtles. Section 7 consultations were conducted for USN aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs) (NMFS 1997), and the operation of USCG's boats and cutters in the U.S. Atlantic (NMFS 1995). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity.

NMFS has also consulted on military training operations conducted by the U.S. Air Force (USAF) and U.S. Marine Corps (USMC). From 1995-2007, three consultations have been completed that evaluated the impacts of ordnance detonation during gunnery training or aerial bombing exercises (NMFS 1998a, NMFS 2004c, NMFS 2005b). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity. A consultation evaluating the impacts from USAF search-and-rescue training operations in the Gulf of Mexico was completed in the 1999 (NMFS 1999c). This consultation determined the training operations would adversely affect sea turtles but would not jeopardize their continued existence and an ITS was issued.

4.2.4 Oil and Gas Exploration

COE and MMS authorize oil and gas exploration, well development, production, and abandonment/rig removal activities that may adversely affect sea turtles. Both of these agencies have consulted frequently with NMFS on these types of activities. These activities include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, the impacts vessel strikes, noise, and marine debris have been analyzed in biological opinions for individual and multi-lease sales.

Explosive removal of offshore structures may adversely affect sea turtles. Section 7 consultation for COE-New Orleans District rig removal activities found them likely to adversely affect, but not jeopardize, the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles (NMFS 1998b). An ITS for this activity was provided. In July 2004, MMS completed a programmatic environmental assessment (PEA) on geological and geophysical exploration on the Gulf of Mexico Outer Continental Shelf (MMS 2004). The MMS has also recently completed a PEA on removal and abandonment of offshore structures and effects on protected species in the Gulf of Mexico (MMS 2005).

4.2.5 ESA Permits

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under section 10(a)(1)(A) of the ESA. In addition, section 6 of the ESA allows NMFS to enter into cooperative agreements with states to assist in recovery actions of listed species. Prior to issuance of these permits, the proposal must be reviewed for compliance with section 7 of the ESA.

Sea turtles are the focus of research activities authorized by section 10 permits under the ESA. As of January 2009, there were 21 active scientific research permits directed toward sea turtles that are applicable to the action area of this biological opinion. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, to blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally captured sea turtles. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of sea turtles annually. Most takes authorized under these permits are expected to be non-lethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by NMFS must also undergo a section 7 analysis to ensure the issuance of the permit does not result in jeopardy to the species.

4.2.6 Vessel Traffic

Commercial traffic and recreational pursuits can adversely affect sea turtles through propeller and boat strikes. The Sea Turtle Stranding and Salvage Network (STSSN) includes many records of vessel interaction (propeller injury) with sea turtles off Gulf of Mexico coastal states such as Florida, where there are high levels of vessel traffic. The extent of the problem is difficult to assess because of not knowing whether the majority of sea turtles are struck pre- or post-mortem. Private vessels in the action area participating in high-speed marine events (e.g., boat races) are a particular threat to sea turtles. NMFS and the USCG have completed several formal consultations on individual marine events that may affect sea turtles. NMFS and USCG St. Petersburg Sector are currently conducting a formal consultation regarding high-speed boating events and fishing tournaments occurring off the west coast of Florida that may affect sea turtles.

4.2.7 Marine Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local or private action, may indirectly affect sea turtles in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants such as PCBs; storm water runoff from coastal towns, cities, and villages; and runoff into rivers that empty into bays and groundwater. The pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986).

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to stimulate plankton blooms in closed or semi-closed estuarine systems. An example is the large area of the Louisiana continental shelf with seasonally depleted oxygen levels (< 2mg/l), caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as “dead zones.” The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid summer, and disappears in the fall. Since 1993, the average extent of mid-summer bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 square kilometers, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2001, when it was 21,700 square kilometers (Rabalais et al. 2002). The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

4.3 Conservation and Recovery Actions Benefiting Sea Turtles

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for Atlantic HMS, Gulf of Mexico reef fish, and South Atlantic snapper-grouper fishery, and TED requirements for Southeast shrimp trawl fishery. In addition to regulations, outreach programs have been established and data on sea turtle interactions with recreational fisheries has been collected through the Marine Recreational Fishing Statistical Survey (MRFSS). The summaries below discuss all of these measures in more detail.

4.3.1 Regulations Reducing Threats to Sea Turtles from Fisheries

Reducing Threats from Pelagic Longline and Other Hook-and-Line Fisheries
On May 1, 2009 NMFS published an emergency rule (74 FR 20229), effective from May 18, 2009 through October 28, 2009, prohibiting bottom longlining for Gulf reef fish east of 85°30'W longitude (near Cape San Blas, Florida) and in the portion of the EEZ shoreward of the 50-fathom depth contour. The emergency rule is intended to reduce sea turtle takes in the short-term while the Gulf of Mexico Fishery Management Council develops long-term protective measures through Amendment 31 to the Fishery Management Plan for Reef Fish Resources in the Gulf of Mexico.

NMFS published the final rule to implement sea turtle release gear requirements and sea turtle careful release protocols in the Gulf of Mexico reef fish fishery on August 9, 2006 (71 FR 45428). These measures require owners and operators of vessels with federal commercial or charter vessel/headboat permits for Gulf reef fish to comply with sea turtle (and smalltooth sawfish) release protocols and have on board specific sea turtle release gear. NMFS is currently conducting rulemaking to implement similar release gear and handling requirements for the South Atlantic snapper-grouper fishery.

On July 6, 2004, NMFS published a final rule to implement management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality. The rulemaking, based on the results of the 3-year Northeast Distant Closed Area research experiment and other available sea turtle bycatch reduction studies, is expected to have significant benefits to endangered and threatened sea turtles.

Revised Use of Turtle Excluder Devices in Trawl Fisheries
NMFS has also implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. In particular, NMFS has required the use of TEDs in southeast United States shrimp trawls since 1989 and in summer flounder trawls in the Mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs exclude 97 percent of the sea turtles caught in such trawls. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), floatation, and more widespread use.

Significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring TEDs in trawl nets fished from the North Carolina/South Carolina border to Cape Charles, Virginia. However, the TED requirements for the summer flounder trawl fishery do not require the use of larger TEDs that are used in the shrimp trawl fishery to exclude leatherbacks, as well as large, benthic, immature and sexually mature loggerheads and green sea turtles.

NMFS has also been working to develop a TED, which can be effectively used in a type of trawl known as a flynet, which is sometimes used in the Mid-Atlantic and Northeast fisheries to target sciaenids and bluefish. Limited observer data indicate that takes can be quite high in this fishery. A top-opening flynet TED was certified this summer, but experiments are still ongoing to certify a bottom-opening TED.

Placement of Fisheries Observers to Monitor Sea Turtle Takes
On August 3, 2007, NMFS published a final rule required selected fishing vessels to carry observers on board to collect data on sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary (72 FR 43176). This rule also extended the number of days NMFS observers placed in response to a determination by the Assistant Administrator that the unauthorized take of sea turtles may be likely to jeopardize their continued existence under existing regulations, from 30 to 180 days.

Final Rules for Large-Mesh Gillnets
In March 2002, NMFS published new restrictions for the use of gillnets with larger than 8-inch stretched mesh, in federal waters (3-200 nautical miles) off North Carolina and Virginia. These restrictions were published in an interim final rule under the authority of the ESA (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on ESA-listed sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the interim final rule, NMFS published a final rule on December 3, 2002, that established the restrictions on an annual basis. As a result, gillnets with larger than 8-inch stretched mesh were not allowed in federal waters (3-200 nautical miles) in the areas described as follows: (1) north of the North Carolina/South Carolina border at the coast to Oregon Inlet at all times; (2) north of Oregon Inlet to Currituck Beach Light, North Carolina, from March 16-January 14; (3) north of Currituck Beach Light, North Carolina, to Wachapreague Inlet, Virginia, from April 1-January 14; and (4) north of Wachapreague Inlet, Virginia, to Chincoteague, Virginia, from April 16-January 14. On April 26, 2006, NMFS published a final rule (71 FR 24776) that included modifications to the large-mesh gillnet restrictions. The new final rule revised the gillnet restrictions to apply to stretched mesh that is greater than or equal to 7 inches. Federal waters north of Chincoteague, Virginia, remain unaffected by the large-mesh gillnet restrictions. These measures are in addition to Harbor Porpoise Take Reduction Plan measures that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and federal waters from Delaware through North Carolina out to 72º 30'W longitude) from February 15-March 15, annually.

4.3.2 Other Sea Turtle Conservation Efforts

Sea Turtle Handling and Resuscitation Techniques
NMFS published a final rule (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear.

Outreach and Education, Sea Turtle Entanglements, and Rehabilitation
There is an extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the USFWS, the U.S. Coast Guard, or any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA [50 CFR 223.206(b)].

Other Actions
A draft revised recovery plan for the loggerhead sea turtle was published May 30, 2008 (73 FR 31066). The recovery plan for the Kemp's ridley sea turtle is in the process of being updated. Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising these plans based upon the latest and best available information. Five-year status reviews have recently been completed for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. However, further review of species data for the green, hawksbill, leatherback, and loggerhead sea turtles was recommended, to evaluate whether distinct population segments (DPS) should be established for these species (NMFS and USFWS 2007a-e).

4.4 Factors Affecting *Acropora* within the Action Area

In Section 3 (Status of Species), we described the range-wide status of *Acropora*.[17] Within the action area, *Acropora* occur in two specific areas off southeast Florida and in the Gulf of Mexico, with the majority of colonies located in the Florida Keys. *Acropora* colonies are non-motile and susceptible to relatively localized adverse affects as a result. Localized adverse affects on *Acropora* in the action area have resulted from many of the same stressors affecting *Acropora* throughout its range, namely anthropogenic breakage, disease, and intense weather events (i.e., hurricanes and extreme cold-water disturbances). These stressors have led to abundance declines of *Acropora* in the action area commensurate with the declines seen elsewhere in the species' range (*Acropora* BRT 2005). Therefore, we believe the status of the species described in Section 3 is an accurate reflection of the species status within the action area.

4.4.1 Federal Actions

This is the first formal consultation evaluating the effects of a federal fishery on *Acropora*. As such, there are no other biological opinions to reference regarding the impacts of federal fisheries on these species. Given the morphology and distribution of *Acropora*, it is possible certain types of fishing gear (e.g., bottom trawl, bottom longline, and hook-and-line) will adversely affect these species. However, there is currently little data available to evaluate the impacts of those gear types on these species.

[17] Throughout the rest of the document we use the term '*Acropora*' to refer to the two listed *Acropora* species (*Acropora cervicornis* and *A. palmata*), unless an individual species is specifically identified.

NMFS is collecting data to analyze the impacts of federal fisheries and will conduct section 7 consultations as appropriate.

Other federal agencies also authorize actions within the action area with the potential to affect *Acropora*, including:

- The U.S. Army Corps of Engineers (COE) authorizes and carries out construction and dredge and fill activities that may result in direct mortality, injure *Acropora*, or eliminate or impede *Acropora's* access to habitat.
- The COE permits discharges to surface waters. Shoreline and riparian disturbances (whether in the riverine, estuarine, marine, or floodplain environment) resulting in discharges may retard or prevent the reproduction, settlement, reattachment, and development of listed corals (e.g., land development and run-off, and dredging and disposal activities, result in direct deposition of sediment on corals, shading, and lost substrate for fragment reattachment or larval settlement).
- The U.S. Environmental Protection Agency (EPA) regulates the discharge of pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water, including sewage water, into the waters of the United States. Elevated discharge levels may cause direct mortality, reduced fitness, or habitat destruction/modification.
- The National Marine Sanctuary Program and the National Park Service regulate activities within their boundaries that are conducted in shallow water coral reef areas including collection of coral, alteration of the seabed, discharges, boating, anchoring, fishing, recreational scuba diving, and snorkeling.

As more data becomes available to evaluate the impacts of this suite of activities section 7 consultations will be reinitiated as necessary.

4.4.2 Other Non-Federal Actions Affecting *Acropora*

Poor boating and anchoring practices, poor snorkeling and diving techniques, and destructive fishing practices cause abrasion and breakage to *Acropora*. Nutrients, contaminants, and sediment from point and non-point sources cause direct mortality and the breakdown of normal physiological processes. Additionally, these stressors create an unfavorable environment for reproduction and growth.

Diseases have been identified as the major cause of *Acropora* decline. Although the most severe mortality resulted from an outbreak in the early 1980s, diseases (i.e., white band disease) are still present in *Acropora* populations and continue to cause mortality.

Hurricanes and large coastal storms could also significantly harm *Acropora*. Due to its branching morphology, it is especially susceptible to breakage from extreme wave action and storm surges. Historically, large storms potentially resulted in an asexual reproductive event, if the fragments encountered suitable substrate, attached, and grew into a new colony. However, in the recent past, the amount of suitable substrate is significantly reduced; therefore, many fragments created by storms die.

4.4.3 Conservation and Recovery Actions

On November 26, 2008, NMFS published the final rule designating critical habitat for *Acropora*. This designation included areas in four locations: Florida, St. John/St. Thomas, Puerto Rico, and St. Croix. These areas possess the physical or biological features deemed necessary for the conservation of these species (73 FR 72209).

On October 29, 2008 NMFS published a final rule prohibiting the take of *Acropora*, pursuant to section 4(d) of the ESA (73 FR 64264). Such regulations prohibit many actions pertaining to *Acropora*, including but not limited to: importing or exporting these species from or into the United States; taking of these species from U.S. waters, its territorial sea, or the high seas; or possessing or selling these species.

Other federal regulatory mechanisms and conservation initiatives have focused on addressing physical impacts, including damage from fishing gear, anchoring, and vessel groundings. The Coral Reef Conservation Act and the two Coral and Coral Reef Fishery Management Plans require the protection of corals and prohibit the collection of hard corals. Depending on the specifics of zoning plans and regulations, marine protected areas (MPAs) can help prevent damage from collection, fishing gear, groundings, and anchoring.

4.5 Factors Affecting Smalltooth Sawfish Within the Action Area

In recent years, NMFS has undertaken section 7 consultations to address the effects of federally permitted fisheries and other federal actions on smalltooth sawfish, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on smalltooth sawfish. The following sections summarize anticipated sources of incidental take of smalltooth sawfish in the Atlantic, and Gulf of Mexico EEZ, which have already concluded formal section 7 consultation.

4.5.1 Fisheries

NMFS has completed a section 7 consultation on the continued authorization of *HMS Atlantic shark fisheries* (NMFS 2008). The commercial fishery uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect declining shark stocks the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and smalltooth sawfish. The biological opinion concluded that smalltooth sawfish may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize its continued existence and an ITS was provided.

NMFS recently completed a section 7 consultation on the continued authorization of the *coastal migratory pelagic* fishery in the Gulf of Mexico and South Atlantic (NMFS 2007). In the Gulf of Mexico, hook-and-line, gillnet, and cast net gears are used. Gillnets are the primary gear type used by commercial fishermen in the South Atlantic, while the recreational sector uses hook-and-line gear. The biological opinion concluded that smalltooth sawfish may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize its continued existence and an ITS was provided.

NMFS completed a section 7 consultation on the continued authorization of the *Gulf of Mexico reef fish fishery* on February 15, 2005 (NMFS 2005a). The fishery uses three basic types of gear: spear and powerhead, trap, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel). The biological opinion concluded that smalltooth sawfish may be adversely affected by the operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of this species and an ITS has been provided.

A section 7 consultation on the *South Atlantic snapper-grouper fishery* was completed by NMFS on June 7, 2006 (NMFS 2006a). The fishery uses spear and powerhead, black sea bass pot, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel). The consultation concluded the hook-and-line component of the fishery was likely to adversely affect smalltooth sawfish, but was not likely to jeopardize its continued existence. An ITS was issued for takes in the hook-and-line component of the fishery.

NMFS has also conducted section 7 consultations on the impacts of the *Gulf of Mexico shrimp trawl fishery* (NMFS 2006b) *and the South Atlantic shrimp trawl fishery* (NMFS 2005c) on smalltooth sawfish. Both of these consultations found these fisheries likely to adversely affect smalltooth sawfish, but not likely jeopardize their continued existence. The ITS provided in those biological opinions anticipated the lethal take of up to one smalltooth sawfish annually in each of these two fisheries. In May 2009, NMFS requested reinitiation of section 7 consultations on the impacts of the South Atlantic shrimp trawl fishery because the amount of authorized incidental take for smalltooth sawfish had been exceeded. One lethal take was observed in 2008, and three additional takes (one lethal and two non-lethal) were observed in 2009.

Smalltooth sawfish may infrequently be taken in other South Atlantic and Gulf of Mexico federal fisheries involving trawl, gillnet, bottom longline gear, and hook-and-line gear. However, NMFS has little data to substantiate such takings. NMFS is collecting data to analyze the impacts of these fisheries and will conduct section 7 consultations as appropriate.

4.5.2 ESA Permits

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for scientific research purposes under section 10(a)(1)(A). Prior to issuance of these permits, the proposal must be reviewed for compliance with section 7 of the ESA. There are currently two active smalltooth sawfish research permits. Permit holders are Dr. John Carlson (SEFSC), and Florida Fish and Wildlife Conservation Commission. Although the permitted research may result in disturbance and injury of smalltooth sawfish, the activities are not expected to affect the reproduction of the individuals that are caught, nor result in mortality.

4.5.3 Conservation and Recovery Actions

Under section 4(f)(1) of the ESA, NMFS is required to develop and implement a recovery plan for the conservation and survival of endangered and threatened species. In September 2003, NMFS convened a smalltooth sawfish recovery team composed of nine members from federal, state, non-governmental, and non-profit organizations. The team has completed a draft recovery plan. The goal of the recovery plan is to rebuild and assure the long-term viability of the U.S. DPS of smalltooth sawfish in the wild, allowing initially for reclassification from endangered to threatened status (downlisting) and ultimately the recovery and subsequent removal from the List of Endangered and Threatened Wildlife (delisting). NMFS released the final Smalltooth Sawfish Recovery Plan on January 21, 2009 (74 FR 3566).

On November 20, 2008, NMFS proposed to designate critical habitat for smalltooth sawfish (73 FR 70290). The proposed critical habitat would comprise of two units off southwestern Florida – the Charlotte Harbor Estuary and the Ten Thousand Island/Everglades unit – comprising approximately 619,013 acres. These areas contain the physical and biological features deemed essential for the conservation of the species.

5.0 Effects of the Action

In this section of the opinion, we assess the probable effects of the continued operation of the Gulf of Mexico/South Atlantic spiny lobster fishery on ESA-listed species. The analysis in this section forms the foundation for our jeopardy (risk) analysis in section 7. A jeopardy determination is reached if we would reasonably expect the proposed action to cause, either directly or indirectly, reductions in numbers, reproduction, or distribution that would appreciably reduce a listed species' likelihood of surviving and recovering in the wild. The ESA defines an endangered species as "...in danger of extinction throughout all or a significant portion of its range..." and a threatened species as "...likely to become an endangered species within the foreseeable future..." The status of each listed species likely to be adversely affected by the continued authorization of the Gulf of Mexico/South Atlantic spiny lobster fishery is reviewed in Section 3. Sea turtle species are listed because of their global status; a jeopardy determination must therefore find the proposed action will appreciably reduce the likelihood of survival and recovery of each species globally. The *Acropora* species are listed because of their statuses throughout their ranges. Like sea turtles, a jeopardy determination for these species must find the proposed action will appreciably reduce the likelihood of survival and recovery for each species throughout its entire range. Only the U.S. DPS of smalltooth sawfish is listed; a jeopardy determination must therefore find the proposed action will appreciably reduce the likelihood of survival and recovery of the U.S. DPS.

The analyses in this section are based upon the best available commercial and scientific data on sea turtles, *Acropora*, and smalltooth sawfish biology and the effects of the proposed action. Data pertaining to the Gulf of Mexico/South Atlantic spiny lobster fishery, relative to interactions with sea turtles, *Acropora*, and smalltooth sawfish are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Frequently, different analytical approaches may be applied to the same data sets. In those cases, in keeping with the direction from the U.S. Congress to resolve uncertainty by providing the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], we will generally select the value yielding the most conservative outcome (i.e., would lead to conclusions of higher, rather than lower, risk to endangered or threatened species).

When analyzing any proposed action, it is important to consider not only its immediate effects to ESA-listed species, but also the effects caused by or resulting from it that are reasonably certain to occur later in time. For example, effects from the proposed action occurring later in time could include habitat degradation, reduction of prey/foraging base, etc. No such effects to sea turtles or smalltooth sawfish have been identified because of the operation of the Gulf of Mexico/South Atlantic spiny lobster fishery (i.e., scuba diving, vessel operations, gear deployment and retrieval). Our analysis assumes sea turtles, smalltooth sawfish, and *Acropora* are not likely to be adversely affected by a gear type unless they interact with it. We also assume the potential effects of each gear type are proportional to the number of interactions between the gear and each species.

Approach to Assessment
Our analysis of the effect of the action in this section involved several steps. We began by determining which gear types/techniques (i.e., bully nets, hand harvest gears [e.g., nets and snares], and traps) were likely to adversely affect sea turtles, *Acropora*, and smalltooth sawfish. We then reviewed the range of responses to an individual's exposure to fishing gear and the factors affecting the likelihood of exposure. The focus then shifts to evaluating and quantifying the impacts of spiny lobster fishing on sea turtles, *Acropora*, and smalltooth sawfish under status quo management (see Section 2.1 for more detail). For sea turtles and smalltooth sawfish, we estimated the number of individuals likely to be exposed to the fishery, and the likely fate of those animals. For *Acropora*, we estimated the area likely to have been adversely affected by the fishery. We then consider how the fishery's continued operation would affect future levels of take; i.e., whether the estimated past take would increase or decrease and by how much, or whether the same levels would continue in the future.

There are three basic types of gear used in the directed spiny lobster fishery: bully nets, hand harvest gears (e.g., nets and snares), and traps. Section 2 describes these gears and how recreational or commercial fishermen use them to target spiny lobster. The type of fishing gears, the areas, and the manner in which they are used, all affect the likelihood of sea turtle or smalltooth sawfish interactions. For this reason, each gear type is evaluated separately.

Due to a number of factors, the number of traps issued in the fishery has remained essentially unchanged since the 2003/04 fishing season (see Section 2.1). As a result, when discussing the fishery and its interactions with ESA-listed species, we use the fishing seasons from 2004-2005 through 2006-2007 as the baseline to project the number of individuals by species likely to be exposed to the various components of the fishery. We believe data from this time series best reflect the level fishing effort currently occurring in the fishery, and ultimately the level of ESA-listed species interactions occurring under the current management regime.

5.1 Effects on Sea Turtles, *Acropora*, and Smalltooth Sawfish from Commercial and Recreational Bully Net Gear

We believe commercial and recreational bully net use is not likely to adversely affect sea turtles, *Acropora*, or smalltooth sawfish based on the low likelihood of interactions between these species and this gear type. Bully nets require an active fishing technique that is only effective when target prey can be seen and the net is tended constantly. The reliance upon visual contact with a target species greatly improves a fisher's ability to avoid incidentally taking sea turtles, *Acropora*, and smalltooth sawfish. This makes it extremely unlikely that sea turtles, *Acropora*, or smalltooth sawfish would become entangled in these gears. Fragmentation or abrasion of *Acropora* caused by bully nets is also extremely unlikely. *Acropora* are extremely unlikely to occur on the seagrass and mud flats were the vast majority of bully nets are used. Since the likelihood of any interaction between bully net gear and sea turtles, *Acropora*, and smalltooth sawfish is extremely low, we believe any impact from this fishing gear is discountable.

5.2 Effects on Sea Turtles, *Acropora*, and Smalltooth Sawfish from Commercial and Recreational Diving

Effects on Sea Turtles and Smalltooth Sawfish

We believe commercial and recreational spiny lobster diving is not likely to adversely affect sea turtles or smalltooth sawfish. The distribution of spiny lobster diving effort overlaps spatially with areas known to be inhabited by sea turtles and smalltooth sawfish. However, divers only occasionally encounter sea turtles and rarely encounter smalltooth sawfish, if at all. Anecdotal information from encounters indicates some sea turtles and smalltooth sawfish change their route to avoid coming in close proximity to divers, whereas others appear unaware of their presence. There are no reports of incidental sea turtle or smalltooth sawfish takes by spiny lobster divers. Given the selectivity of the gears used and the visual nature of the hunt and capture of spiny lobsters, spiny lobster divers will easily be able to avoid sea turtles and smalltooth sawfish. Any behavioral effects on sea turtles or smalltooth sawfish from the presence of spiny lobster divers are expected to be insignificant. We therefore conclude that diving for spiny lobster is not likely to adversely affect sea turtles or smalltooth sawfish.

Effects on Acropora

Commercial and recreational diving for spiny lobster is not likely to adversely affect *Acropora* species. *Acropora* occurs only rarely and in discrete locations within the Gulf of Mexico and South Atlantic regions, and is not found in the Gulf of Mexico portion of the Florida Keys. Where they do occur, fisheries could cause fragmentation or abrasion resulting from: (1) fishing gear/marine debris, (2) damaging fishing practices, (3) vessel groundings, (4) anchoring, and (5) diver/snorkeler interactions (*Acropora* BRT 2005). However, no impacts are anticipated to occur because of lawful commercial and recreational spiny lobster diving. From 1996-2006, all commercial and recreational spiny lobster trips that occurred in areas where *Acropora* might be present, were inside the Florida Keys National Marine Sanctuary (FKNMS). The FKNMS has specific regulations protecting corals within the sanctuary. Thus, we believe the rarity of *Acropora* in the Gulf of Mexico and South Atlantic, coupled with regulations to protect these corals where they do occur, greatly reduces the likelihood of these impacts occurring at all. Below is a discussion of our rationale for reaching a not likely to adversely affect determination.

Derelict fishing gear/marine debris can destroy benthic organisms especially *Acropora*, due to their branching morphology. However, unlike other fisheries (e.g., hook-and-line fisheries), the propensity of the commercial/recreational spiny lobster dive fishery to produce fishing-related marine debris is extremely unlikely. Fishery-related marine debris is often created by accidental gear loss due to weather or accidental entanglement with submerged benthic features. Commercial/recreational divers targeting spiny lobster primarily use their hands and/or nets to collect lobster and return to surface with those gears when fishing is completed. Since these gears are constantly used by fishers and never intentionally left behind at the cessation of fishing, we believe the likelihood of gear being lost and becoming detrimental marine debris is extremely unlikely, and therefore discountable.

Trawling and other types of fishing gear can be harmful to coral reefs. Trawls can dislodge and abrade corals, and stationary gear such as traps can damage branching corals by breaking branches off as they move across the sea floor or by directly landing on them. This is particularly true in the case of storms that can mobilize traps and often snare buoy lines in branching corals such as *Acropora* (*Acropora* BRT 2005). Trawling and traps are not used by commercial/recreational divers targeting spiny lobster. The use of chemicals (i.e., chlorine, bleach, etc.) to harvest spiny lobster is prohibited (50 CFR 640.22(a)(3)). Since these damaging fishing practices are prohibited, we believe any adverse effects to *Acropora* are extremely unlikely to occur, and therefore discountable.

Vessel groundings are another example of anthropogenic impacts that may harm *Acropora*. A modern large steel ship is a powerful mass and its impact can dislodge and fracture corals, pulverize coral skeletons into small debris-rubble, displace sediment deposits, flatten the topography, and destroy or fracture the reef platform (*Acropora* BRT 2005). However, current regulations governing the operations of vessels within the FKNMS prohibit vessels from striking or otherwise injuring corals (15 CFR 922.163(a)(5)(i)). The presence of navigational aides throughout the FKNMS is also likely to reduce to potential for vessel groundings. Since regulations are currently in place that prohibit vessel groundings, we believe adverse effects to *Acropora* from such events are extremely unlikely to occur, and therefore discountable.

Novice snorkelers/divers may stand on or kick *Acropora* causing breakage, although there are no studies that document the frequency of this damage. FKNMS regulations prohibit damaging, breaking, cutting, or otherwise disturbing *Acropora* inside the sanctuary's boundaries (15 CFR 922.163(a)(2)). Likewise, taking or possessing wildlife protected under the ESA is also prohibited under FKNMS regulations (15 CFR 922.163(a)(10)). Mooring buoys have also been deployed throughout the Sanctuary, reducing boaters' need to anchor. Since FKNMS regulations prohibit the actions that precipitate these effects, we believe they are extremely unlikely to occur and therefore discountable.

5.3 Sea Turtle, *Acropora*, and Smalltooth Sawfish Interactions with Commercial Spiny Lobster Trap Gear

5.3.1 Sea Turtle/Trap Interactions

Commercial lobster traps are known to adversely affect sea turtles via entanglement and forced submergence. Captured sea turtles can be released alive or can be found dead upon retrieval of the gear as a result of forced submergence. Sea turtles released alive may later succumb to injuries sustained at the time of capture. Of the entangled sea turtles that do not die from their wounds, some may suffer impaired swimming or foraging abilities, altered migratory behavior, or altered breeding or reproductive patterns. The following discussion summarizes in detail the available information on how individual sea turtles may respond to interactions with spiny lobster trap gear.

Entanglement
The primary effect on sea turtles from traps is entanglement in buoy lines. Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that trap lines can wrap around the neck, flipper, or body of a sea turtle and severely restrict swimming or feeding. If a sea turtle is entangled when young, the line could become tighter and more constricting as the sea turtle grows, cutting off blood flow and causing deep gashes, some severe enough to remove an appendage.

Loggerhead sea turtles may be particularly vulnerable to entanglement in trap lines because of their attraction to, or attempts to feed on, species caught in the traps and epibonts growing on traps, trap lines, and floats NMFS and USFWS 1991b). Due to body configuration, leatherback sea turtles are also thought to be particularly prone to entanglement.

Forcible Submergence
Sea turtles can be forcibly submerged by trap gear. Forcible submergence may occur through an entanglement event, where the sea turtle is unable to reach the surface to breathe. Forced submergence could also occur if a sea turtle becomes entangled in a trap line below the surface and the line is too short and or the trap is too heavy to be brought up to the surface by the swimming sea turtle.

Sea turtles that are forcibly submerged undergo respiratory and metabolic stress that can lead to severe disturbance of their acid-base balance (i.e., pH level of the blood). Most voluntary dives by sea turtles appear to be an aerobic metabolic process, showing little if any increases in blood lactate and only minor changes in acid-base status. In contrast, sea turtles that are stressed as a result of being forcibly submerged due to entanglement eventually consume all their oxygen stores. This oxygen consumption triggers anaerobic glycolysis, which can significantly alter their acid-base balance, sometimes leading to death (Lutcavage and Lutz 1997).

Numerous factors affect the survival rate of forcibly submerged sea turtles. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling, as well as the length of submergence (Lutcavage and Lutz 1997). Other factors influencing the severity of effects from forced submergence include the size, activity level, and condition of the sea turtle; the ambient water temperature, and if multiple forced submergences have recently occurred. Disease factors and hormonal status may also influence survival during forced submergence. Larger sea turtles are capable of longer voluntary dives than small sea turtles, so juveniles may be more vulnerable to the stress from forced submergence. During the warmer months, routine metabolic rates are higher. Increased metabolic rates lead to faster consumption of oxygen stores, which triggers anaerobic glycolysis. Subsequently, the onset of impacts from forced submergence may occur more quickly during these months. With each forced submergence event, lactate levels increase and require a long (up to 20 hours) time to recover to normal levels. Sea turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple forced submergence events in a short period. Recurring submergence does not allow sea turtles sufficient time to process lactic acid loads (Lutcavage and Lutz 1997). Stabenau and Vietti (2003) illustrated that sea turtles given time to stabilize their acid-base balance after being forcibly submerged have a higher survival rate. The rate of acid-base stabilization depends on the physiological condition of the turtle (e.g., overall health, age, size), time of last breath, time of submergence, environmental conditions (e.g., sea surface temperature, wave action, etc.), and the nature of any injuries sustained at the time of submergence (NRC 1990).

5.3.2 *Acropora*/Trap Interactions

Traps and/or trap lines can adversely affect *Acropora* via fragmentation or abrasion. Traps may affect *Acropora* via fragmentation and abrasion if they become mobilized during storm events and collide with colonies.[18] The deployment of spiny lobster traps may adversely affect *Acropora* as traps drop toward the sea floor or when traps are retrieved and pulled to the surface. Abrasion may occur when traps or trap lines contact *Acropora* during storm events or normal fishing activities. However, *Acropora* is only rarely, if ever, observed in the Gulf of Mexico off south Florida where the vast majority of trap fishing occurs, because of relatively poor water quality. For this reason, we believe any adverse affects from abrasion/fragmentation due to interactions with commercial spiny lobster trap gear are only likely to occur in the South Atlantic waters off south Florida. The following discussion summarizes the best available information on how *Acropora* may be impacted by these interactions with lobster trap fishing gear.

Fragmentation

Severe fragmentation can adversely affect sexual reproduction by reducing colonial biomass and/or causing a reallocation of energy away from reproduction toward stabilization, lesion repair, and growth (Van Veghel and Bak 1994, Van Veghel and Hoetjes 1995, Hall and Hughes 1996, Lirman 2000). Colony size in cnidarians[19] is directly correlated to survivorship, growth, and reproduction (i.e., the larger the colony, the greater the survivorship, growth, and reproductive potential) (Connell 1973, Loya 1976, Highsmith 1982, Jackson 1985, Karlson 1986, 1988; Hughes and Connell 1987, Lasker 1990, Babcock 1991, Hughes et al. 1992). Thus, fragmentation caused by spiny lobster trap gear could result in smaller colonies, potentially reducing their overall survivorship, and growth and reproduction potential. Mortality of coral fragments may also occur, eliminating entirely the possibility of asexual regeneration or future sexual reproduction by those fragments.

Fragmented coral colonies also frequently stop producing gametes for a period of time, due to the reallocation of energy mentioned above. Gamete production is likely to resume only once a certain level of growth and/or tissue repair/regeneration has occurred (Lirman 2000). Lirman (2000) found that *A. palmata* coral colonies that suffered fragmentation during Hurricane Andrew did not produce gametes fully three years after the event. Similar shifts in energy allocation from reproduction toward regeneration have been noted in *Montastraea annularis* (Van Veghel and Bak 1994) and other hard coral species (Kojis and Quinn 1985, Szmant 1986, Hughes et al. 1992). Thus, even surviving *Acropora* fragments may be removed from the spawning population for at least some period of time.

Lirman (2000) observed that the survivorship of *A. palmata* fragments was influenced by the type of substrate upon which the fragment settled. Fragments landing atop other *A. palmata* colonies showed no signs of mortality, while fragments landing on sand showed a 71 percent loss in tissue after four months. The relative scarcity of *Acropora* colonies in the Florida Keys reduces the likelihood of an *Acropora* fragment landing on another *Acropora* colony. As a result, fragments in isolated colonies may have a lower likelihood of survival (T. Matthews, FFWCC, pers. comm. 2008). Other studies suggest a similar correlation between substrate type and survivorship in other coral species (e.g., Yap and Gomez 1984,

[18] Storm events are weather events with sustained winds of 15 knots for 2 days or more (C. Lewis and T. Matthews, FFWCC, pers. comm. 2007).
[19] *Acropora* are members of the phylum cnidaria.

1985; Heyward and Collins 1985, Wallace 1985, Bruno 1998). The benthic habitat of the Florida Keys consists primarily of seagrass (71 percent) and bare substrate (20 percent) (e.g., sand or mud) (FFWCC 2000). Since *Acropora* are highly reliant upon sunlight for nourishment (Porter 1976, Lewis 1977), if fragments are transported into these seagrass areas, their survivorship may be reduced due to shading. Seagrass beds also accrete sediment; any *Acropora* fragments transported into seagrass beds may also be susceptible to burial in sediment.

Abrasion
Abrasion by marine debris or fishing gear (e.g., spiny lobster traps and trap lines) can result in the loss of tissue, or tissue and skeleton. The loss of tissue can be partial or complete and the loss of tissue and skeleton can by superficial or extensive (Woodley et al. 1981, Glynn 1990, Craik et al. 1990, Hall 1997). The extent and severity of abrasion injuries is dependent upon the duration and frequency of the abrasion events.

The adverse affects to *Acropora* resulting from abrasion injuries are similar to those mentioned above for fragmentation. One of the primary impacts is the reallocation of energy away from reproduction and growth, towards regeneration or repair of the injured tissue and skeleton (Kobayashi 1984, Rinkevich and Loya 1989, Meester et al. 1994, Van Veghel and Bak 1994, Van Veghel and Hoetjes 1995, Hall and Hughes 1996, Hall 1997).

Areas injured by abrasion also provide sites for pathogens to enter and create habitable space for settlement of other organisms (e.g., algae, sponges, or other corals) (Bak et al. 1977, Hall 1997). In many coral species, polyps defend the colony by secreting mucus, discharging nematocysts, or through the production of allelochemicals (Hall 1997). The removal of polyps reduces a colony's ability to protect itself, potentially affecting its survivorship. Abrasion injuries also reduce the surface area available to photosynthesize, feed, and reproduce (Jackson and Palumbi 1979, Wahle 1983, Hughes and Jackson 1985, Babcock 1991, Hall and Hughes 1996, Hall 1997).

The type and severity of an abrasion injury (i.e., tissue or skeleton) affects the amount of time required for healing and the amount of energy that must be allocated for regeneration. Hall (1997) states that the time needed to fully recover from tissue injuries was much faster than the time required to completely regenerate fragmented skeleton. This suggests that the loss of tissue from a branch has less impact to the colony as a whole, than the loss of a branch. Hall (1997) hypothesizes that the replacement/regeneration of soft tissue requires the commitment of fewer resources than the regeneration of skeletal material, thus soft tissue can be replaced more quickly. However, Hall (1997) also observed that the area exposed when a branch is fragmented from the colony often healed more quickly than other soft tissue injuries. This suggests that while the regeneration of a fragmented branch may take considerably longer than healing a soft tissue injury, the colony may be exposed to disease and competitors for less time after branch fragmentation than when the colony is repairing a tissue injury.

5.3.3 Smalltooth Sawfish/Trap Interactions

Commercial spiny lobster traps may adversely affect smalltooth sawfish via entanglement. Entangled smalltooth sawfish may suffer impaired swimming or foraging abilities, altered migratory behavior, and altered breeding or reproductive patterns. The following discussion summarizes the available information on how individual smalltooth sawfish may be impacted by spiny lobster trap gear.

Entanglement
Entanglement of a smalltooth sawfish's toothed rostrum in a spiny lobster trap's float line is the primary route of effect between these species and this gear type. While no specific information exists on the effects of spiny lobster trap entanglement on smalltooth sawfish, Seitz and Poulakis (2006) list chafing and irritation of the skin, as well as the loss of rostral teeth, as consequences of entanglement in other types of marine debris. The loss of rostral teeth could be especially detrimental because, unlike other elasmobranchs, smalltooth sawfish do not replace lost teeth (Slaughter and Springer 1968). Since the smalltooth sawfish's rostrum is its primary means for acquiring food, the loss of rostral teeth may impact an animal's ability to forage and hunt effectively. Entanglement injuries could also impair an animal's ability to swim. All such injuries could affect an individual's growth and reproductive abilities.

5.4 Factors Affecting ESA-Listed Species Interactions with Spiny Lobster Traps

5.4.1 Gear Characteristics and Fishing Technique

Bait
Live, under-sized lobster can legally be used as "bait" in the spiny lobster fishery. Due to spiny lobsters' thigmotactic nature and desire for social aggregations, fishers will often use an under-sized lobster to attract other lobsters. Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hardbottom habitats. As such, loggerhead sea turtles may be attracted to spiny lobster traps when lobsters are inside. They are also known to feed on epibionts growing on traps, trap lines, and floats and may be attracted to spiny lobster traps for this reason (NMFS and USFWS 1991b). Smalltooth sawfish feed primarily on fish. Mullet, jacks, and ladyfish are believed to be their primary food resources (Simpfendorfer 2001). There is currently no data available on the attraction of smalltooth sawfish to spiny lobster trap gear.

Spatial/Temporal Overlap Between Fishing Effort and Sea Turtle and Smalltooth Sawfish
Another factor affecting the likelihood of sea turtle and smalltooth sawfish entanglement in spiny lobster trap gear is the spatial and temporal overlap between where they occur and fishing effort. The spatial distribution of sea turtles and smalltooth sawfish influences the rate of interaction with spiny lobster traps. The more abundant sea turtles are in a given area where fishing occurs, the greater the probability a sea turtle or smalltooth sawfish will interact with gear. Aerial survey data suggest that sea turtles are more abundant nearshore (i.e., approximately 0-120 feet) than offshore (L. Garrison, SEFSC, pers. comm. 2009). Spiny lobster trap fishing in both state and federal waters occurs almost exclusively within this depth range.

The temporal distribution of fishing effort and sea turtle and smalltooth sawfish abundance is also a factor. Of the 10 sea turtle stranding records from the Florida Keys with documented entanglement in spiny lobster gear applicable to the 2004-2005 through 2006-2007 fishing seasons, four (40 percent) were recorded in January, two (20 percent) were recorded in August; one (10 percent) was noted for each month of March, June, October, and December. No strandings of sea turtles with spiny lobster gear were documented in February, April, May, July, September or November (NMFS unpublished data).

Soak Time
Spiny lobster gear interactions with sea turtles and smalltooth sawfish also depend on soak time. The longer the soak time, the longer a sea turtle or smalltooth sawfish is exposed to an entanglement threat, increasing the likelihood of such an event occurring. The mortality rate of entangled sea turtles increases with soak time because of the higher potential for extended forced submergence times. Since forced submergence is not a concern for smalltooth sawfish, soak times do not appear to affect morality rates for incidentally caught animals.

5.4.2 Life Stage

Different life stages of sea turtles and smalltooth sawfish are associated with different habitat types and water depths. For example, pelagic stage loggerheads are found offshore; closely associated with *Sargassum* rafts. As loggerheads mature, they begin to live in coastal inshore and nearshore waters foraging over soft- and hardbottom habitats of the continental shelf (Carr 1987, Witzell 2002). Therefore, traps set closer to these areas are more likely to encounter adult loggerheads. Leatherbacks and juvenile loggerheads are more likely to be found further offshore in deeper, colder water. Spiny lobster traps are generally not fished in these areas, thus the fishery is far less likely to interact with these life stages. Ten sea turtle stranding records show evidence of spiny lobster trap gear entanglements during the 2004-2005 through 2006-2007 fishing seasons, three loggerheads, three green, two leatherbacks, one Kemp's ridley, and one unidentified sea turtle. Of those records, size data to estimate animal life stage was available for four animals: two small benthic juvenile loggerheads, one adult green, and one benthic juvenile Kemp's ridley (NMFS unpublished data). Although genetic samples are collected from sea turtles, the number of samples currently available is too small to be able to determine the sub-population origin of individuals.

Juvenile smalltooth sawfish are most commonly associated with shallow-water areas off Florida, close to shore, and typically associated with mangroves (Simpfendorfer and Wiley 2004). Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001). Mature animals are known to occur in water depths of 100 m or more (C. Simpfendorfer pers. comm. 2006). Thus, gear deployed in deeper water is more likely to encounter adult age classes.

5.5 Estimating ESA-Listed Species Take in the Commercial Spiny Lobster Trap Fishery

The preceding sections discussed the potential adverse effects to sea turtles, *Acropora*, and smalltooth sawfish that may result from interactions with spiny lobster trap gears. Our discussion now shifts to evaluating and quantifying the impacts of spiny lobster trap fishing on those species. In the following sections, we describe the data used, the processes, and the results of our analyses for estimating the number or amount of sea turtle, *Acropora*, and smalltooth sawfish take that occurred in the commercial spiny lobster trap fishery from 2004-2005 through 2006-2007.

As noted above (Section 2.1), Florida's Lobster Trap Certificate Program has placed a cap on the number of traps available to the fishery since the 1993/94 fishing season. Annual reductions in the number of trap tags[20] available from the FFWCC succeeded in reducing the number of trap tags issued. Since the number of trap tags issued from 2004-2005 through 2006-2007 has remained relatively stable (see Table 2.1 and Figure 2.1), our analysis focuses on the fishery over this period. We believe using this period best represents how the fishery operates today and using effort information before this period would introduce a positive bias that may overestimate the potential for adverse effects. The cap on number of traps available to the fishery also excludes the possibility of the number of traps in the fishery returning to previous levels. As a result, using data from this period will not underestimate effort in the fishery. Since data for the 2007-2008 fishing season is not yet complete, those data are not used in our analysis.

5.5.1 Estimating Sea Turtle Take by Commercial Spiny Lobster Traps

As noted above, sea turtles may be adversely affected by spiny lobster traps via entanglement and forced submergence. The following sections present our process for estimating sea turtle take by commercial spiny lobster traps. When calculating the sea turtle take rate, we used all STSSN stranding and incidental capture records documented during the 2004-2005 through 2006-2007 fishing seasons to increase our sample size (see the following section for more details on those data). We believe this approach is sensible for a number of reasons. Trap construction requirements are very similar in the state and federal fisheries, and the fishing season is the same. The species of sea turtles that occur in the action area are all highly migratory and found in both state and federal waters off Florida. The vast majority of both state and federal fishing effort occurs in the depth range (0-120 ft) where sea turtles are known to occur most frequently; thus, neither fishery is likely to have a disproportionate rate of entanglement of sea turtles. Since the gear, timing, and distribution of effort with respect to sea turtle abundance, are essentially the same in both state and federal waters, we believe the number of traps fished in the state and federal fisheries is the best predictor of sea turtle entanglements.

Our analysis used the best available sea turtle entanglement and commercial trap fishery data to estimate the total number of sea turtles taken by the Gulf of Mexico/South Atlantic spiny lobster fishery during the 2004-2005 through 2006-2007 fishing seasons. We calculated a sea turtle take rate per trap soak day and multiplied this figure by the number of traps in the federal fishery to estimate the number of sea turtles taken. We also estimated the number of mortalities occurring as a result of those takes, and assigned both lethal and non-lethal takes by species. Due to the statistical and mathematical computation used to estimate take and mortality, some of our estimates do not use whole numbers. However, because it is impossible to take only a portion of a sea turtle, we round off our final take estimates.

5.5.1.1 Summary of Data Used to Estimate Sea Turtle Takes

Sea Turtle Stranding and Salvage Network Data

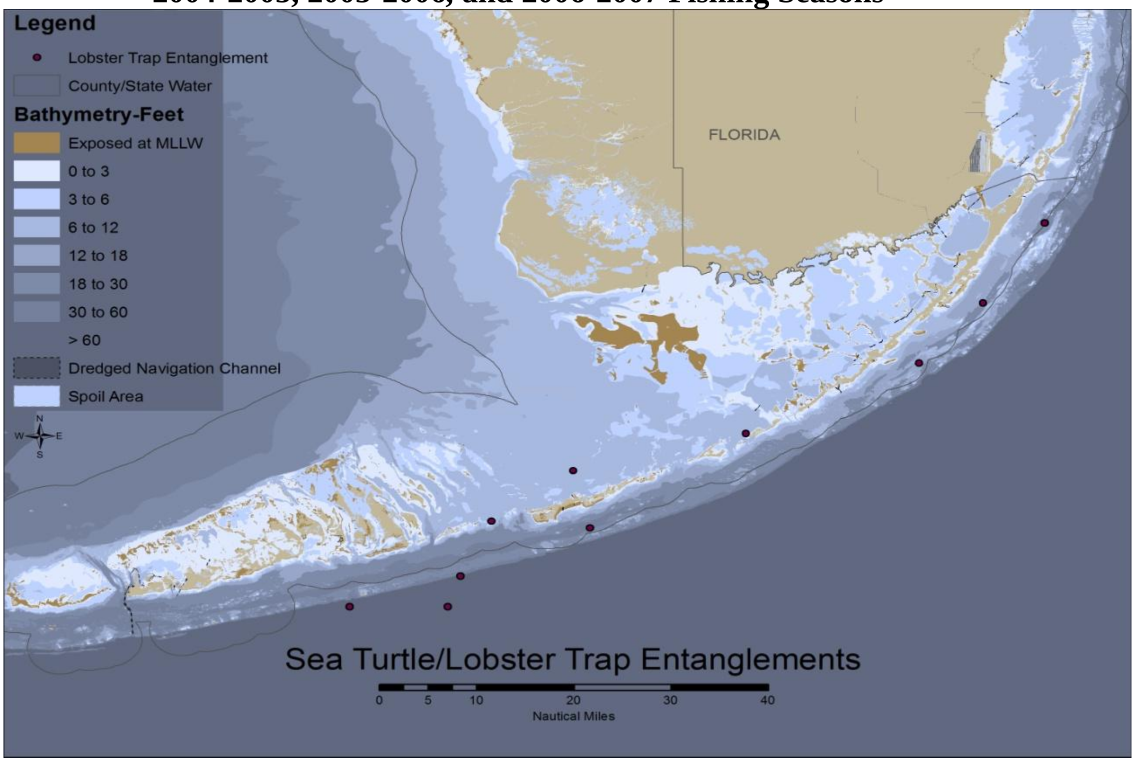
The Sea Turtle Stranding and Salvage Network (STSSN) was formally established in 1980 to collect information on and document strandings and incidental captures of sea turtles along the U.S. Gulf of Mexico and Atlantic coasts. The SEFSC currently maintains this database. The network encompasses the coastal areas of eighteen states, including all the states in the Gulf of Mexico and South Atlantic

[20] Trap tags are required and must be attached to each individual spiny lobster trap fished. As a result, trap tags are a reasonable surrogate for estimating the actual number of traps fished. It is possible for a trap tag to be purchased but never actually used. To act conservatively, our analysis assumes all trap tags issued represent actual traps used in the fishery.

region. Network participants document sea turtle strandings and incidental captures in their respective states, noting any fishing gear or other marine debris associated with the animal. Those data are then entered into a central STSSN database.

The data contained in this database is the best and only available on sea turtle entanglements in spiny lobster trap gear in action area. Querying this database returned 10 records of sea turtle entanglement in spiny lobster trap gear in both state and federal waters (Table 5.2), covering the 2004-2005 through 2006-2007 fishing years. Records indicate entanglements occurred in both state and federal waters (STSSN Database, unpublished data). Two of these records noted the animal was dead when it was found; the remaining seven animals were alive at the time of discovery.

Figure 5.1 Location of Sea Turtle Strandings in Spiny Lobster Trap Gear for the 2004-2005, 2005-2006, and 2006-2007 Fishing Seasons



Individual Spiny Lobster Trap Use and Soak Time by Month

Results from mail surveys showed that from the 1993-94 through the 1999-2000 fishing season, the percentage of total available spiny lobster traps fished each month declined markedly over the course of the fishing season (Matthews 2001). Those data show that, on average, close to 100 percent of traps were fished when the season opened, but only 42 percent were still being fished at the end of the season (Figure 5.2). Table 5.1 summarizes the results.

Matthews (2001) also notes that soak time for each trap varies by month (Figure 5.3). Early in the season, traps were soaked for a relatively short period of time (approximately eight days on average).

Soak times then increased as the season progressed, with an average soak time of approximately 27 days by March.

Figure 5.2 Percentage of Traps Used Each Month by Fishing Season
Source: Matthews 2001

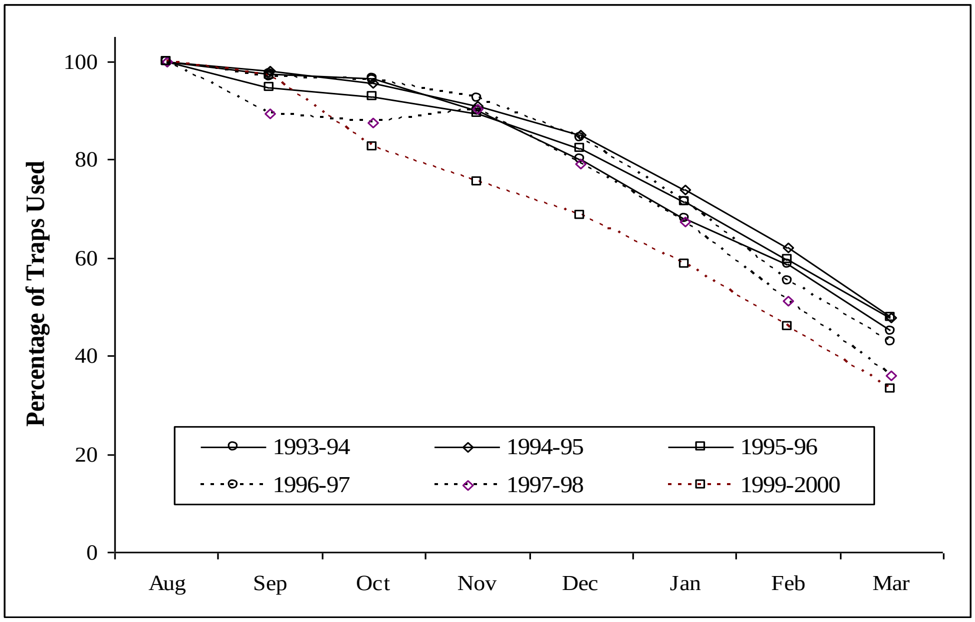
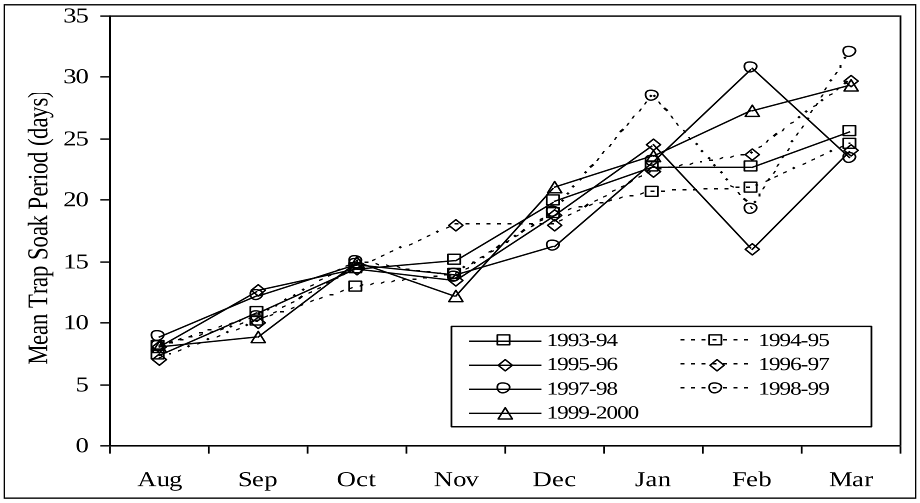


Table 5.1 Percentage of Traps Used Each Month by Fishing Season
Source: Matthews 2001

	1993/94	1994/95	1995/96	1996/97	1997/98	1999/2000	Average by Month
August	100.00	100.00	100.00	100.00	100.00	100.00	100.00
September	97.63	98.18	94.73	96.80	89.34	97.36	95.67
October	96.69	95.83	92.75	96.33	87.52	82.56	91.95
November	90.00	91.11	89.47	92.70	90.35	75.35	88.16
December	80.08	85.04	82.40	84.48	79.18	68.62	79.97
January	68.14	74.09	71.33	71.48	67.50	58.57	68.52
February	58.67	62.06	59.75	55.29	51.25	46.12	55.52
March	45.12	47.79	47.78	42.94	35.90	33.25	42.13
Average by Yr	79.54	81.76	79.78	80.00	75.13	70.23	77.74

Figure 5.3 Mean Soak Time for Spiny Lobster Traps by Month
Source: Matthews 2001



5.5.1.2 Estimating Sea Turtle Take in the Commercial Spiny Lobster Trap Fishery

Estimating Sea Turtle Take Rates Per Fishing Year

We began by assigning the STSSN sea turtle entanglement records to a specific commercial spiny lobster fishing season (August 6-March 31) based on the date the stranding was documented (Table 5.2). One stranding record could not be assigned to a specific fishing season using this method. Since this event was documented as spiny lobster trap gear entanglement, we believe it should be included in our analysis. We also believe it is reasonable to assume this entanglement occurred as a result of fishing in the season immediately preceding the date of the stranding (i.e., the stranding documented on June 3, 2006, was likely the result of fishing that occurred during the 2005-2006 season). Therefore, we assigned it to the 2005-2006 fishing season.

Table 5.2 Sea Turtle Stranding Records Noting Lobster Trap Gear Entanglement

Fishing Season	Month	Day	Species	Area	Condition
2005-2006	December	03	Loggerhead	FL - Gulf of Mexico	Alive
2005-2006	January	16	Leatherback	FL - Gulf of Mexico	Alive
2005-2006	March	17	Unknown	FL - Gulf of Mexico	Alive
2005-2006*	June	03	Green	FL – South Atlantic	Alive
2006-2007	August	08	Green	FL – South Atlantic	Dead
2006-2007	August	08	Green	FL – South Atlantic	Dead
2006-2007	November	07	Kemp's Ridley	FL - Gulf of Mexico	Alive
2006-2007	January	16	Loggerhead	FL - Gulf of Mexico	Alive
2006-2007	January	16	Loggerhead	FL - Gulf of Mexico	Alive
2006-2007	January	23	Leatherback	FL - Gulf of Mexico	Alive

*This record fell outside of a specific fishing season and was assigned using the process noted above.

While these data are the best available regarding sea turtle interactions with spiny lobster trap gear, determining what proportion of all lobster gear induced strandings these records actually represent is difficult. Because of oceanic conditions (i.e., currents, waves, wind) and the dynamic nature of the marine environment, it is likely that stranding records actually represent only a small number of the total at-sea entanglements caused by trap/pot gear (Murphy and Hopkins-Murphy 1989, Epperly et al. 1996).

Studies of at-sea mortalities indicate stranding data only represent between 5 percent and 28 percent of all moralities occurring at sea (Hopkins-Murphy 1989, Epperly et al 1996, TEWG 1998, Hart et al. 2006). NMFS SEFSC (2001) states that on average, the number of dead sea turtle strandings represent 20 percent, at best, of all at-mortalities. We also believe it is likely that the number of live sea turtle strandings reported is only a small fraction of the total actually occurring. Unfortunately, there are currently no estimates available of what percentage of live sea turtles strandings are actually reported. We addressed this potential under-representation by dividing the number of sea turtles strandings each year, by 20 percent (Table 5.3).

Table 5.3 Original and Adjusted Estimates of Sea Turtle Strandings

Fishing Year	Number of STSSN Stranding Events	Adjusted Stranding Events
2004-2005	0	0
2005-2006	4	20
2006-2007	6	30
Total	**10**	**50**

Next, we tabulated and calculated the amount of commercial trap fishing effort in the fishery during the 2004-2005, 2005-2006, and 2006-2007 fishing years (Florida Fish and Wildlife Conservation Commission, Marine Fisheries Trip Ticket Program, unpublished data). Effort can be measured in variety of ways, including the traps available, total number of trips, traps fished, sets, hours fished, and soak time. Since we believe the likelihood of sea turtle entanglement is dependent on the amount of time the trap spends in the water, we used trap soak time for calculating entanglements (Table 5.4).

The trap soak time in federal waters was calculated by multiplying the number of traps issued each season, by the percentage of all traps used each month (see Table 5.1) to estimate the total number of times traps were used each month. We then multiplied that figure, by the average soak time of a single trap each month (Figure 5.3) to estimate the total number of trap soak days for each month. By summing the total trap soak day estimates from each month, we estimated the total number of trap soak days for the entire fishery (Table 5.4). This method is conservative because it assumes each trap issued will be used in the fishery. Since each trap can be used more than once during a fishing season, the number of traps used is greater than the number of total traps issued.

Table 5.4 Total Trap Soak Days in Federal and State Waters

Fishing Year	Traps Issued	No. of Traps Fished Each Year	Total Trap Soak Days
2004-2005	498,409	3,099,705	49,552,717
2005-2006	497,042	3,091,204	49,416,807
2006-2007	495,770	3,083,293	49,290,343
Total	1,491,221	9,274,202	148,259,867

Next, we divided our annual adjusted sea turtle stranding estimates by the number of trap soak days for each fishing year, yielding an estimate of sea turtle takes per trap soak day (Table 5.5). The sea turtle take rates were far less than one. They ranged from a low of 0 interactions in the 2004-2005 fishing years when no sea turtle strandings were reported, to a high of $6x10^{-7}$ takes per trap soak day during the 2006-2007 fishing year.

Table 5.5 Sea Turtle Take Rates Per Trap Soak Day

Fishing Year	Total Trap Soak Days	Sea Turtle Strandings (Adjusted)	Sea Turtle/Soak Day Interaction Rate
2004-2005	49,552,717	0	0.0000000
2005-2006	49,416,807	20	0.0000004
2006-2007	49,290,343	30	0.0000006
Total	148,259,867	50	--

Sea Turtle Takes in the Federal Spiny Lobster Trap Fishery

Since the proposed action is the continued authorization of the federal fishery, we applied the above sea turtle take rates to the effort in the federal fishery only. Using Florida Trip Ticket information, we calculated the percentage of all traps in the fishery that are fished in federal waters. Applying that percentage to the total trap soak days used each year, we estimated the number of trap soak days in the federal fishery. Multiplying those figures by our sea turtle take rate yielded the number of sea turtle takes by spiny lobster traps in federal waters (Table 5.6). We estimate 6.2 sea turtles takes occurred between the 2004-2005 and 2006-2007 fishing years; an average of 2.06 per fishing season.

Table 5.6 Estimated Sea Turtle Takes in Federal Waters

Fishing Year	% of All Traps Pulled	Total Trap Soak Days in Federal Waters	Sea Turtle/Trap Interaction rate	No. of Sea Turtle Takes
2004-2005	18.10%	8,971,140	0.0000000	0.00
2005-2006	16.31%	8,060,826	0.0000004	3.22
2006-2007	10.09%	4,975,731	0.0000006	2.98
Total	--	22,007,697	--	6.20

Estimating Mortality

Next, we estimated how many of these takes may have resulted in mortality. Our sea turtle strandings records indicate that 20 percent of sea turtle entanglements in spiny lobster trap gear result in mortality. However, it is impossible to ascertain what role the entangling gear actually played in causing the mortality of these animals. Likewise, it is impossible to determine how entangling gear would have affected the live sea turtles if the gear had not been removed. While we acknowledge these potential biases exist, we have no way of non-arbitrarily addressing them. Therefore, we use our estimate of 20 percent mortality when calculating the number of lethal takes.

Estimating Sea Turtle Takes by Species

To conduct our jeopardy (risk) analysis and effectively assess the impacts of incidental takes, we must assign take for individual species. We rely on what we know about sea turtle relative abundance and behavior in the action area to arrive at take estimates for each sea turtle species.

We initially produced a sea turtle species composition estimate with the nine sea turtle stranding records returned from our STSSN query (Table 5.7). However, we were concerned that this small sample size might not accurately represent the potential for entanglement of other species. For example, hawksbill sea turtles are known to inhabit the nearshore areas where spiny lobster trap fishing is common and could potentially become entangled. To address these issues we evaluated the suitability of other data sources for estimating sea turtle species composition. Since the federal lobster trap fishing effort is concentrated so close to shore, we believe the STSSN database represents the best available source for estimating sea turtle species composition in the action area.

Between the 2004-2005 and 2006-2007 fishing years, over 80 percent of federally-fished traps were off the Florida Keys and Dade County, Florida. The STSSN regional statistical zones 1, 2, 24, and 25 entirely circumscribe these areas (Figure 5.3 and 5.4). We aggregated all sea turtle stranding data available from these statistical zones to estimate sea turtle composition (Table 5.8). These data suggest loggerheads are the most abundant, followed by green sea turtles.

Table 5.7 Sea Turtle Species Composition Derived from 10-Queried STSSN Records

Species	No. of Strandings	% of Total Strandings
Loggerhead	3	30
Green	3	30
Leatherback	2	20
Kemp's Ridley	1	10
Unknown	1	10
Total	10	--

Table 5.8 Sea Turtle Species Composition Derived from All STSSN Records in Statistical Zones 1, 2, 24, & 25

Species	No. of Strandings	% of Total Strandings
Loggerhead	647	48.3
Green	503	37.5
Leatherback	19	1.4
Hawksbill	106	7.9
Kemp's Ridley	18	1.3
Unknown	46	3.4
Total	1339	--

(STSSN Database, Accessed June 1, 2007)

Figure 5.4 STSSN Statistical Zones for the Gulf of Mexico Region

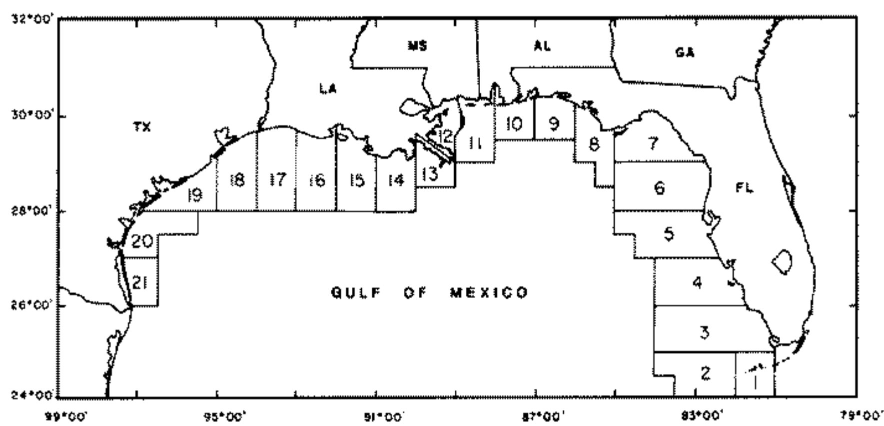
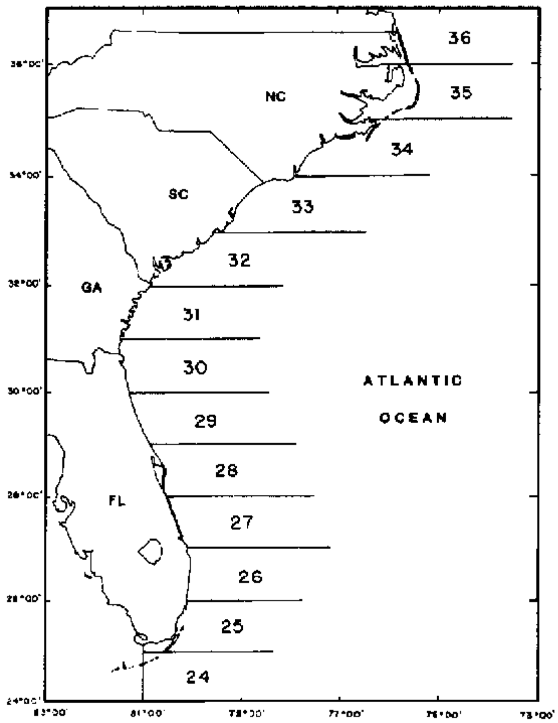


Figure 5.5 STSSN Statistical Zones for the South Atlantic Region



We chose to use the species composition estimate from all STSSN records (Table 5.8) because it represents a much larger sample size. We believe this species composition best represents the species likely to be in area. By multiplying our take estimate by the STSSN species composition estimate listed above (Table 5.8), and using our mortality estimate from above, we estimated non-lethal and lethal takes by species: 2.99 loggerheads (0.59 lethal); 2.33 green (0.47 lethal); 0.09 leatherbacks (0.018 lethal); 0.49 hawksbill (0.10 lethal) and 0.08 Kemp's ridley (0.016 lethal) sea turtles.

Because the take estimates for leatherback, hawksbill, and Kemp's ridley sea turtles were far less than one, we combined these species when calculating take.[21] Since it is not possible to take a partial sea turtle, we rounded our calculations up to the nearest whole number. Likewise, since our estimates of lethal take for each species are less than one, we did not round each individual lethal take up to the nearest whole number. We believe doing so would artificially inflate our take numbers beyond a reasonable characterization of take levels in the fishery. Instead, our estimates reflect take that could be either lethal or non-lethal. Therefore, we estimate that during the 2004-2005 through 2006-2007 fishing years, three loggerhead (lethal or non-lethal), three green (lethal or non-lethal) and one hawksbill, leatherback, or Kemp's ridley sea turtle (lethal or non-lethal) take occurred. Table 5.9 summarizes these estimates.

[21] This means we believe only one take of one of these species occurred. It does not mean one take of each species.

Table 5.9 Estimated Lethal and Non-Lethal Sea Turtle Takes in the Federal Fishery, 2004-2005 Through 2006-2007 Fishing Years

Species	Number of Takes
	Lethal or Non-Lethal
Loggerhead	3
Green	3
Hawksbill	1*
Leatherback	1*
Kemp's Ridley	1*

*The take for these species is in combination, not one per each species.

5.5.2 Estimating Adverse Affects to *Acropora* from Commercial Spiny Lobster Traps

The preceding sections discussed the potential adverse effects to *Acropora* from interactions with spiny lobster trap gears. Our discussion now shifts to evaluating and quantifying those impacts. *Acropora* may be adversely affected by spiny lobster traps as a result of buoyed[22] and derelict traps moving during storm events.[23,24] Even pulling traps can adversely affect *Acropora* via fragmentation and abrasion.[25] We quantified the adverse affects to *Acropora* by estimating the area likely to be affected. We chose this metric because traps affect an area of the seafloor, and using this parameter made quantification of adverse affects easier. The morphology of the species also makes using an areal metric necessary. Because *Acropora* are branching, colonial species, definition of discrete colonies can be difficult without individual genetic identification. Partially for this reason, coral monitoring (including *Acropora* monitoring) is customarily done by evaluating areal metrics. Therefore, quantified adverse affects to *Acropora* by area and our incidental take statement is issued the same way.

Because of *Acropora*'s distribution, we believe these routes of effect are only likely to occur in the South Atlantic waters off south Florida. Approximately 99 percent of all trap fishing occurring in the South Atlantic is conducted in the Florida Keys (Florida Fish and Wildlife Conservation Commission, Marine Fisheries Trip Ticket Program, unpublished data). Therefore, our effects analysis for trap impacts to *Acropora* focuses on the fishing effort in the Florida Keys.

As noted above (Section 2.1), Florida's Lobster Trap Certificate Program has placed a cap on the number of traps available to the fishery. Since the number of trap tags issued from 2004-2005 through 2006-2007 has remained relatively stable (see Table 2.1 and Figure 2.1), our analysis focuses on the fishery over this period. In the following sections, we describe the data used, the processes, and the results of our analyses for estimating the amount of *Acropora* take that occurred in the commercial spiny lobster trap fishery from 2004-2005 through 2006-2007. Then in Section 5.6, we use these estimates to project the level of take likely to occur in the future.

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[22] For the purposes of our analysis we assume buoyed traps are being actively fished.
[23] Derelict traps have been lost or abandoned and are no longer being actively fished.
[24] Storm events are weather events with sustained winds of 15 knots for 2 days or more (C. Lewis and T. Matthews, FFWCC, pers. comm. 2007).
[25] We use the term pulled trap to indicate all aspects of trap fishing, including retrieval and deployment. Since an individual trap can be pulled many times during a fishing season, the number of traps pulled may be greater than the number of individual traps used in a fishing season.

5.5.2.1 Data Used for Estimating Adverse Affects to *Acropora*

Individual Spiny Lobster Trap Use and Soak Time by Month
See Section 5.5.1.1

Wind Driven Trap Mobilization Study
Lewis et al. (in review) evaluated the impacts of trap mobilization on coral reef habitat during storm events. They studied the movement of buoyed and unbuoyed traps at three depths (4, 8, and 12 m). They observed that the mean area of impact from an individual buoyed spiny lobster trap was 4.96 square meters, 2.85 square meters, and 0.78 square meter, at 4, 8, and 12 m depths, respectively. The mean area of impact for an individual unbuoyed trap was 0.75 square meter at both 4 and 8 m depths. Tests at 12 m were not conducted for unbuoyed traps. When estimating the adverse effects of mobilized buoyed traps, we used the average area of mean impact from the 8 m and 12 m trials because the majority of federal waters occur beyond 4 m depth (Lewis et al. in review). The study also noted an annual average of 18 non-tropical storm events. It is worth noting that these estimates of annual storm events do not include the impacts of tropical storms or hurricanes.

Lewis et al. (in review) estimate two to five tropical weather events (i.e., tropical storms and hurricanes) occur annually, and the impacts from trap mobilization during such events are believed to be far greater than the impacts measured in this study. While anecdotal evidence suggests traps may move several miles during tropical weather events, no data exists on the extent of mobilization or the impacts of mobilization (T. Matthews, FFWCC, pers. comm. 2008). Since the impacts of tropical weather events are considerable, we believed it was necessary to include their impacts. Since no data exists on the size of the impacts of these events, we selected the greatest area of impact associated with non-tropical weather events, 4.96 square meters, for our analysis. We recognize this area of observed impact occurred in depths shallower than where the federal fishery is likely to operate. However, given what we know about the impacts of tropical weather events on trap mobilization, we believe this impact estimate is appropriate, and may actually underestimate the impacts from these mobilization events. The number of tropical weather events occurring annually varies greatly. Therefore, we used the annual average of 3.5 tropical weather events from Lewis et al. (in review) in our analysis.

Acropora Population Abundance and Size in the Florida Keys
Miller et al. (2007) surveyed 235 sites in the Florida Keys National Marine Sanctuary (FKNMS) and Biscayne National Park (BNP). The survey evaluated nine unique habitat types for the presence and absence of *Acropora*, recording colonial density and size where found. The areas surveyed included FKNMS no-take zones, as well as areas open to fishing. Since these data are the best available and most comprehensive for the action area, we applied them to each fishing season.

Acropora cervicornis was observed at 55 of the 235 (23 percent) sites surveyed, 508 colonies within eight habitat types. Of these, 113 colonies (22.2 percent) were counted from among 36 mid-channel patch reefs, 246 colonies (48.4 percent) from 42 offshore patch reefs, 15 colonies (3.0 percent) from 25 shallow (< 6 m) low-relief hardbottom sites, 29 colonies (5.7 percent) from eight inner line reef tract spur-and-groove sites, 90 colonies (17.7 percent) from 51 high-relief spur-and-groove sites, one colony (0.2 percent) from 15 deeper (> 6 m) hard-bottom sites, six colonies (1.2 percent) from 21 patchy hardbottom sites, and eight colonies (1.6 percent) from 33 low-relief spur-and-groove sites. The greatest mean (± 1 SE) site level density (no. of colonies per square meter) was 1.217 ± 1.780 on an offshore patch reef north of Looe Key Sanctuary Preservation Area (SPA). Colony size ranged from 42 to 1,312 square centimeters.

Acropora palmata was found at 24 of 235 (10.2 percent) sites surveyed, 403 colonies within three habitat types. The habitat distribution of this coral was much narrower than its congener and was only found on: offshore patch reefs (4.8 percent of 42 sites), inner line reef tract spur and groove reefs (37.5 percent of 8 sites), and high-relief spur-and-groove reefs (27.5 percent of 51 sites). Of these, 15 colonies (3.7 percent of the total) were counted from among 42 offshore patch reefs, 10 colonies (2.5 percent) from eight inner line reef tract spur and groove sites, and 378 colonies (93.8 percent) from 51 high-relief spur and groove sites (Miller et al. 2007). The greatest mean ± 1 SE site level density (no. colonies per m^2) was 1.250 ± 0.959 recorded at high-relief spur and groove reefs at Elbow Reef SPA. Colonial size ranged from 184 cm^2 to 9,959 cm^2 (Miller et al. 2007).

Spiny Lobster Trap Distribution in the Florida Keys

Matthews (2003) conducted a survey of trap distribution in the Florida Keys. Of 2,119 traps observed, 1,697 were identified as spiny lobster traps and used in the analysis. Matthews (2003) identified 15 different habitat types upon which spiny lobster traps could be found and estimated the relative distribution of traps across each. We consolidated five specific habitat types into two broader categories (coral and hardbottom) that we believe represent *Acropora* supporting habitat (ASH)[26] (Table 5.10).

Miller et al. (2007) observed *Acropora cervicornis* in all the habitat types they surveyed, while *Acropora palmata* was more discretely distributed. Therefore, our analysis assumes the traps observed on habitats in both the coral and hardbottom categories may impact *Acropora cervicornis* (15 percent of all traps; Table 5.10), while only those traps observed in the habitats of coral category may impact *Acropora palmata* (4 percent of all traps; Table 5.10).

[26] For our analysis of the federal fishery, we considered ASH to be coral or hardbottom areas, from 0 to 30 m depth, occurring in areas open to fishing, in federal waters.

Table 5.10 Habitat Types Used to Estimate the Total Percentage of Traps Landing on *Acropora* Supporting Habitat (Adapted from Matthews 2003)

Category	Habitat Type	Relative Distribution of Spiny Lobster Traps
Coral	High-Relief Coral	0%
	Low-Relief Coral	3%
	Rubble	1%
	Total Coral Group	4%
Hardbottom	Gorgonians	11%
	Grass and Benthic Fauna	0%
	Mixed Benthic Fauna	0%
	Total Hardbottom Group	11%
Other	Grass and Algae	1%
	Mixed Grass	3%
	Syringodium sp.	11%
	Thalassia sp.	20%
	Halodule sp.	0%
	Sponges	0%
	Attached Algae	13%
	Coarse sediment	19%
	Fine Sediment	16%
	Total Other Group	85%

5.5.2.2 Estimating Adverse Effects to *Acropora* from Storm-Mobilized, Buoyed Spiny Lobster Traps

Traps are frequently moved from their original locations during storm events. The extent of mobilization varies depending on trap depth, and whether they are tethered to buoys. Because of these differences, we bifurcated our analyses to examine the effects from buoyed and non-buoyed ("derelict") traps separately.

In this analysis, we estimate the impacts to *Acropora* from storm-mobilized, buoyed traps. Our analysis makes certain assumptions to overcome gaps in our knowledge. For example, we use number of spiny lobster trap tags as a surrogate for the number of spiny lobster traps. Since every spiny lobster trap must have a single trap tag, we assume that a spiny lobster tag translates to a single spiny lobster trap. It also assumes that traps set outside areas closed to fishing could migrate into those closed areas; thus, we used average *Acropora* colonial densities estimates for areas both open and closed to fishing. We also assume *Acropora* will be adversely affected (via fragmentation and/or abrasion) each time there is contact with a spiny lobster trap.

To estimate adverse effects to *Acropora*, we conducted six different analyses, one for each species of *Acropora*, in each region of the Florida Keys (i.e., Upper, Middle, and Lower). These estimates are divided regionally (i.e., Upper, Middle, and Lower) to remain consistent with the *Acropora* abundance and density data provided in Miller et al. (2007). As noted in Section 5.5.2.1, because of species distribution, we assume 4 percent of all federally fished traps will affect habitat supporting *A. palmata*, while we believe 15 percent of all federally fished traps will affect habitat supporting *A. cervicornis*. In the interest of brevity, only the narrative of the analysis conducted for *A. cervicornis* during the 2006-2007 fishing year in the Upper Keys, appears below. Table 5.14 summarizes the constants that remained the same across all fishing seasons that were used in the analyses of storm-mobilized buoy traps. Tables 5.15 and 5.16 provide summary results of all six analyses. Appendix 3 provides a more comprehensive review of the steps used in the analyses, as well as the results.

Estimating Buoyed Spiny Lobster Trap Effects to ASH in the Upper Keys During the 2006-2007 Fishing Season

We began by tabulating and calculating the amount of commercial trap fishing effort in the fishery for the 2006-2007 fishing year. Effort can be measured in a variety of ways, including the traps issued, total numbers of trips, traps fished, number of sets, hours fished, and soak time. We measured the effort in the fishery by estimating the number of traps fished during a given year, based on the number of traps issued to fishers reported by FFWCC (FFWCC 2007).[27] To be conservative toward the species, our analysis assumes all traps issued were actually used in the fishery.

We then multiplied the number of traps issued during the season (466,686) by the percentage of traps used each month. Next, we multiplied the number of traps used each month by the percentage of all trap fishing that occurred in federal waters and then multiplied that figure by percentage of federal trap fishing occurring in the region. This yielded an estimate of the number of traps fished each month in the federal waters off the Upper Keys. Multiplying our monthly trap use figures by the percentage of traps that end up on ASH for *A. cervicornis* (15 percent) (Matthews 2003), yielded an estimate of the number of federally fished traps that land on ASH each month. Table 5.11 summarizes this process.

Table 5.11 Estimating Monthly Federal Trap Impact to ASH in the Upper Keys During the 2006-2007 Fishing Season

Month	% of All Traps Used	No. Traps Used Each Month	% of All Trap Fishing Occurring Federal Waters	No. Traps Used in Federal Waters	% of All Federal Effort Occurring in the Region	Traps Fished in Federal Waters in the Region	No. of Federally Fished Traps Landing on ASH
Aug	100.00	466,686	10.09	47,111	0.124	58.49	8.77
Sep	95.67	446,478	10.09	45,071	0.124	55.96	8.39
Oct	91.95	429,118	10.09	43,318	0.124	53.78	8.07
Nov	88.16	411,430	10.09	41,533	0.124	51.57	7.73
Dec	79.97	373,209	10.09	37,674	0.124	46.78	7.02
Jan	68.52	319,773	10.09	32,280	0.124	40.08	6.01
Feb	55.52	259,104	10.09	26,156	0.124	32.47	4.87
Mar	42.13	196,615	10.09	19,848	0.124	24.64	3.70
Average	77.74	362,802	10.09	36,624	0.124	45.47	6.82
Total	--	2,902,414	--	292,991	--	363.77	54.56

Since the type of weather event (tropical or non-tropical) affects the extent of trap mobilization, we calculated the impacts from both types separately. We estimated 0.875 tropical weather event occurred each month (August-November) and 2.57 non-tropical weather events per month (October-April) [Lewis et al. (in review)]. For each month, we multiplied the number of traps landing on ASH, by the number of tropical or non-tropical weather events likely to affect those traps, and the area of impact associated with each weather event. As mentioned in above, we used 4.96 square meters and 1.815 square meters as the areas of impact resulting from tropical and non-tropical weather events, respectively. For months when both tropical and non-tropical weather events could occur (October and November), we estimated

[27] FFWCC defines active traps as spiny lobster trap tags issued, not whether the traps was actually fished.

the areas of impact from each event separately, and summed the result. Our analysis showed 317.53 square meters of ASH was affected during the 2006-2007 fishing season due to storm-mobilized, buoyed traps. Table 5.12 summarizes these steps.

Table 5.12 Estimating Monthly and Annual Area of Impact from Storm-Mobilized Buoyed Traps During the 2006-2007 Fishing Season

Month	Traps Fished in Federal Waters in the Region	No. of Federally Fished Traps Landing on ASH	No. Tropical Weather Events (3.5/yr)	Individual Trap Area of Impact from Tropical Weather Events (m^2)	No. Non-Topical Weather Events (18/yr)	Individual Trap Area of Impact from Non-Tropical Weather Events (m^2)	Annual Area of Impact
Aug	58.49	8.77	0.875	4.96	0	0	38.08
Sep	55.96	8.39	0.875	4.96	0	0	36.43
Oct	53.78	8.07	0.875	4.96	2.57	1.815	72.64
Nov	51.57	7.73	0.875	4.96	2.57	1.815	69.65
Dec	46.78	7.02	0	0	2.57	1.815	32.73
Jan	40.08	6.01	0	0	2.57	1.815	28.04
Feb	32.47	4.87	0	0	2.57	1.815	22.72
Mar	24.64	3.70	0	0	2.57	1.815	17.24
Average	45.47	6.82	--	--	--	--	39.69
Total	363.77	54.56	--	--	--	--	317.53

Quantifying Adverse Effects to Acropora cervicornis in the Upper Keys

We estimated an *A. cervicornis* density of 0.0078 colonies/square meter of ASH, in areas open and closed to fishing in the Upper Keys, from Miller et al. (2007). By multiplying this estimate by the area of ASH in the Upper Keys impacted by storm-mobilized traps, we estimated the number of *A. cervicornis* colonies affected during the 2006-2007 fishing season. By multiplying the number of colonies impacted by the average area of each *A. cervicornis* colony, we estimated 0.052 square meter of *A. cervicornis* was adversely impacted by spiny lobster trap mobilization in the Upper Keys, during the 2006-2007 fishing season. Table 5.13 summarizes the analysis for *A. cervicornis* in the Upper Keys.

Table 5.13 Impacts of Storm-Mobilized, Buoyed Traps on *Acropora cervicornis*

Upper Keys	
	Fishing Season
	2006-2007
Total Traps Issued[a]	466,686
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	10.09
% of Federal Effort by Region	0.124
No. Traps Used in Federal Waters by Region	363.77
No. of Traps Used Landing on ASH	54.56
No. of Traps on ASH Mobilized by Tropical Weather Events	17.17
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	74.51
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	15.80
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	142.29
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	21.60
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	100.73
Area of ASH Impacted Annually by Mobilized Traps (m^2)	317.53
No. *A. cervicornis* Colonies Impacted	2.477
Area of *A. cervicornis* Impacted by Mobilized Traps (m^2)	**0.052**

[a]FFWCC 2007; [b]Derived from FFWCC, unpublished data

Adverse Effects to Acropora in the Remaining Regions During the 2004-2005 Through 2006-2007 Fishing Seasons

Throughout all regions of the Florida Keys, we estimate 351.33 square meters of *A. cervicornis* and 6.89 square meters of *A. palmata* were adversely affected by mobilized, buoyed spiny lobster traps during the 2004-2005 through 2006-2007 fishing seasons. Table 5.14 summarizes the constants used in the analyses that remained the same across all fishing seasons. Tables 5.15 and 5.16 summarize the resulting calculations for both species across all regions and all years.

Table 5.14 Constants Used in Storm-Mobilized, Buoyed Trap Impact Analyses

Parameter		**Region**		
		Upper Keys	Middle Keys	Lower Keys
Avg. Area of Impact Per Trap from Tropical Weather Events (m^2)[a]		4.96	4.96	4.96
Avg. No. of Tropical Storms Occurring Monthly (Aug.-Nov.)		0.875	0.875	0.875
Avg. Area of Impact Per Trap Non-Tropical Weather Events (m^2)[a]		1.815	1.815	1.815
Avg. No. of Non-Tropical Weather Events Occurring Monthly (Oct.Apr.)[a]		2.57	2.57	2.57
Area of ASH (m^2)[b]		83,712,586	54,579,251	45,989,091
% of Traps Landing on ASH[c]	*A. cervicornis*	15	15	15
	A. palmata	4	4	4
Avg. Colonial Density (no./m^2)[d]	*A. cervicornis*	0.0078	0.0013	0.0394
	A. palmata	0.0094	0.0008	0.0297
Total No. of *Acropora* colonies in ASH[d]	*A. cervicornis*	652,958	70,953	1,811,970
	A. palmata	136,452	112,870	31,372
Avg. Size (Surface Area) of Each Colony (m^2)[d]	*A. cervicornis*	0.021	0.014	0.0186
	A. palmata	0.122	0.101	0.148

[a]Lewis et al. (in review); [b]NMFS unpublished data; [c]Matthews 2003; [d]Derived from Miller et al. 2007

Table 5.15 Storm-Mobilized, Buoyed Trap Impacts to *Acropora cervicornis* in All Regions of the Florida Keys

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Traps Used Landing on ASH	80,599.24	72,971.26	43,948.66	197,519.16
No. of Traps on ASH Mobilized by Tropical Weather Events	25,358.33	22,958.40	13,827.24	62,143.97
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	110,055.16	99,639.45	60,010.20	269,704.81
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	23,341.80	21,132.71	12,727.67	57,202.17
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	210,182.37	190,290.53	114,606.95	515,079.84
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	31,899.11	28,880.16	17,393.75	78,173.02
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	148,795.02	134,712.93	81,134.03	364,641.98
Area of ASH Impacted Annually by Mobilized Traps (m^2)	469,032.54	424,642.90	255,751.18	1,149,426.63
No. *A. cervicornis* Colonies Impacted	7,367.34	5,834.21	5,906.28	19,107.83
Area of *A. cervicornis* Impacted by Mobilized Traps (m^2)	**135.29**	**106.83**	**109.21**	**351.33**

[a]FFWCC 2007; [b]Derived from FFWCC, unpublished data

Table 5.16 Storm-Mobilized, Buoyed Trap Impacts to *Acropora palmata* in All Regions of the Florida Keys

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Traps Used Landing on ASH	21,493.13	72,857.20	25,829.13	120,179.45
No. of Traps on ASH Mobilized by Tropical Weather Events	6,762.22	6,122.24	3,687.26	16,571.72
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	29,348.04	26,570.52	16,002.72	71,921.28
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	6,224.48	5,635.39	3,394.05	15,253.91
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	56,048.63	50,744.14	30,561.85	137,354.62
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	8,506.43	7,701.37	4,638.33	20,846.14
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	39,678.67	35,923.45	21,635.74	97,237.86
Area of ASH Impacted Annually by Mobilized Traps (m^2)	125,075.34	113,238.11	68,200.32	306,513.77
No. *A. palmata* Colonies Impacted	193.48	183.18	87.26	463.92
Area of *A. palmata* Impacted by Mobilized Traps (m^2)	**2.86**	**2.68**	**1.35**	**6.89**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

5.5.2.3 Estimating Adverse Effects to *Acropora* from Storm-Mobilized, Derelict Spiny Lobster Traps

Since we addressed the impacts of storm-mobilized, buoyed traps in the previous section, our analysis now moves to estimating the impacts of storm-mobilized, unbuoyed traps lost in the environment. A number of traps are lost annually due to storm events, accidental cut-offs, etc., where the buoy is lost and fishers can no longer locate the trap. We refer to these unbuoyed, lost traps as 'derelict traps'. Derelict traps can adversely affect *Acropora* when they mobilize during storm events. Our analysis assumes that after two years a derelict trap will have degraded to a point where storm mobilization is unlikely and the trap no longer poses a threat to *Acropora* (T. Matthews, FFWCC, pers. comm. 2007). This analysis uses the same basic process presented in the previous section. However, it describes the process for estimating the number of traps lost, the number of derelict traps remaining, and how we quantified the impacts of storm-mobilized derelict traps. Table 5.19 summarizes the constants used in the analyses of storm-mobilized, derelict traps that remained the same across all fishing seasons. Tables 5.20 and 5.21 provide summary results of all six analyses. Appendix 3 provides a more comprehensive review of the steps used in the analyses, as well as the results.

Estimating the Derelict Spiny Lobster Trap Impacts to ASH in the Upper Keys During the 2006-2007 Fishing Season

We started by using the same steps listed above to estimate the number of traps fished in the federal waters of the region each month (see Table 5.11). We multiplied these figures by the percentage of traps lost estimated from FFWCC commercial fisheries mail surveys (unpublished data). Next, we multiplied our estimates of derelict traps by the mean percentage of lost traps recovered annually through marine debris recovery programs to estimate derelict traps remaining in the environment. We then reduced this number by half to account for degraded traps.

We then multiplied our estimate of the number of derelict traps remaining in the environment after degradation by percentage of all traps likely to end up on ASH. This produced an estimate of the number of derelict traps that landed on ASH in the Upper Keys, each month during the 2006-2007 fishing season. These values were then substituted into the analysis above in place of the federally fished traps landing on ASH.

When estimating the area of impact from weather events for derelict traps we used the same area of impact for tropical weather events (4.96 square meters). For estimating impacts from non-tropical weather events, we used the area of impact (0.75 square meters) for derelict traps reported in Lewis et al. (in review). Table 5.17 illustrates these changes.

Table 5.17 Estimating Monthly and Annual Area of Impact from Storm-Mobilized Derelict Traps During the 2006-2007 Fishing Season

Month	No. Derelict Traps Remaining After Degradation	No. of Derelict Traps Landing on ASH	No. Tropical Weather Events (3.5/yr)	Individual Trap Area of Impact from Tropical Weather Events (m^2)	No. Non-Topical Weather Events (18/yr)	Individual Trap Area of Impact from Non-Tropical Weather Events (m^2)	Annual Area of Impact
Aug	5.53	0.83	0.875	4.96	0	0	3.60
Sep	5.29	0.79	0.875	4.96	0	0	3.44
Oct	5.08	0.76	0.875	4.96	2.57	0.75	4.78
Nov	4.87	0.73	0.875	4.96	2.57	0.75	4.58
Dec	4.42	0.66	0	0	2.57	0.75	1.28
Jan	3.79	0.57	0	0	2.57	0.75	1.10
Feb	3.07	0.46	0	0	2.57	0.75	0.89
Mar	2.33	0.35	0	0	2.57	0.75	0.67
Average	4.30	0.64	--	--	--	--	2.54
Total	34.38	5.16	--	--	--	--	20.33

Recalculating the area of ASH and number of *A. cervicornis* colonies affected annually with the values in Table 5.17, we estimate 0.014 square meter of *A. cervicornis* was adversely impacted by mobilized, derelict traps off the Upper Keys after the 2006-2007 fishing season. Table 5.18 summarizes the analysis for *A. cervicornis* in the Upper Keys.

Table 5.18 Impacts of Storm-Mobilized, Derelict Traps on *Acropora cervicornis*

Upper Keys	
	Fishing Season
	2006-2007
Total Traps Issued[a]	466,686
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	10.09
% of Federal Effort by Region	0.124
No. Traps Used in Federal Waters by Region	363.77
No. of Derelict Traps in Federal Waters	72.75
No. of Derelict Traps in Federal Waters Recovered	4.00
No. of Derelict Traps in Federal Waters Remaining	68.75
No. of Derelict Traps in Federal Waters After Degradation	34.38
No. of Derelict Traps in Federal Waters Affecting ASH	5.16
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	1.62
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	7.04
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	1.49
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	9.36
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	2.04
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	3.93
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	20.33
No. *A. cervicornis* Colonies Impacted	0.153
Area of *A. cervicornis* Impacted by Mobilized Derelict Traps (m^2)	**0.003**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Adverse Effects to Acropora in the Remaining Regions During the 2004-2005 Through 2006-2007 Fishing Seasons

Throughout all regions of the Florida Keys, we estimate 6.03 square meters of *A. cervicornis* and 0.46 square meter of *A. palmata* were adversely affected by mobilized, derelict spiny lobster traps over these fishing seasons. Since the steps used to quantify the adverse effects to *Acropora* in the remaining regions of the Florida Keys are identical to the ones above, we do not provide a narrative of those calculations here. Table 5.19 summarizes the constants used in the analyses that remained the same across all fishing seasons. Tables 5.20 and 5.21 summarize the resulting calculations for both species across all regions and all years.

Table 5.19 Constants Used in Storm-Mobilized, Derelict Trap Impact Analyses

Parameter		Region		
		Upper Keys	Middle Keys	Lower Keys
% of Trap Lost Annually[a]		20	20	20
Annual Average Percentage of Lost Trap Recovered[a]		5.5	5.5	5.5
Avg. Per Trap Area of Impact from Tropical Weather Events (m^2)[b]		4.96	4.96	4.96
Avg. No. of Tropical Storms Occurring Monthly (Aug.-Nov.)		0.875	0.875	0.875
Avg. Per Trap Area of Impact One Non-Tropical Weather Events (m^2)[b]		0.75	0.75	0.75
Avg. No. of Non-Tropical Weather Events Occurring Monthly (Oct.Apr.)[b]		2.57	2.57	2.57
Area of ASH (m^2)[c]		83,712,586	54,579,251	45,989,091
% of Traps Landing on ASH[d]	*A. cervicornis*	15	15	15
	A. palmata	4	4	4
Avg. Colonial Density (no./m^2)[e]	*A. cervicornis*	0.0318	0.0132	0.0589
	A. palmata	0.0495	0.0195	0.0077
Total No. of *Acropora* colonies in ASH	*A. cervicornis*	2,662,060	720,446	2,708,757
	A. palmata	106,482	28,818	108,350
Avg. Size (Surface Area) of Each Colony (m^2)[e]	*A. cervicornis*	0.021	0.014	0.0186
	A. palmata	0.122	0.101	0.148

[a]FDEP 2001; [b]Lewis et al. (in review); [c]NMFS unpublished data; [d]Matthews 2003; [e] Derived from Miller et al. 2007

Table 5.20 Storm-Mobilized, Derelict Trap Impacts to *Acropora cervicornis* in All Regions of the Florida Keys

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	--	--	--	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Derelict Traps in Federal Waters	107,465.66	97,295.01	58,598.21	263,358.88
No. of Derelict Traps in Federal Waters Recovered	5,910.61	5,351.23	3,222.90	14,484.74
No. of Derelict Traps in Federal Waters Remaining	101,555.05	91,943.79	55,375.31	248,874.15
No. of Derelict Traps in Federal Waters After Degradation	50,777.52	45,971.89	27,687.66	124,437.07
No. of Derelict Traps in Federal Waters Affecting ASH	2,031.93	1,849.65	1,111.29	4,992.87
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	639.29	581.94	349.64	1,570.87
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	2,774.52	2,525.63	1,517.42	6,817.57
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	588.45	535.67	321.83	1,445.95
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	3,688.13	3,357.29	2,017.08	9,062.50
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	804.18	732.05	439.82	1,976.05
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	1,550.07	2,511.21	847.75	4,909.02
Area of ASH Impacted Yearly by Mobilized Derelict Traps (m^2)	8,012.71	8,394.12	4,382.26	20,789.09
No. *A. cervicornis* Colonies Impacted	125.83	101.41	100.98	328.22
Area of *A. cervicornis* Impacted by Mobilized Derelict Traps	**2.31**	**1.85**	**1.87**	**6.03**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table 5.21 Storm-Mobilized, Derelict Trap Impacts to *Acropora palmata* for All Regions of the Florida Keys

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	--	--	--	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Derelict Traps in Federal Waters	107,465.66	97,295.01	58,598.21	263,358.88
No. of Derelict Traps in Federal Waters Recovered	5,910.61	5,351.23	3,222.90	14,484.74
No. of Derelict Traps in Federal Waters Remaining	101,555.05	91,943.79	55,375.31	248,874.15
No. of Derelict Traps in Federal Waters After Degradation	50,777.52	45,971.89	27,687.66	124,437.07
No. of Derelict Traps in Federal Waters Affecting ASH	2,031.10	1,838.88	1,107.51	4,977.48
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	639.03	578.55	348.45	1,566.03
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	2,773.39	2,510.91	1,512.26	6,796.56
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	588.21	532.54	320.74	1,441.49
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical weather events (m^2)	3,686.63	3,337.72	2,010.22	9,034.57
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	803.86	727.78	438.32	1,969.96
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	1,549.44	2,500.98	844.87	4,895.29
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	8,009.45	8,349.62	4,367.34	20,726.42
No. *A. palmata* Colonies Impacted	12.39	13.26	5.59	31.24
Area of *A. palmata* Impacted by Mobilized Derelict Traps (m^2)	**0.18**	**0.19**	**0.09**	**0.46**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

5.5.2.4 Estimating Adverse Impacts to *Acropora* from Routine Spiny Lobster Fishing

In this analysis, we quantify the impacts from traps being deployed during fishing (i.e., the impacts of traps being pulled off of or falling to the seafloor) or "trap pulls". Our analysis makes certain assumptions to overcome gaps in our knowledge. We use number of spiny lobster trap tags as a surrogate for the number spiny lobster traps. Since every spiny lobster trap must have a single trap tag, we assume that a spiny lobster tag translates to a single spiny lobster trap. To be conservative, we assume that all traps issued in the fishery will be used during the season. Additionally, because an individual trap can be pulled many times during a fishing season, our estimate of the number of traps pulled annually is greater than the number of individual traps issued. We also assume traps were set only in areas open to fishing; therefore, we used the average *Acropora* colonial density and size estimates calculated only for areas open to fishing.

To quantify the extent of adverse affects to *Acropora*, we conducted six different analyses, one for each species of *Acropora*, in each region of the Florida Keys (i.e., Upper, Middle, and Lower). As noted in Section 5.5.2.1, because of species distribution, we assume 4 percent of all federally fished traps will affect habitat supporting *A. palmata*, while we believe 15 percent of all federally fished traps will affect habitat supporting *A. cervicornis*. For consistency with the *Acropora* abundance and density data provided in Miller et al. (2007), our estimates of federal trap fishing effort have been segregated, to the greatest extent possible, to match the regions as they were defined in those reports. In the interest of brevity, only the narrative of the analysis conducted for *A. cervicornis* during the 2006-2007 fishing year in the Upper Keys appears below. The remaining analyses of routine fishing impacts use the same steps outlined below. Tables 5.23 through 5.25 provide the information used and results of the analyses for all fishing years.

Estimating the Spiny Lobster Trap Impacts to ASH in the Upper Keys During the 2006-2007 Fishing Season

We estimate 57.29 square meters of ASH were adversely affected by routine spiny lobster fishing during the 2006-2007 fishing season. We calculated this number by first multiplying the number of traps issued in the fishery by average number of traps fished each month (see Table 5.1 for monthly trap used estimates). Using the average soak time for each trap per month reported in Matthews (2001)(see Figure 5.3), and dividing the number of days in each month by the average soak time for each month, we estimated the number of times an individual trap was pulled each month. By multiplying the average number of times an individual trap was pulled each month, by the number of traps used each month, we calculated the number of trap pulls each month. We then multiplied the number of trap pulls by the percentage of traps used in the federal waters and the percentage of federal fishing occurring the in the Upper Keys. This calculated the number of traps pulls occurring in federal waters off the Upper Keys during the 2006-2007 fishing season. Multiplying this estimate by the percentage of traps that land on ASH, we calculated the number of traps affecting ASH in the region each month and annually. Since the footprint of a spiny lobster trap is 0.49 square meter we multiplied this measurement by our estimate of the number of traps landing on ASH to calculate to their total area of impact.

Quantifying Adverse Effects to Acropora cervicornis in the Upper Keys During the 2006-2007 Fishing Season

We estimated an *A. cervicornis* density of 0.0094 colonies/square meter of ASH [derived from Miller et al. (2007)], in areas open to fishing in the Upper Keys. By multiplying this estimate by the area of ASH in the Upper Keys impacted by routine fishing, we estimated the number of *A. cervicornis* colonies affected during the 2006-2007 fishing season. We then multiplied the number of colonies impacted by the average area of each *A. cervicornis* colony to calculate 0.012 square meter of *A. cervicornis* had been adversely impacted by spiny lobster trap fishing in the Upper Keys, during the 2006-2007 fishing season. Table 5.22 summarizes the analysis for *A. cervicornis* in the Upper Keys.

Table 5.22 Impacts of Routine Spiny Lobster Fishing on *Acropora cervicornis*

Upper Keys	
	Fishing Season
	2006-2007
Total Traps Issued[a]	466,686
Total Traps Pulled During Season	6,434,135
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	10.09
% of Federal Effort by Region	0.12
No. Traps Pulled in Federal Waters by Region	779.41
No. of Individual Traps Used Landing on ASH	116.91
Area of ASH impacted by traps (m^2)	57.29
No. *A. cervicornis* Colonies Impacted	0.54
Total Area of *A. cervicornis* Adversely Impacted (m^2)	**0.012**

[a] FFWCC 2007

Adverse Effects to Acropora in the Remaining Regions During the 2004-2005 Through 2006-2007 Fishing Seasons

Throughout all regions of the Florida Keys, we estimate 124.73 square meters of *A. cervicornis* and 0.062 square meters of *A. palmata* were adversely affected during routine spiny lobster trap fishing. Since the steps used to quantify the adverse effects to *Acropora* in the remaining regions of the Florida Keys are identical to the ones above, we do not provide a narrative of those calculations here. Table 5.23 summarizes the constants used in the analyses that remained the same across all fishing seasons. Tables 5.24 and 5.25 summarize the resulting calculations for both species across all regions and all years.

Table 5.23 Constants Used in Routine Fishing Impact Analyses

Parameter		**Region**		
		Upper Keys	Middle Keys	Lower Keys
Percentage of Traps Landing on ASH[a]	*A. cervicornis*	15	15	15
	A. palmata	4	4	4
Avg. Colonial Density (no./m^2)[b]	*A. cervicornis*	0.0094	0.0008	0.0297
	A. palmata	0.00031	0	0.00002
Avg. Size (Surface Area) of Each Colony (m^2)[b]	*A. cervicornis*	0.223	0.0054	0.0285
	A. palmata	0.146	0	0.130
Total No. of *Acropora* colonies in ASH[b]	*A. cervicornis*	786,898	43,663	1,365,876
	A. palmata	25,921	0	920
Spiny Lobster Trap Footprint (m^2)		0.49	0.49	0.49
Area of ASH (m^2)[c]		83,712,586	54,579,251	45,989,091

[a]Matthews 2003; [b] Derived from Miller et al. 2007;[c]NMFS unpublished data;

Table 5.24 Routine Spiny Lobster Trap Fishing Impacts to *Acropora cervicornis* in All Regions of the Florida Keys

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
No. Traps Pulled in Federal Waters by Region	1,191,042.10	1,078,320.85	649,444.12	2,918,807.07
No. of Individual Traps Used Landing on ASH	178,656.32	161,748.13	97,416.62	437,821.06
Area of ASH impacted by traps (m^2)	87,541.59	79,256.58	47,734.14	166,798.18
No. *A. cervicornis* Colonies Impacted	1,026.78	811.85	827.57	2,666.19
Total Area of *A. cervicornis* Adversely Impacted (m^2)	**28.26**	**23.37**	**73.10**	**124.73**

[a] FFWCC 2007

Table 5.25 Routine Spiny Lobster Trap Fishing Impacts to *Acropora palmata* in All Regions of the Florida Keys

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
No. Traps Pulled in Federal Waters by Region	1,191,042.10	1,078,320.85	649,444.12	2,918,807.07
No. of Individual Traps Used Landing on ASH	47,641.68	43,132.83	25,977.76	116,752.28
Area of ASH impacted by traps (m^2)	23,344.43	21,135.09	12,729.10	44,479.51
No. *A. palmata* Colonies Impacted	0.18	0.15	0.15	0.48
Total Area of *A. palmata* Adversely Impacted (m^2)	**0.023**	**0.020**	**0.020**	**0.063**

[a] FFWCC 2007

5.5.3 Estimating Past Smalltooth Sawfish Take by Commercial Spiny Lobster Traps

Smalltooth sawfish can become entangled in spiny lobster trap lines. In the following section, we analyze and quantify the adverse effects to smalltooth sawfish from entanglement in spiny lobster traps.

5.5.3.1 Data Used for Estimating Smalltooth Sawfish Takes

The best available data for estimating smalltooth sawfish takes come from two encounter databases, one maintained by Gregg Poulakis (Florida Fish and Wildlife Commission, Fish and Wildlife Research Institute) and Jason Seitz (Florida Museum of Natural History) and another maintained by Mote Marine Laboratory (MML). Each of these datasets is discussed below.

Poulakis and Seitz Database
Biologists Gregg Poulakis and Jason Seitz maintain a non-validated database of recent smalltooth sawfish encounters (1990 to present) from Gulf of Mexico and South Atlantic waters off south Florida. At least 2,969 individual animals have been documented in this database. Poulakis and Seitz (2004) document 1,632 sawfish encounters in Florida Bay and the Keys between 1990 and 2002; approximately 89 percent of these occurred between 1998 and 2002. Most sawfish encounters were reported as a single fish caught on hook-and-line or observed in the water by divers/swimmers, but several sawfish were also observed together. Virtually all of the captured sawfish were the bycatch of fishers targeting sharks, tarpon, snook, or red drum.

MML Database
As discussed in Section 3.2.8, MML maintains a statewide database for Florida of validated smalltooth sawfish encounters from 1998 through the present. From January 1998 through May 2006, MML validated 840 observations of smalltooth sawfish (1,177 individuals) (MML unpublished data). The majority of these encounters (66 percent) occurred during fishing. The encounter data presented in Simpfendorfer and Wiley (2004) suggests that outside of its core range, the smalltooth sawfish appears more common on the west coast of Florida and the Florida Keys. Although the overall latitudinal spread of encounters was similar off both coasts, encounters off the east coast were much less common. The majority of the east coast encounters occurred south of 27.2ºN with no east coast areas having encounters rates greater than 0.03 per km (Simpfendorfer and Wiley 2004). Observations are based on sightings densities that have not been corrected for sightings effort, however, so may be somewhat biased by the amount of fishing effort (i.e., more fishing effort in the Gulf of Mexico state waters than off the Atlantic coast).

These datasets note only two smalltooth sawfish entanglements in lobster trap gear within the last 10 years (Seitz and Poulakis 2006, T. Wiley, pers. comm. 2007) and none between 2004-2005 and 2006-2007. Both occurred off the Florida Keys in 2001 and 2002. One animal was released alive; the condition of the other upon release is not known.

5.5.3.2 Estimating Smalltooth Sawfish Trap Takes

The MML and Poulakis and Seitz data represent the best available for estimating smalltooth sawfish interactions with spiny lobster trap gear. As noted above, those data show two smalltooth sawfish entanglements in the last 10 years. Smalltooth sawfish is an easily identifiable species that was not listed under the ESA until 2003. Because they are relatively rare, easily distinguishable, and only recently protected by law, we believe smalltooth sawfish entanglements in spiny lobster trap gear are rare and likely to have been reported when they do occur. Therefore, we believe that the two documented smalltooth sawfish encounters are likely a good representation of the actual number of smalltooth sawfish takes that have occurred in the trap sector of the Gulf of Mexico/South Atlantic spiny lobster fishery.

Estimating Mortality
One of the smalltooth sawfish entanglements records stated the animal was released alive and in good condition. The condition of the other animal at the time of release was not noted in the other record. The records suggest that smalltooth sawfish survive at least some portion of entanglements, if not all. Smalltooth sawfish physiology may help reduce the severity of impacts resulting from entanglement.

They naturally lay on the sea floor, using their spiracles to breathe (Simpfendorfer pers. comm. 2003). This adaptation allows them to breathe normally without actively swimming. Thorson (1982) reports examples of largetooth sawfish caught by fishermen at night or when no one was present to tag them, surviving, tethered by their rostrums, in the water for several hours with no apparent harmful affects. This evidence leads us to believe entanglement is extremely unlikely to result in mortality. Therefore, based on this information we believe the smalltooth sawfish takes that occurred in the past were non-lethal.

5.6 Anticipated Future Take Resulting from the Continued Authorization of the Gulf of Mexico/South Atlantic Spiny Lobster Fishery

In the preceding sections, we extrapolated the best available data to estimate the area of *Acropora* affected and the number of sea turtle and smalltooth sawfish takes that occurred in the Gulf of Mexico/South Atlantic spiny lobster fishery from 2004-2005 through 2006-2007. We now must consider what effect, if any, the continued authorization of the fishery would have on future levels of take (i.e., whether the levels of lethal and non-lethal take and the areas of *Acropora* adversely impacted in the past are likely to change in the future). Since the number of traps available to the fishery cannot increase [F.A.C. 68B-24.009(1)], we believe the sea turtle, *Acropora*, and smalltooth sawfish interaction patterns that existed in the recent past are likely to continue into the future. Below is a summary of our projections of actual take by species.

Because of the high degree of variability in takes associated with variabilities in water temperatures, species abundances, and other factors that cannot be predicted, a 3-year take estimate was used for the incidental take statement (ITS). Annual take estimates have high variability because of natural and anthropogenic variation. It is unlikely that all species evaluated in this opinion will be consistently impacted year after year by the fishery. Some years may have no interactions, while others may have several. The latter scenario can cause an annual take level to be exceeded because of a potentially anomalous event. As a result, monitoring fisheries using 1-year estimated take levels is largely impractical. However, too long of a time frame is also problematic. We are electing to authorize take for 3-year time periods because this is consistent with our estimates of take occurring during the 2004-2005 through 2006-2007 fishing seasons. This approach reduces the likelihood of requiring reinitiation unnecessarily, while still allowing for an accurate assessment of how the fishery is performing versus expectations.

Triennial Estimate of Sea Turtle Take

The current cap on the number of traps available to the fishery is extremely unlikely to increase over the next three years [F.A.C. 68B-24.009(1)]. Additionally, an action to increase the number of traps available in the fishery would represent a modification to the proposed action and a section 7 consultation could be reinitiated to evaluate any new risks to protected species not previously considered. For these reasons, we believe it is reasonable to assume the level of take we estimated to have occurred over the last three years is likely to continue into the future.

However, our take estimates account for strandings that are not documented. To monitor future take, we must then estimate the number of sea turtles likely to be documented with spiny lobster trap gear entanglements. Since we increased our estimate of strandings to account for the estimated 80 percent that do not get documented, we must now reduce our take estimates by the same percentage to calculate the number of sea turtle entanglements that go undocumented. However, when we apply that percentage to our take estimates, and round up to nearest whole number, we ultimately end up with the same numbers we began with. Therefore, over any consecutive 3-year period, we believe up to three loggerhead, three green sea turtles, and one hawksbill, Kemp's ridley, or leatherback sea turtle may be documented as lethally or non-lethally taken during spiny lobster trap fishing.

Triennial Estimate of Acropora Take
As noted above, the current trap cap makes an increase in the number of traps extremely unlikely. Therefore, we believe it is reasonable to assume the area of *Acropora* adversely affected in the past (2004-2005 through 2006-2007 fishing seasons) is likely to continue into the future. We estimate 482.09 square meters of *A. cervicornis* and 7.41 square meters of *A. palmata* are likely to be taken over any consecutive 3-year period by continued authorization of the spiny lobster fishery.

Triennial Estimate of Smalltooth Sawfish Take
Since the only documented smalltooth sawfish takes by spiny lobster gear occurred relatively recently, and during the same fishing season (2001-2002), it is unclear if these takes represent an emerging trend of increasing interactions between smalltooth sawfish and spiny lobster trap gear, or if they were anomalous. These records illustrate that smalltooth sawfish entanglements can occur, but their relative frequency is uncertain. Given this uncertainty, we believe it is prudent to acknowledge that entanglements can occur, however, assuming two entanglements occurring in one year is common may be inappropriate. Therefore, we estimate two smalltooth sawfish takes could over a triennial period. This approach also allows for some annual variability in smalltooth sawfish abundance or fishing effort. Fluctuations in abundance or effort can influence smalltooth sawfish/fishery interactions, and could account for the recent increase in documented interactions. Selecting a 3-year period for estimating future takes allows us to acknowledge these potential fluctuations. As noted above (see Section 5.5.3.2), we believe smalltooth sawfish are likely to survive entanglements. Based on this information, we believe the two smalltooth sawfish takes will be non-lethal.

5.7 Summary

Based on our review in this section, Gulf of Mexico/South Atlantic spiny lobster traps have adversely affected sea turtles, *Acropora*, and smalltooth sawfish in the past via entanglement and forced submergence, fragmentation and abrasion, and entanglement, respectively. We believe these adverse effects are also likely to continue at their current levels in the future. The other two gear types used in the Gulf of Mexico/South Atlantic spiny lobster fishery – commercial/recreational bully net and commercial/recreational diving – are unlikely to have adversely affected sea turtles, *Acropora*, or smalltooth sawfish, and are unlikely to do so in the future. We have estimated the level of take we believe is likely to occur every three years in the future; Table 5.26 summarizes those estimates.

Table 5.26 Estimated Future 3-Year Take Estimates

<table>
<tr><th rowspan="2">Marine Turtles</th><th colspan="3">Number of Takes</th></tr>
<tr><td colspan="2">Lethal or Non-Lethal</td><td>Total</td></tr>
<tr><td>Loggerhead</td><td colspan="2">3</td><td>3</td></tr>
<tr><td>Green</td><td colspan="2">3</td><td>3</td></tr>
<tr><td>Hawksbill</td><td colspan="2">1*</td><td>1*</td></tr>
<tr><td>Leatherback</td><td colspan="2">1*</td><td>1*</td></tr>
<tr><td>Kemp’s ridley</td><td colspan="2">1*</td><td>1*</td></tr>
<tr><th rowspan="2">Marine Fish</th><th colspan="3">Number of Takes</th></tr>
<tr><td>Lethal</td><td>Non-Lethal</td><td>Total</td></tr>
<tr><td>Smalltooth sawfish</td><td>0</td><td>2</td><td>2</td></tr>
<tr><th>Corals</th><th colspan="3">Area Effected</th></tr>
<tr><td>Acropora cervicornis</td><td colspan="3">482.09 m^2</td></tr>
<tr><td>Acropora palmata</td><td colspan="3">7.41 m^2</td></tr>
</table>

*The take for these species is in combination, not one per each species.

6.0 Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area considered in this biological opinion. Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Within the action area, major future changes are not anticipated in ongoing human activities described in the environmental baseline. The present, major human uses of the action area, such as commercial fishing, recreational boating and fishing, and shipping of goods through the area, are expected to continue at the present levels of intensity in the near future as are their associated risks of injury or mortality to sea turtles and smalltooth sawfish posed by incidental capture by fishermen, accidental oil spills, vessel collisions, marine debris, chemical discharges, and man-made noises.

Beachfront development, lighting, and beach erosion control are all ongoing activities along the Atlantic and Gulf coasts of the United States. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, an increasing number of coastal counties have or are adopting more stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Some of these measures were drafted in response to lawsuits brought against the counties by concerned citizens who charged the counties with failing to uphold the ESA by allowing unregulated beach lighting that results in takes of hatchlings.

Urbanization in many southeastern coastal states has resulted in substantial loss of coastal habitat through activities such as agricultural and urban development (wetland conversion, flood control and diversion projects, dredge-and-fill operations). Smalltooth sawfish are particularly vulnerable to coastal habitat degradation because of their affinity for shallow, estuarine systems. Marine pollutants and debris may also negatively impact smalltooth sawfish if it gets caught on their saw and interfere with feeding.

Several examples of stressors to *Acropora* are outlined in the Atlantic *Acropora* Status Review (BRT 2005). Abrasion and breakage of *Acropora* induced by divers/snorkelers, improper anchoring, vessel groundings, marine debris, and destructive fishing practices are the primary ways humans impact corals directly. Sedimentation occurring from activities like dredging and nutrient and contaminant loading from both point and non-point source pollution are examples of activities that can indirectly impact these species.

State-regulated commercial and recreational boating and fishing activities in local waters currently result in the incidental take of threatened and endangered species. It is expected that states will continue to license and permit large vessel and thrill-craft operations that do not fall under the purview of a federal agency, and will issue regulations that will affect fishery activities. Recreational hook-and-line fisheries have been known to take sea turtles and smalltooth sawfish. Future cooperation between NMFS and the states on these issues should help decrease take of sea turtles caused by recreational activities. NMFS will continue to work with states to develop ESA section 6 agreements and section 10 permits to enhance programs to quantify and mitigate these takes.

In addition to fisheries, NMFS is not aware of any proposed or anticipated changes in other human-related actions (e.g., habitat degradation, poaching) or natural conditions (e.g., changes in oceanic conditions, etc.) that would substantially change the impacts that each threat has on the sea turtles or smalltooth sawfish covered by this opinion. Therefore, NMFS expects that the levels of take of these species described for each of the fisheries and non-fisheries will continue at similar levels into the foreseeable future.

7.0 Jeopardy Analysis

The analyses conducted in the previous sections of this opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of any ESA-listed sea turtles, *Acropora*, or smalltooth sawfish. In Section 5, we outlined how the proposed action can affect these species and the extent of those effects in terms of estimates of the numbers of sea turtles and smalltooth sawfish caught and injured or killed and the amount of *Acropora* taken. Now we turn to an assessment of each species' response to this impact. We evaluate the overall population effects from the estimated take, and whether those effects of the proposed action, when considered in the context of the status of the species (Section 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), will jeopardize the continued existence of the affected species.

"To jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to appreciably reduce the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Thus, in making this determination for each species, we must look at whether there will be a reduction in the reproduction, numbers, or distribution. Then, if there is a reduction in one or more of these elements, we evaluate whether it will cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

7.1 Effects of the Action on the Likelihood of Sea Turtles' Survival and Recovery in the Wild

In two steps, this section analyzes if the anticipated take from the proposed action will reduce the likelihood of green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles' survival and recovery in the wild. First, we evaluate how each species' population is likely to respond if takes were non-lethal or lethal. Then we evaluate whether the anticipated take will result in any reduction in distribution, reproduction, or numbers of each species that may appreciably reduce the likelihood of survival. Second, we consider how anticipated take is likely to affect these species' recovery in the wild by considering recovery objectives in the recovery plans of each species. Since incidental take affects individuals, some of which may be reproductively mature, we pay specific attention to those objectives that may be affected by reductions in the numbers or reproduction of resulting from the proposed action.

7.1.1 Hawksbill, Kemp's Ridley, and Leatherback Sea Turtles

Survival in the Wild

The proposed action may result in up to one hawksbill, Kemp's ridley, or leatherback sea turtle take (lethal or non-lethal) during a given 3-year period.

The non-lethal take of up to one hawksbill, Kemp's ridley, or leatherback sea turtle, in combination, over consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. That individual is expected to fully recover such that no reductions in reproduction or numbers of these species are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of hawksbill, Kemp's ridley, or leatherback sea turtles is anticipated.

The lethal take of up to one hawksbill, Kemp's ridley, or leatherback sea turtle, in combination, over consecutive 3-year periods would reduce their respective population by one, compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. A lethal take could also result in a reduction in future reproduction, assuming the individual was a female and would have survived to reproduce in the future. For example, an adult hawksbill sea turtle can lay 3-5 clutches of eggs every few years (Meylan and Donnelly 1999, Richardson et al. 1999) with up to 250 eggs/nest (Hirth 1980). The loss of one adult female sea turtle, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage is expected to survive to sexual maturity. Thus, the death of a female eliminates that individual's contribution to future generations, and the action will result in a reduction in sea turtle reproduction. The anticipated take is expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of hawksbill, Kemp's ridley, or leatherback sea turtles is expected from the take of an individual.

Whether the reductions in numbers and reproduction of these species attributed to spiny lobster fishery would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The 5-year status review for hawksbill sea turtles states their populations appear to be increasing or stable at the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out: Mona Island, Puerto Rico, and Buck Island Reef National Monument (BIRNM), St. Croix, USVI (NMFS and USFWS 2007b). Mona Island hosts between 199-332 nesting females per season, while 56 females nest at BIRNM per season (NMFS and USFWS 2007b). Although today's nesting population is only a fraction of what it was historically (i.e., 20 to 100 years ago), nesting activity in recent years by hawksbills has increased on well-protected beaches in Mexico, Barbados, and Puerto Rico (Caribbean Conservation Corporation 2005). Increasing protections for live coral habitat over the last decade in the Atlantic, Gulf of Mexico, and Caribbean may also increase survival rates of hawksbills in the marine environment.

The total population of Kemp's ridleys is not known, but nesting has been increasing significantly in the past several years (9 to 13 percent per year) with over 15,000 nests recorded in 2007 (Gladys Porter Zoo 2007). Kemp's ridleys mature and nest at an age of 7-15 years, which is earlier than other chelonids. A younger age at maturity may be a factor in the response of this species to recovery actions. A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles. The increased survivorship of immature sea turtles is largely attributable to the introduction of turtle excluder devices (TEDs) in the U.S. and Mexican shrimping fleets and Mexican beach protection efforts. The TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

The Leatherback Turtle Expert Working Group estimates there are between 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) in the North Atlantic. Of the five leatherback populations or groups of populations in the North Atlantic, three show an increasing or stable trend (Florida, Northern Caribbean, and Southern Caribbean). This includes the largest nesting population, located in the Southern Caribbean at Suriname and French Guiana. Of the remaining two populations, there is not enough information available on the West African population to conduct a trend analysis, and, for the Western Caribbean, a slight decline in annual population growth rate was detected (TEWG 2007).[28]

Although the anticipated mortalities would result in a reduction in absolute population numbers, it is not likely these small reductions would appreciably reduce the likelihood of survival of any of these sea turtle species. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Considering that all three species' nesting trends are either stable or increasing, we believe the loss of up to one hawksbill, Kemp's ridley, or leatherback sea turtle every three years will not have any measurable effect on those trends.

Based on the above analysis, we believe the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of these species of sea turtles in the wild.

Recovery in the Wild

Although no change in distribution was concluded for any species, we concluded lethal takes would result in a reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of any species in the wild.

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[28] An annual growth rate of 1.0 is considered a stable population; the growth rates of two nesting populations in the Western Caribbean were 0.98 and 0.96 (TEWG 2007).

The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild.

The Recovery Plan for the population of the hawksbill sea turtles (NMFS and USFWS 1993) lists the following relevant recovery objectives over a period of 25 continuous years:

- The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests at five index beaches, including Mona Island and Buck Island Reef National Monument;
    - Of the rookeries regularly monitored: Jumby Bay (Antigua/Barbuda), Barbados, Mona Island, and Buck Island Reef National Monument all show increasing trends in the annual number of nests (NMFS and USFWS 2007b).
- The numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.
    - In-water research projects at Mona Island, Puerto Rico, and the Marquesas, Florida, which involve the observation and capture of juvenile hawksbill turtles, are underway. Although there are 15 years of data for the Mona Island project, abundance indices have not yet been incorporated into a rigorous analysis or a published trend assessment. The time series for the Marquesas project is not long enough to detect a trend (NMFS and USFWS 2007b).

The recovery plan for Kemp's ridley sea turtles (USFWS and NMFS 1992) lists the following relevant recovery objective:

- Attain a population of at least 10,000 females nesting in a season.
    - An estimated 4,047 females nested in 2006, which is a substantial increase from the 247 nesting females estimated during the 1985-nesting season (P. Burchfield, Gladys Porter Zoo, personal communication, 2007, in NMFS and USFWS 2007c).
    - In 2007, an estimated 5,500 females nested in the state of Tamaulipas from May 20-22 (P. Burchfield, Gladys Porter Zoo, personal communication, 2007, in NMFS and USFWS 2007c).
    - 10,000 nesting females in a season = about 30,000 nests (NMFS and USFWS 2007c).

The Atlantic recovery plan for the U.S. population of the leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico; St. Croix, USVI; and along the east coast of Florida.

- In Puerto Rico, the main nesting areas are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, nesting increased in Puerto Rico from a minimum of 9 nests recorded in 1978 and to a minimum of 469-882 nests recorded each year between 2000 and 2005. Annual growth rate was estimated to be 1.1 with a growth rate interval between 1.04 and 1.12, using nest numbers between 1978 and 2005 (NMFS and USFWS 2007d).
- In the U.S. Virgin Islands, researchers estimated a population growth of approximately 13 percent per year on Sandy Point National Wildlife Refuge from 1994 through 2001. Between 1990 and 2005, the number of nests recorded has ranged from 143 (1990) to 1,008

(2001). The average annual growth rate was calculated as approximately 1.10 (with an estimated interval of 1.07 to 1.13) (NMFS and USFWS 2007d).

- In Florida, a Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 (1989) to 800-900 (early 2000s). Based on standardized nest counts made at Index Nesting Beach Survey sites surveyed with constant effort over time, there has been a substantial increase in leatherback nesting in Florida since 1989. The estimated annual growth rate was approximately 1.18 (with an estimated 95 percent interval of 1.1 to 1.21) (NMFS and USFWS 2007d).

The potential lethal take of one hawksbill, Kemp's ridley, or leatherback sea turtle, in combination, over consecutive 3-year periods is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. It is worth noting that this level of take has already occurred in the past, yet we have still seen positive trends in the status of these species. Thus, we believe the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of hawksbill, Kemp's ridley, or leatherback sea turtles' recovery in the wild.

7.1.2 Green Sea Turtle

Survival in the Wild
The proposed action may result in two green sea turtle takes (lethal or non-lethal) over consecutive 3-year periods.

The potential non-lethal take of three green sea turtles over consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of green sea turtles is anticipated.

The potential lethal take of three green sea turtles over consecutive 3-year periods would reduce the number of green sea turtles, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal takes could also result in a potential reduction in future reproduction, assuming the individuals were females and would have survived to reproduce. For example, an adult green sea turtle can lay 1-7 clutches (usually 2-3) of eggs every 2 to 4 years, with 110-115 eggs/nest. The loss of two adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage are expected to survive to sexual maturity. The anticipated takes are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of green sea turtles is expected from these takes.

Whether the reductions in numbers and reproduction of these species attributed to spiny lobster fishery would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The 5-year status review for green sea turtles states that of the seven green sea turtle nesting concentrations in the Atlantic basin for which abundance trend information is available, all were determined to be either stable or increasing (NMFS and USFWS 2007a). That review also states that the annual nesting female population in the Atlantic basin ranges from 29,243-50,539 individuals. Additionally, the pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of index beaches in Florida in 1989. An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a).

Although the anticipated mortalities would result in an instantaneous reduction in absolute population numbers, the U.S. populations of green sea turtles would not be appreciably affected. For a population to remain stable, sea turtles must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Since the abundance trend information for green sea turtles is either stable or increasing, we believe the loss of two green turtles over consecutive 3-year periods will not have any measurable effect on that trend.

Based on the above analysis, we believe the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of the green sea turtle in the wild.

Recovery in the Wild

Although no change in distribution was concluded for green sea turtles, we concluded lethal takes would result in a reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of green sea turtles in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild.

The Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991b) lists the following relevant recovery objectives over a period of 25 continuous years:

- The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years;
    - Green turtle nesting in Florida over the past six years has been documented as follows: 2001 – 581 nests, 2002 – 9,201 nests, 2003 – 2,622, 2004 – 3,577 nests, 2005 – 9,644 nests, and 2006 – 4,970 nests. This averages 5,039 nests annually over the past 6 years (NMFS and USFWS 2007a).
- A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
    - Several actions are being taken to address this objective; however, there are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds.

The potential lethal take of three green sea turtles over consecutive 3-year periods is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. It is worth noting that this level of take has already occurred in the past, yet we have still seen positive trends in the status of this species. Thus, the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of green sea turtles' recovery in the wild.

7.1.3 Loggerhead Sea Turtle

Survival in the Wild
The proposed action may result in up to three loggerhead sea turtle takes (lethal or non-lethal) over consecutive 3-year periods.

The potential non-lethal take of three loggerhead sea turtles over consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. These individuals are expected to fully recover such that no reductions in reproduction, or numbers of loggerhead sea turtles are anticipated. Since these takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of loggerhead sea turtles is anticipated.

The potential lethal take of three loggerhead sea turtles over consecutive 3-year periods would reduce the number of loggerheads as compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal takes could also result in a potential reduction in future reproduction, assuming these individuals were female and would have survived to reproduce. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2 to 4 years, with 100-130 eggs/clutch. The loss of two adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage are expected to survive to sexual maturity. These anticipated takes are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of loggerhead sea turtles is expected from the take of an individual.

Whether the reductions in numbers and reproduction of these species attributed to spiny lobster fishery would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The TEWG (2000) assessment of the status of the two loggerhead populations about which the most is known, concluded that no population trend for the Northern subpopulation [essentially the Northern Recovery Unit (NRU)] could be determined, and that the South Florida subpopulation (essentially the Peninsular Florida Recovery Unit [PFRU]) was increasing at that time. Annual nest totals from northern beaches, reflective of the NRU, averaged 5,215 nests from 1989-2008. This was a period of near-complete surveys of nesting beaches (GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data), representing approximately 1,272 nesting females per year (4.1 nests per female, Murphy and Hopkins 1984). Daily beach surveys showed a significant declining trend in nesting of 1.3 percent annually. Nest counts from aerial surveys conducted by SCDNR showed a 1.9 percent annual decline in nesting in South Carolina since 1980. A Georgia DNR analysis of the 40-year time-series trend data shows an overall decline in nesting. However, the shorter comprehensive survey data (20 years) indicates a stable population (SCDNR 2008, GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data). Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. Nesting data from 2008 showed a reversal in the annual declining trends, but future nesting years will need to be analyzed to determine if this trend is continuing. In North Carolina, 841 loggerhead nests were observed compared to the 10-year average of 715 nests. South Carolina had the seventh highest year on record since 1980, with 4,500 nests. Georgia beach surveys located 1,648 nests in 2008; surpassing the previous statewide record of 1,504 nests in 2003 (SCDNR 2008, GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data).

Following the 2000 TEWG assessment, the Florida Wildlife Research Institute conducted a, yet-to-be-published, analysis of PFRU nesting data from 1989-2005. The analysis indicates there is a significant declining trend in nesting at beaches utilized by the PFRU (McRae letter to NMFS, October 25, 2006). Data from the 2006 and 2007 nesting seasons are also consistent with the decline in loggerhead nests. The core index nesting beach nest number only reached 28,074; the lowest total since the index nesting beach monitoring program started in 1989. However, in 2008, 39,789 nests were observed at the index nesting beaches, which is the highest total since 2003, but the overall nesting trend data still indicate a significant declining trend (FWRI Index Nesting Beach website: http://research.myfwc.com/features/view_article.asp?id=10690). It has been unclear if the nesting decline reflects a decline in population, or is indicative of a failure to nest by reproductively mature females due to other factors (resource depletion, nesting beach problems, oceanographic conditions, etc.). However, recent analysis of the data has led to the conclusion that the nesting decline is best explained by an actual decline in the number of adult female loggerheads in the population (Witherington et al. 2009).

The meaning of the nesting decline data is further confounded by various in-water research projects that indicate the abundance of neritic juvenile loggerheads is steady or increasing. Epperly et al. (2007) reported a 13.2 percent per year increase in loggerhead catch per unit effort (CPUE) off North Carolina during sea turtle sampling in 1995-1997 and 2001-2003. Ehrhart et al. (2007) also reported a significant increase in loggerhead CPUE over the last four years in the Indian River Lagoon, Florida. Entrainment of loggerheads at St. Lucie Power Plant on Hutchison Island, Florida, has also increased at an average rate of 11 percent per year from 1998 to 2005 (M. Bersette pers. comm. in Epperly et al. 2007). Epperly et al. (2007) determined the trends of increasing loggerhead catch rates from all the aforementioned studies in combination provide evidence that there has been an increase in neritic juvenile loggerhead abundance in the southeastern United States in the recent past. Whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence is not clear. NMFS has convened a new Turtle Expert Working Group for loggerhead sea turtles that will gather available data and examine the potential causes of the nesting decline and what the decline means in terms of population status. A final report by the loggerhead TEWG is expected in 2009.

The remaining three recovery units, the Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU) are much smaller subpopulations but remain relevant to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2004 (although the 2002 year was missed). Nest counts ranged from 168-270, with a mean of 246, but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data; NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. The 12-year dataset (1997-2008) of index nesting beaches in the area show a significant declining trend of 4.7 percent annually (NMFS and USFWS 2008). Similarly, nesting survey effort has been inconsistent among the GCRU nesting beaches and no trend can be determined for this subpopulation. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico from 1987-2001, where survey effort was consistent during the period. However, nesting has declined since 2001 and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

It is still unclear whether nesting beach trends, in-water abundance trends, or some combination of both, best represents the actual status of loggerhead sea turtle populations in the Northwest Atlantic. Regardless, we do not believe the loss of two individuals over consecutive 3-year periods, even if they are removed from the smallest recovery unit, will have a measurable impact on the likelihood of the loggerhead's survival in the wild. Although the declining annual nest density at major loggerhead sea turtle nesting beaches requires further study and analysis to determine the causes and long-term effects on population dynamics, the likelihood of survival in the wild of loggerheads will not be appreciably reduced because of this action. Therefore, we believe that the lethal or non-lethal take of two loggerhead sea turtles associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of survival of this species of sea turtles in the wild.

Recovery in the Wild

Although no change in distribution was concluded for loggerhead sea turtles, we concluded lethal takes would result in a reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of loggerhead sea turtles in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild.

The second revision of the recovery plan for the Northwest Atlantic population of loggerhead sea turtles (NMFS and USFWS 2008), herein incorporated by reference, lists the following relevant recovery objective:

- Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females
  - Northern Recovery Unit

    (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 2 percent or greater resulting in a total annual number of nests of 14,000 or greater for this recovery unit (approximate distribution of nests is NC=14 percent [2,000], SC=66 percent [9,200], and GA=20 percent [2,800]).

    (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).
  - Peninsular Florida Recovery Unit

(1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is statistically detectable (1 percent), resulting in a total annual number of nests of 106,100 or greater for this recovery unit.

(2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Dry Tortugas Recovery Unit

  (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 3 percent or greater, resulting in a total annual number of nests of 1,100 or greater for this recovery unit.

  (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Northern Gulf of Mexico Recovery Unit

  (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 3 percent or greater resulting in a total annual number of nests of 4,000 or greater for this recovery unit (approximate distribution of nests (2002-2007) is FL=92 percent [3,700] and AL=8 percent [300]).

  (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Greater Caribbean Recovery Unit

  (1) The total annual number of nests at a minimum of three nesting assemblages, averaging greater than 100 nests annually (e.g., Yucatán, Mexico; Cay Sal Bank, The Bahamas) has increased over a generation time of 50 years.

  (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.

  - Trends in Abundance on Foraging Grounds:

    A network of in-water sites, both oceanic and neritic, distributed across the foraging range is established and monitoring is implemented to measure abundance. There is statistical confidence (95 percent) that a composite estimate of relative abundance from these sites is increasing for at least one generation.

  - Trends in Neritic Strandings Relative to In-water Abundance:

    Stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation.

The potential lethal take of three loggerhead sea turtles over consecutive 3-year periods will result in reduction in numbers when takes occur but it is unlikely to have any detectable influence on the trends noted above. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action is not in opposition to the recovery objectives above, and is not likely to result in an appreciable reduction in the likelihood of loggerhead sea turtle recovery in the wild.

7.2 Effects of the Action on the Likelihood of *Acropora* Survival and Recovery in the Wild

As noted in Section 5.6, we believe *Acropora* is likely to be adversely affected by the continued authorization of the spiny lobster fishery. We must now determine if the action would reasonably be expected to appreciably reduce, either directly or indirectly, the likelihood of *Acropora* survival and recovery in the wild. Given what we know about the fishery and the stressors impacting *Acropora* throughout its range, we do not believe the fishery is likely to directly or indirectly reduce the likelihood of *Acropora* survival and recovery in the wild. The fishery has been on going throughout periods of both high and low *Acropora* abundance. Additionally, over the last 15 years the number of traps in the fishery has been declining, further reducing the likelihood of adverse affects from the fishery occurring on *Acropora*.

In two steps, the following sections provide our rationale for why we believe the fishery is not likely to appreciably reduce the likelihood of *Acropora* survival and recovery in the wild. First, we evaluate whether the anticipated take for each species will result in any reduction in distribution, reproduction, or areal coverage that may appreciably reduce the species likelihood of survival in the wild. Second, we consider how the anticipated take is likely to affect these species' recovery in the wild. We believe some of the *Acropora* taken would eventually recover, and regain its functional potential within the population.[29] However, because it is unclear what portion would regain this potential, we err on the side of species conservation and assume all taken *Acropora* will lose its functional potential forever and will be lost from the population.

7.2.1 Acropora cervicornis

Survival in the Wild

The final listing rule for *Acropora* (71 FR 26852; May 9, 2006) provides the following rationale for listing the species as threatened and not endangered: (1) the species geographic range remains intact, (2) there are believed to be a high number of colonies still in existence throughout its range, and (3) asexual reproduction provides a source for new colonies that can buffer natural demographic and environmental variability.

Since *Acropora* are threatened species, we believe an appreciable reduction in the likelihood of survival in the wild can be determined by evaluating if the proposed action is likely to bring the species any closer to an endangered listing. Therefore, if we determine the proposed action had detectable effects range wide on the species' geographic distribution, number of colonies, or the species' ability to asexually reproduce; we would conclude the proposed action is appreciably reducing the likelihood of the species' survival in the wild.

The continued authorization of the spiny lobster fishery will not appreciably reduce the distribution of the *A. cervicornis* throughout its range, leaving its geographic range intact. The proposed action may adversely affect up to 482.09 square meters of *A. cervicornis* over consecutive 3-year periods. We estimated that throughout the action area a minimum of 116,372 square meters of *A. cervicornis* exists.

[29] We define 'functional potential' to mean the potential for producing viable gametes or clones.

The adverse impact to 482.09 square meters of *A. cervicornis* over consecutive 3-year periods would represent 0.41 percent of the total believed to exist in the action area. The action area represents only a small portion of the species current range. Such a small reduction would have no measurable effect on the distribution of the species throughout its range.

The proposed action is also not likely to appreciably reduce the likelihood of survival via a reduction in numbers. The potential loss of 482.09 square meters of *A. cervicornis* or 22,102 colonies over consecutive 3-year periods would reduce the population by that amount, compared to the population in the absence of the continued authorization of the Gulf of Mexico/South Atlantic spiny lobster fishery. However, viewed against the large number of colonies still in existence throughout the range of the species, the effects from the proposed action will not be detectable range wide. Miller et al. (2008), estimate over 13 million *A. cervicornis* colonies likely exist currently in the Florida Keys, and while the absolute number of *Acropora* colonies is unknown, it is estimated that as many as a billion individual colonies may exist range wide (71 FR 26852; May 9, 2006). The loss of 22,102 colonies would represent only 0.17 percent of the colonies believed to exist in the Florida Keys, and would be undetectable range wide. Therefore, the proposed action is not likely to measurably reduce the large number of colonies thought to exist range wide.

Acropora cervicornis is a simultaneously hermaphroditic species.[30] For this reason, our discussion of the impacts on reproduction from the proposed action focuses on colonial sexual maturity. Soong and Lang (1992) estimated that *A. cervicornis* becomes sexually mature when branch lengths reach 17 centimeters. Using *A. cervicornis* branch length records observed in 2007 (Miller et al. unpublished data), we estimated 2.41 percent of *A. cervicornis* colonies occurring in the action area are sexually mature. If we assume 2.41 percent of adversely impacted *A. cervicornis* is sexually mature, the proposed action would remove 11.61 square meters of sexually mature *A. cervicornis* over consecutive 3-year periods. This represents 0.41 percent of the total estimated sexually mature area of *A. cervicornis* in the action area. *Acropora cervicornis* is also a relatively fast growing coral. Given the species morphology, a fast growth rate directly influences how quickly a colony reaches sexual maturity. In the Florida Keys, *A. cervicornis* likely grows 10 to 11.5 cm/year (Shinn 1966, Jaap 1974, Shinn 1976). Such high growth rates suggest a relatively short juvenile period. This means on any given year several size classes (i.e., 7 to 16 cm branch length) considered juveniles the previous years will become sexually mature, assuming all other variable remain the same. This greatly increases *A. cervicornis'* ability to replace sexually mature colonies taken by the proposed action. Additionally, the proposed action is extremely unlikely to impede *A. cervicornis'* ability to reproduce asexually. This reproductive strategy will continue to provide a source of new colonies that can buffer natural demographic and environmental variability.

We believe the proposed action may adversely affect *A. cervicornis*, but is not appreciably reducing its likelihood of survival in the wild. The proposed action will not reduce the species distribution, leaving its geographic range intact. The level of anticipated take will reduce the overall numbers of *A. cervicornis* and will likely remove some sexually mature colonies. However, these amounts are unlikely to even be detectable range wide, given the number of colonies believed to exist, and species' fast growth rate. Since we do not believe the effects of the action will be detectable range wide, we

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[30] Simultaneously hermaphroditic refers to colonies with both female and male reproductive parts. Gametes (eggs and sperm) of these colonies are located in different mesenteries of the same polyp (Soong 1991).

conclude that the continued authorization of spiny lobster fishing is not appreciably reducing the likelihood of the species survival in the wild.

Recovery in the Wild

Although no change in distribution was concluded, we concluded the anticipated level of take would result in a reduction of the overall areal coverage, which may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of either species in the wild. The following analysis considers the effects of the anticipated loss of areal coverage on the likelihood of recovery in the wild.

For sea turtles and smalltooth sawfish we evaluate the impacts of the proposed action against the recovery objectives outlined in their respective recovery plans. Recovery plans delineate actions that the available information indicates are necessary for the conservation and survival of listed species. Actions deemed necessary for the conservation and survival of the species are developed after considering the threats and causal listing factors. A recovery plan for *Acropora cervicornis* and *A. palmata* is not yet available; though a list of threats and causal listing factors exists (Table 7.1). We can compare the proposed action to this list, to get a sense of how all fishing (classified as anthropogenic abrasion and breakage, below) ranks as a stressor to these species. Anthropogenic abrasion and breakage is currently considered a moderate threat to *Acropora cervicornis* and *A. palmata*, and is likely less of a threat with protective regulations in place. The proposed action represents only a small fraction of all fishing, and fishing represents only a portion of the larger anthropogenic abrasion and breakage category. Additionally, the proposed action is not likely to reduce the chances of *A. cervicornis'* and *A. palmata's* (see Section 7.2.2) survival in the wild. Therefore, we do not believe the continued authorization of the Gulf of Mexico/South Atlantic spiny lobster fishery will appreciably reduce the likelihood of *Acropora*'s recovery in the wild.

Table 7.1 Rank of stressor severity to *Acropora* without (w/out) and with (w/) prohibition/protection of existing regulatory mechanisms (regs)* (*Acropora* BRT 2005)

Stressor	***A. palmata***		***A. cervicornis***	
	Rank w/o Regs	Rank w/ Regs	Rank w/o Regs	Rank w/ Regs
Disease	5+	5+	5+	5+
Temperature	5	5	5	5
Over-harvest	5*	1	5*	1
Natural abrasion and breakage	4	4	4	4
Anthropogenic abrasion and breakage	3	2	2	1
Competition	3	3	3	3
Predation	3	3	3	3
Sedimentation	3	2	3	2
African Dust	1	1	1	1
CO_2	1	1	1	1
Nutrients	1	1	1	1
Sea level rise	1	1	1	1
Sponge boring	1	1	1	1
Contaminants	U	U	U	U
Loss of genetic diversity	U	U	U	U

*A rank of 5 represents the highest threat, 1 the lowest, and U undetermined/unstudied.

7.2.2 *Acropora palmata*

Survival in the Wild

The final listing rule for *Acropora* (71 FR 26852; May 9, 2006) provides the following rationale for listing the species as threatened and not endangered: (1) the species geographic range remains intact, (2) there are believed to be a high number of colonies still in existence throughout its range, and (3) asexual reproduction provides a source for new colonies that can buffer natural demographic and environmental variability.

Since *Acropora* are threatened species, we believe an appreciable reduction in the likelihood of survival in the wild can be determined by evaluating if the proposed action is likely to bring the species any closer to an endangered listing. Therefore, if we determine the proposed action had detectable effects range wide on the species' geographic distribution, number of colonies, or the species' ability to asexually reproduce, we would conclude the proposed action is appreciably reducing the likelihood of the species' survival in the wild.

The continued authorization of the spiny lobster fishery will not appreciably reduce the distribution of the *A. palmata* throughout its range, leaving its geographic range intact. The proposed action may adversely affect up to 7.41 square meters of *A. palmata* over consecutive 3-year periods. We estimated that throughout the action area a minimum of 134,647 square meters of *A. palmata* exists. The adverse impact to 7.41 square meters of *A. palmata* over consecutive 3-year periods would represent 0.005 percent of the total believed to exist in the action area. The action area represents only a small portion of the species current range. Such a small reduction would have no measurable effect on the distribution of the species throughout its range.

The proposed action is also not likely to appreciably reduce the likelihood of survival via a reduction in numbers. The potential loss of 7.41 square meters of *A. palmata* or 495 colonies over consecutive 3-year periods would reduce the population by that amount, compared to the population in the absence of the continued authorization of the Gulf of Mexico/South Atlantic spiny lobster fishery. However, viewed against the large number of colonies still in existence throughout the range of the species, the effects from the proposed action will not be detectable range wide. Miller et al. (2008), estimate over 1.6 million *A. palmata* colonies likely exist currently in the Florida Keys, and while the absolute number of *Acropora* colonies is unknown, it is estimated that as many as a billion individual colonies may exist range wide (71 FR 26852; May 9, 2006). The loss of 495 colonies would represent only 0.031 percent of the colonies believed to exist in the Florida Keys, and would be undetectable range wide. Therefore, the proposed action is not likely to measurably reduce the large number of colonies thought to exist range wide.

Acropora palmata is a simultaneously hermaphroditic species. For this reason our discussion of the impacts on reproduction from the proposed action focuses on colonial sexual maturity. Soong and Lang (1992) estimated *A. palmata* colonies become sexually mature when they reach a surface area of 1,600 square centimeters. Using the colonial size data from Miller et al. (2007), we estimate 26.3 percent of *A. palmata* colonies in the action area are sexually mature. If we assume 26.3 percent of adversely impacted *A. palmata* is sexually mature, the proposed action would remove 1.94 square meters of sexually mature *A. palmata,* over consecutive 3-year periods. This represents less than one percent of the total estimated sexually mature area of *A. palmata* in the action area. Like *A. cervicornis, A. palmata* also has a relatively fast growth rate, directly influencing how quickly colonies reach sexual maturity. In the Florida Keys, *A. palmata* has a documented growth rate of 10 cm/year (Jaap 1974). Such high growth rates suggest a relatively short juvenile period. This greatly increases *A. palmata's* ability to replace sexually mature colonies taken by the proposed action. Additionally, the proposed action is extremely unlikely to impede *A. palmata's* ability to reproduce asexually. This reproductive strategy will continue to provide a source of new colonies that can buffer natural demographic and environmental variability.

We believe the proposed action may be adversely affecting *A. palmata*, but is not appreciably reducing its likelihood of survival in the wild. The proposed action will not reduce the species distribution, leaving its geographic range intact. The level of anticipated take will reduce the overall numbers of *A. palmata* and will likely remove some sexually mature colonies. However, these amounts are unlikely to even be detectable range wide, given the number of colonies believed to exist, and species' fast growth rate. Since we do not believe the effects of the action will be detectable range wide, we conclude that the continued authorization of spiny lobster fishing is not appreciably reducing the likelihood of the species survival in the wild.

Recovery in the Wild
See Section 7.2.1

7.3 Effects of the Action on the Likelihood of Smalltooth Sawfish Survival and Recovery in the Wild

This section analyzes the effects of the action on the likelihood smalltooth sawfish survival and recovery in the wild, in two steps. First, we evaluate how the population is likely to respond if takes were non-lethal or lethal, then we evaluate whether the anticipated take will result in any reduction in distribution, reproduction, or numbers that may appreciably reduce its likelihood of survival. Second, we consider how anticipated take is likely to affect smalltooth sawfish recovery in the wild by considering recovery objectives in the recovery plan.

Survival in the Wild
The non-lethal take of two smalltooth sawfish over consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The vast majority of smalltooth sawfish released after incidental capture show no apparent signs of any negative sub-lethal effects. Although the range of impacts of non-lethal takes are variable, this take estimate represents only those takes for which all animals are expected to fully recover such that no reductions in reproduction or numbers of smalltooth sawfish are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of green sea turtles is anticipated.

Recovery in the Wild
Since only non-lethal take is anticipated, we believe there will be no effect to the population of reproductive adults and thus no appreciable reduction in the likelihood of smalltooth sawfish survival or recovery in the wild.

8.0 Conclusion

We have analyzed the best available data, the current status of the species, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of any sea turtle species, *Acropora*, or smalltooth sawfish.

Green, Hawksbill, Kemp's Ridley, Leatherback, and Loggerhead Sea Turtles
Our sea turtle analyses focused on the impacts to and population response of sea turtles in the Atlantic basin. However, the impact of the effects of the proposed action on the Atlantic populations must be directly linked to the global populations of the species, and the final jeopardy analysis is for the global populations as listed in the ESA. Because the proposed action will not reduce the likelihood of survival and recovery of any Atlantic populations of sea turtles, it is our opinion that the continued operation of the Gulf of Mexico/South Atlantic spiny lobster fishery is also not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles.

Acropora
Our *Acropora* analysis focused on the impacts and population response of *Acropora*. Based on these analyses, it is our opinion that the continued operation of the Gulf of Mexico/South Atlantic spiny lobster fishery is not likely to jeopardize the continued existence of *Acropora cervicornis* or *Acropora palmata*.

Smalltooth Sawfish

The smalltooth sawfish analyses focused on the impacts and population response of the U.S. DPS of smalltooth sawfish. Based on these analyses, it is our opinion that the continued operation of the Gulf of Mexico/South Atlantic spiny lobster fishery is not likely to jeopardize the continued existence of smalltooth sawfish.

9.0 Incidental Take Statement (ITS)

Section 9 of the ESA and protective regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the RPMs and terms and conditions of the ITS.

Section 7(b)(4)(c) of the ESA specifies that to provide an ITS for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of protected marine mammals is provided and no take is authorized. Nevertheless, F/SER2 must immediately notify (within 24 hours, if communication is possible) NMFS' Office of Protected Resources should a take of a listed marine mammal occur.

9.1 Anticipated Amount or Extent of Incidental Take

NMFS anticipates the following incidental takes may occur in the future as a result of the continued operation of Gulf of Mexico/South Atlantic spiny lobster fishery. As noted in Section 5.5.2, incidental take for *Acropora* is issued as an area because of the species unique morphology, and because of the accepted practice of monitoring coral species using areal parameters.

Table 9.1 3-Year Anticipated Future Take in the Gulf of Mexico/South Atlantic Spiny Lobster Fishery

Marine Turtles	**Number of Takes**		
	Lethal or Non-Lethal		Total
Loggerhead	3		3
Green	3		3
Hawksbill	1*		1*
Leatherback	1*		1*
Kemp's ridley	1*		1*
Marine Fish	**Number of Takes**		
	Lethal	Non-Lethal	Total
Smalltooth sawfish	0	2	2
Corals	**Area Effected**		
Acropora cervicornis	482.09 m^2		
Acropora palmata	7.41 m^2		

* These estimates are for all species in combination, not each species individually.

9.2 Effect of the Take

NMFS has determined the level of anticipated take specified in Section 9.1 is not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles, *Acropora*, or smalltooth sawfish.

9.3 Reasonable and Prudent Measures (RPMs)

Section 7(b)(4) of the ESA requires NMFS to issue to any agency whose proposed action is found to comply with section 7(a)(2) of the ESA, but may incidentally take individuals of listed species, a statement specifying the impact of that taking. It also states that RPMs necessary to minimize the impacts from the agency action, and terms and conditions to implement those measures, must be provided and followed. Only incidental taking that complies with the specified terms and conditions is authorized.

The RPMs and terms and conditions are required, per 50 CFR 402.14 (i)(1)(ii) and (iv), to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species. These measures and terms and conditions are non-discretionary, and must be implemented by NMFS for the protection of section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If it fails to adhere to the terms and conditions of the incidental take statement through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of the incidental take, F/SER2 must report the progress of the action and its impact on the species to F/SER3 as specified in the incidental take statement [50 CFR 402.14(i)(3)].

We have determined that the following RPMs are necessary and appropriate to minimize the impacts of future takes of sea turtles, *Acropora*, and smalltooth sawfish by the Gulf of Mexico/South Atlantic spiny lobster fishery and to monitor levels of incidental take.

1. <u>Sea Turtle and Smalltooth Sawfish Handling Requirements:</u>
   As noted in Section 5.3.1, spiny lobster trap gear can adversely affect sea turtles and smalltooth sawfish via entanglement and/or forced submergence. Most, if not all, sea turtles and smalltooth sawfish released after entanglement events have experienced some degree of physiological injury from forced submergence and/or abrasions/lacerations caused by trap ropes. Experience with other gear types (i.e., hook-and-line) has shown that the ultimate severity of these events is dependent not only upon actual interaction (i.e., physical trauma from entanglement/forced submergence), but the amount of gear remaining on the animal at the time of release. The handling of an animal also greatly affects its chance of recovery. Therefore, the experience, ability, and willingness of fishers to remove gear, is crucial to the survival of sea turtles and smalltooth sawfish following release, and NMFS shall require that captured sea turtles and smalltooth sawfish are handled in a way that minimizes adverse effects from incidental take and reduces mortality.

2. <u>Minimization of Trap Impacts to *Acropora*:</u>
   As noted in Section 5.3.2, spiny lobster trap gear can affect *Acropora* via fragmentation or abrasion occurring during routine fishing or by storm-mobilized traps. We estimate only 20

percent of all spiny lobster trap fishing occurs in federal waters, on average. All the adverse affects to *Acropora* outlined in this document are also likely to be occurring in state waters, but at a greater magnitude because of the higher level fishing effort. Since we believe that adverse affects are occurring to *Acropora* in areas beyond the scope of this opinion, implementing strong conservation measures in the federal fishery is the best approach to providing protection for these species occurring in federal waters at this time. Therefore, NMFS must require that federal spiny lobster fishing is conducted in such a manner and area that adverse impacts to *Acropora* are minimized. Further, NMFS must collaborate with the State of Florida to reduce adverse impacts to *Acropora* from state spiny lobster fishing to the greatest extent possible.

3. <u>Monitoring the Frequency and Magnitude of Incidental Take:</u>
   The jeopardy analyses for sea turtles, smalltooth sawfish, and *Acropora* are based on the assumption that the frequency and magnitude of adverse effects that occurred in the past will continue into the future. If our estimates regarding the frequency and magnitude of incidental take prove to be an underestimate, we risk having misjudged the potential adverse effects to the sea turtles, smalltooth sawfish, and *Acropora*. Thus, it is imperative that we monitor and track the level of take occurring specific to the spiny lobster trap fishery. Therefore, NMFS must ensure that monitoring and reporting of any sea turtles or smalltooth sawfish encountered, or any *Acropora* interactions: (1) detects any adverse effects resulting from the Gulf of Mexico/South Atlantic spiny lobster fishery; (2) assess the actual level of incidental take in comparison with the anticipated incidental take documented in that opinion; and (3) detect when the level of anticipated take is exceeded.

9.4 Terms and Conditions

To be exempt from take prohibitions established by section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

The following terms and conditions implement RPM No. 1.

1. NMFS must update careful release protocols and modify release gears as new information becomes available.
2. F/SER2, in cooperation with F/SER3, F/SEC, and the State of Florida, must distribute information to permitted spiny lobster trap tag holders specifying handling and/or resuscitation requirements fishers must undertake for any sea turtles taken, as stated in 50 CFR 223.206(d)(1-3).
3. F/SER2, in cooperation with the State of Florida, shall inform all permitted spiny lobster trap tag holders that disentanglement of sea turtles from trap gear takes priority over transferring catch from traps to vessels. Simply cutting lines and leaving entangled gear on sea turtles is strongly discouraged. If a sea turtle is cut loose with the line attached, the flipper may eventually become occluded, necrotic and infected, and this could lead to mortality.
4. F/SER2, in cooperation with F/SER3, F/SEC, and the State of Florida, must also remind permitted spiny lobster trap tag holders they should take the following actions to safely handle and release an incidentally caught smalltooth sawfish:
   a. Leave the sawfish, especially the gills, in the water as much as possible.

b. Do not remove the saw (rostrum) or injure the animal in any way.
c. Remove as much fishing gear as safely possible, from the body of the animal.
d. If it can be done safely, untangle any line wrapped around the saw.
e. Use extreme caution when handling and releasing sawfish as the saw can thrash violently from side to side.

The following terms and conditions implement RPM No. 2.

5. F/SER2, in cooperation with F/SER3, F/SEC, and the State of Florida, must develop and provide permitted spiny lobster trap certificate holders with outreach material describing the appearance and likely habitat of *Acropora*, to aid fishers in avoiding potential interactions with these species.
6. The spiny lobster fishery in Florida is primarily a state fishery (see fishery discussion in Section 2.1). As such, the greatest conservation value to *Acropora* will come from minimizing adverse impacts from spiny lobster trap fishing occurring in state waters. Therefore, NMFS must work with the State of Florida to develop and implement changes in the state fishery that reduce impacts to ESA-listed species. Specifically, NMFS should encourage the State of Florida to pursue an ESA section 10(a)(1)(B) Incidental Take Permit and develop a Conservation Plan for the state's spiny lobster fishery.
7. NMFS, in cooperation with the Florida Keys National Marine Sanctuary, Gulf of Mexico and South Atlantic Fishery Management Councils, must work to establish new closed areas or expand the size of existing closed areas in waters under their jurisdiction where *Acropora* is present to prohibit spiny lobster trap fishing. This will reduce the likelihood of spiny lobster traps affecting *Acropora*.
8. NMFS, in cooperation with the State of Florida, must work to promote the removal of spiny lobster trap marine debris during the spiny lobster closed (April 1-August 5). Specifically, NMFS should provide funding, to the greatest extent practicable, to marine debris projects targeting spiny lobster trap gear.
9. NMFS, in cooperation with industry and Gulf of Mexico and South Atlantic Fishery Management Councils, should also explore allowing the public or other entities to remove trap line, buoys, and make unfishable, any spiny lobster trap gear found in the environment when the fishery is closed and all traps must be out of the water (April 1-August 5).
10. NMFS must remind spiny lobster trap fishers that a good-faith effort should be made to remove all traps from the water, or move them to a location that minimizes the likelihood of mobilization, 48 hours before a forecasted storm arrives.
11. NMFS must work with NMFS SEFSC Harvesting Systems Branch or fund other projects exploring potential spiny lobster trap gear modifications that reduce adverse impacts from spiny lobster traps. If these efforts produce viable gear modifications, F/SER2 must work with the State of Florida, and the Gulf of Mexico and South Atlantic Fishery Management Councils to implement these gear modifications as soon as practicable.

The following terms and conditions implement RPM No. 3

12. NMFS will continue to coordinate with the STSSN and states to monitor strandings. If stranding trends show a significant increase in spiny lobster trap gear related strandings, this may represent new information that would require reinitation of section 7 consultation.

13. NMFS must work with the Gulf of Mexico and South Atlantic Fishery Management Councils, and the State of Florida, to implement measures requiring that all spiny lobster trap rope be a specific color or have easily identifiable patterns/markings, not currently in use in other fisheries, along its entire length. This will ensure any trap rope affects can be attributed to the appropriate fishery (e.g., stone crab, spiny lobster, or blue crab fisheries). Easily identifiable ropes must be phased into the federal fishery no later than five years after the finalization of this biological opinion.
14. NMFS, in cooperation with the State of Florida, must develop a module for STSSN volunteers to provide training on identifying spiny lobster trap gear. This effort should be coordinated with the STSSN's existing fishing gear identification program. Since sea turtle strandings data is the primary means for monitoring the level of take within the fishery, this training is necessary to increase the accuracy of sea turtle entanglement reports. Additionally, this training will help ensure that sea turtle entanglements in trap gear are attributed to the appropriate fishery (e.g., stone crab, spiny lobster, or blue crab fisheries).
15. NMFS, in cooperation wit the State of Florida, must ensure, to the greatest extent practicable, that the Florida STSSN remains operational at least at its current level of monitoring. STSSN participants should be reminded to fill out the SEFSC Sea Turtle Life History Form to the greatest extent possible. STSSN participants should also be strongly encouraged to photograph strandings to confirm species identity, release condition, and any fishing gear associated with the animal.
16. F/SER2, in collaboration with the SEFSC, must submit STSSN stranding reports, including the information below, that show evidence of trap entanglements to F/SER3 by May 1 of each year.
    a. The STSSN report must include information on: species, sex, date (day, month, and year), state, the region where the take occurred (Gulf of Mexico or Atlantic Ocean), the NMFS statistical zone, the latitude and longitude, the animal condition and disposition, and the curved and/or straight carapace length (when available).
    b. These reports must be forwarded to the Assistant Regional Administrator for Protected Resources, Southeast Regional Office, Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701.
17. NMFS will continue to use *Acropora* abundance surveys to monitor *Acropora* in the action area. If these data show a decrease in abundance not easily attributed to non-anthropogenic sources (e.g., an active hurricane season, disease outbreak, etc.) this may represent new information that would require reinitation of section 7 consultation.

10.0 Conservation Recommendations for Sea Turtles, *Acropora*, and Smalltooth Sawfish

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The following additional measures are recommended. For F/SER3 to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, F/SER3 requests notification of the implementation of any conservation recommendations.

Sea Turtles:

1. NMFS should work with the State of Florida to evaluate the feasibility of adding ESA-listed species reporting requirements to the Florida Trip Ticket reporting system. This will provide data regarding the incidental capture of ESA-listed species.
2. To better understand sea turtle populations and the impacts of incidental take in Gulf of Mexico/South Atlantic spiny lobster fishery, NMFS should support in-water abundance estimates of sea turtles to achieve more accurate status assessments for these species and improve our ability to monitor them.
3. Once reasonable in-water estimates are obtained, NMFS should support population modeling or other risk analyses of the sea turtle populations affected by the Gulf of Mexico/South Atlantic spiny lobster fishery. This will help improve the accuracy of future assessments of the effects of different levels of take on sea turtle populations.
4. NMFS should encourage the State of Florida to apply for funds available under section 6 of the ESA, to conduct research into the impacts of trap fisheries on sea turtles occurring in state waters.
5. NMFS should encourage the State of Florida to develop and implement programs aimed at helping conserve ESA-listed sea turtles species occurring in state waters.

Acropora:

6. NMFS should encourage the State of Florida to develop and implement programs aimed at helping conserve ESA-listed *Acropora* species occurring in state waters.
7. NMFS should conduct or fund research into identifying and quantifying the impacts of fishing related marine debris, particularly trap rope, on *Acropora*.
8. NMFS should conduct or fund research into the efficacy of marine debris removal programs, for the purpose of identifying potential ways to improve the efficiency of such programs.
9. NMFS should conduct, fund, or otherwise develop educational and outreach materials explaining the impacts of fishing related marine debris on ESA-listed *Acropora* species.
10. NMFS should conduct or fund *Acropora* restoration efforts in the Florida Keys.
11. NMFS should conduct or fund efforts to increase the assessment, monitoring, and modeling of coral reefs in the Florida Keys National Marine Sanctuary to allow for a better understanding of *Acropora* abundance and distribution within the area.

Smalltooth Sawfish:

12. NMFS should conduct or fund research on the distribution, abundance, and migratory behavior of smalltooth sawfish to better understand their occurrence in federal waters and potential for interaction with spiny lobster trap gear.
13. NMFS should conduct or fund reproductive behavioral studies to ensure that the incidental capture of smalltooth sawfish in the Gulf of Mexico/South Atlantic spiny lobster fishery is not disrupting any such activities.
14. NMFS should consider time/area closures to reduce fishery interactions in areas where significant numbers of smalltooth sawfish interactions occur.

15. NMFS should encourage the State of Florida to develop and implement programs aimed at helping conserve smalltooth sawfish occurring in state waters.

16. NMFS should encourage the State of Florida, to develop regulations that prohibit spiny lobster trap fishing in waters three feet or less. This action will help reduce to likelihood of adult smalltooth sawfish becoming entangled in trap lines while using the nearshore areas for breeding. This will also provide protection for younger smalltooth sawfish that use the nearshore environment as nursery habitat.

11.0 Reinitiation of Consultation

This concludes formal consultation on the Gulf of Mexico/South Atlantic spiny lobster fishery. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of the taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, F/SER2 must immediately request reinitiation of formal consultation.

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Appendix 1 Overview of Management Objectives and Measures for the Gulf of Mexico and South Atlantic Spiny Lobster Fishery

FMP/Amendment	Management Objectives/Measures
Original FMP (GMFMC and SAFMC 1982)	• Protect the long-run yields and prevent depletion of lobster stocks • Increase yield by weight from the fishery • Reduce user group and gear conflicts in the fishery • Acquire the necessary information to manage the fishery • Promote efficiency in the fishery
Amendment 1 (GMFMC and SAFMC 1987)	• Required a commercial permit • Limited the possession of undersized lobsters used as attractants and require a live well for those that are kept on board until placed in traps • Modified the recreational possession and season regulations • Modified closed season regulations • Required the immediate release of egg bearing females • Modified the minimum size limit • Required a permit to separate tails while at sea • Prohibited the possession or stripping of egg bearing slipper lobsters
Amendment 2 (GMFMC and SAFMC 1989)	• Modified optimum yield • Established a procedure and protocol for an enhanced management system • Added additional measures to the vessel safety and habitat sections of the original FMP
Amendment 3 (GMFMC and SAFMC 1990)	• Overfishing was defined • NMFS' right to charge a fee for issuing permits was clarified
Regulatory Amendment 1 (GMFMC and SAFMC 1992)	• Extended the Florida spiny lobster trap certificate system for reducing the number of traps in the commercial fishery to the EEZ off Florida • Revised the FMP commercial permitting requirements • Limited the number of live undersize lobster that could be used as attractants for baiting traps • Specified allowable gear for commercial fishing in the EEZ off Florida • Specified the possession limit of spiny lobsters by persons diving at night • Required lobsters harvested by divers be measured without removing from the water • Specified uniform trap and buoy numbers for the EEZ off Florida
Regulatory Amendment 2 (GMFMC and SAFMC 1993)	• Changed the days for the special recreational season in the EEZ off Florida • Prohibited nighttime harvest off Monroe County, Florida during the special recreational season • Specified allowable gear during the special recreational season • Provided different bag limits during the special recreational season off the Florida Keys and the EEZ off other areas of Florida

Appendix 1 Continued

Amendment 4 (GMFMC and SAFMC 1994)	• Allowed the harvest of two lobsters per person per day for all fishermen year round in the South Atlantic waters north of the Florida/Georgia border
Amendment 5 (SAFMC 1998a)	• Identified Essential Fish Habitat (EFH) and EFH-Habitat Areas of Particular Concern for spiny lobster
Amendment 6 (SAFMC 1998b)	• Amended the original FMP as required to make definitions of MSY, OY, overfishing, and overfished consistent with National Standard Guidelines • Identified and defined fishing communities and addressed bycatch management measures
Amendment 7 (GMFMC 2000)	• Addressed the establishment of the Tortugas Marine Reserves

Appendix 2 The anticipated annual incidental take of loggerhead, leatherback, Kemp's ridley, green, and hawksbill sea turtles as outlined in the most recent opinions on NMFS-authorized federal fisheries.

FISHERY	SEA TURTLE SPECIES				
	LOGGERHEAD	LEATHERBACK	KEMP'S RIDLEY	GREEN	HAWKSBILL
ATLANTIC BLUEFISH	6-No more than 3 lethal	None	6-Lethal or non-lethal	None	None
ATLANTIC MACKEREL/SQUID/ BUTTERFISH	6-No more than 3 lethal	1-Lethal or non-lethal	2-Lethal or non-lethal	2-Lethal or non-lethal	None
ATLANTIC HMS-PELAGIC LONGLINE	635-No more than 113 lethal	588-No more than 28 lethal	35-No more than 6 lethal for these species in combination		
ATLANTIC HMS-SHARK FISHERIES	679-No more than 346 lethal	74-No more than 47 lethal	2 – No more than 1 lethal	2 – No more than 1 lethal	2 – No more than 1 lethal
COASTAL MIGRATORY PELAGICS	11-Lethal takes	2-Lethal takes for leatherbacks, hawksbill, and Kemp's ridley-both lethal take	14-Lethal takes	2-Lethal takes for Leatherbacks, hawksbill, and Kemp's ridley-both lethal take	
DOLPHIN-WAHOO	12-No more than 2 lethal	12-No more than 1 lethal	3-All species in combination; no more than 1 lethal take		
GULF OF MEXICO REEF FISH	68-No more than 26 lethal	7-No more than 3 lethal	1-Lethal or non-lethal	17-No more than 7 lethal	15-No more than 5 lethal
MONKFISH (GILLNET)	3-Loggerhead (No more than 5 lethal loggerhead takes by all monkfish gear over 5 yrs)	1-Leatherback, Kemp's ridley or green			None
MONKFISH (TRAWL)	1-Loggerhead, leatherback, Kemp's ridley or green				None
NORTHEAST MULTISPECIES	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	None
SOUTH ATLANTIC SNAPPER-GROUPER	68-No more than 23 lethal	9-No more than 5 lethal	7-No more than 3 lethal	13-No more than 5 lethal	2-No more than 1 lethal

Appendix 2 Continued

SOUTHEASTERN U.S. SHRIMP	163,160-No more than 3,948 lethal	3,090-No more than 80 lethal	155,503-No more than 4,208 lethal	18,757-No more than 514 Lethal	640-All lethal
SPINY DOGFISH	3-No more than 2 lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	1-Lethal or non-lethal	None
SUMMER FLOUNDER/SCUP/ BLACK SEA BASS	19-No more than 5 lethal (total - either loggerheads or Kemp's ridley)	None	See loggerhead entry	2 lethal or non-lethal	None

Appendix 3 Storm-Mobilized Spiny Lobster Trap Effects on *Acropora*

Quantifying Adverse Impacts to *Acropora* from Buoyed Spiny Lobster Traps Over the 2004-2005 Through 2006-2007 Fishing Seasons

The following section illustrates in more detail the analysis of trap mobilization impacts to *Acropora*, conducted in Section 5.5.2.2. Our analysis makes certain assumptions to overcome gaps in our knowledge. We use number of spiny lobster trap tags as a surrogate for the number spiny lobster traps. Since every spiny lobster trap must have a single trap tag, we assume that a spiny lobster tag translates to a single spiny lobster trap. It also assumes that traps set outside areas closed to fishing could migrate into those closed areas; thus, we used average *Acropora* colonial densities estimates for areas both open and closed to fishing. We also assume *Acropora* will be adversely affected (via fragmentation and/or abrasion) each time there is contact with a spiny lobster trap.

To quantify the extent of adverse affects to *Acropora*, we conducted six different analyses, one for each species of *Acropora*, in each region of the Florida Keys (i.e., Upper, Middle, and Lower). As noted in Section 5.5.2.1, because of species distribution, we assume 4 percent of all federally fished traps will affect habitat supporting *A. palmata*, while we believe 15 percent of all federally fished traps will affect habitat supporting *A. cervicornis*. For consistency with the *Acropora* abundance and density data provided in Miller et al. (2007), our estimates of federal trap fishing effort have been segregated, to the greatest extent possible, to match the regions as they were defined in those reports. In the interest of brevity, only the narrative of the analysis conducted for *A. cervicornis* during the 2006-2007 fishing year in the Upper Keys appears below. The remaining analyses of storm-mobilized buoyed trap impacts use the same steps outlined below. Tables A3.3 through A3.5 provide the information used and results of the analyses for both species over the 2004-2005 through 2006-2007 fishing seasons.

Estimating Buoyed Spiny Lobster Trap Effects to ASH in the Upper Keys During the 2006-2007 Fishing Season

We began by tabulating and calculating the amount of commercial trap fishing effort in the fishery for the 2006-2007 fishing year. Effort can be measured in variety of ways, including the traps issued; total number of trips, traps fished, sets, hours fished, and soak time. We measured the effort in the fishery by estimating the number of traps fished during a given year, based on the number of traps issued to fishers reported by FFWCC (FFWCC 2007).[31] To be conservative toward the species, our analysis assumes all trap issued were actually used in the fishery.

The number of traps issued by the FFWCC during the season was 466,686. This number was then multiplied by the percentage of traps used each month to estimate the number of traps pulled monthly. The number of traps pulled each month was then multiplied the percentage of all traps (state and federal waters) used in federal waters. During the 2006-2007 fishing season, traps used in federal waters accounted for 10.09 percent of all traps used in the Florida Keys (FFWCC unpublished data).[32] We multiplied this percentage by the number of traps pulled each month to estimate the number of individual traps used each month and annually in federal waters. Using FFWCC Trip Ticket information, we estimated the percentage of total federal fishing effort that occurred in the Upper Keys

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[31] FFWCC defines active traps as spiny lobster trap tags issued, not whether the traps was actually fished.

[32] In our analyses, we used percentage of traps pulled in federal waters and region of the Florida Keys, as a proxy for estimating the total number of individual traps used in those areas.

(0.124 percent) during the 2006-2007 season. By multiplying this percentage by our estimate of the number of traps used each month in federal waters, we estimated the number of individual traps used monthly in federal waters off the Upper Keys. Multiplying our monthly trap use figures by the percentage of traps that end up on ASH for *A. cervicornis* (15 percent) (Matthews 2003), yielded an estimate of the number of federally fished traps that land on ASH each month. Table A3.1 summarizes this process.

Table A3.1 Estimating Monthly Federal Trap Impact to ASH in the Upper Keys

Month	% of All Traps Used	No. Traps Used Each Month	% of All Trap Fishing Occurring Federal Waters	No. Traps Used in Federal Waters	% of All Federal Effort Occurring in the Region	Traps Fished in Federal Waters in the Region	No. of Federally Fished Traps Landing on ASH
Aug	100.00%	466,686	10.09	47,111	0.124	58.49	8.77
Sep	95.67%	446,478	10.09	45,071	0.124	55.96	8.39
Oct	91.95%	429,118	10.09	43,318	0.124	53.78	8.07
Nov	88.16%	411,430	10.09	41,533	0.124	51.57	7.73
Dec	79.97%	373,209	10.09	37,674	0.124	46.78	7.02
Jan	68.52%	319,773	10.09	32,280	0.124	40.08	6.01
Feb	55.52%	259,104	10.09	26,156	0.124	32.47	4.87
Mar	42.13%	196,615	10.09	19,848	0.124	24.64	3.70
Average	77.74%	362,802	10.09	36,624	0.124	45.47	6.82
Total	--	2,902,414	--	292,991	--	363.77	54.56

Since the type of storm (tropical or non-tropical) affects the extent of trap mobilization, we calculated the impacts from both types separately. We estimated the impacts from storm-mobilized buoyed traps landing on ASH, during tropical and non-tropical storm events, by first estimating the type of weather event likely to occur during each month. We assumed 3.5 tropical weather events would occur annually; only during August through November (0.875 tropical events/month). Lewis et al. (in review) observed 18 non-tropical weather events occurring during October through April (2.57 non-tropical weather events/month). For each month, we multiplied the number of traps landing on ASH, by the number of tropical or non-tropical weather events likely to affect those traps, and the area of impact associated with each weather event. As mentioned in Section 5.5.2.1, we used 4.96 square meters and 1.815 square meters as the areas of impact resulting from tropical and non-tropical weather events, respectively. For months when both tropical and non-tropical weather events could occur (October and November), we estimated the areas of impact from each event separately, and summed the result. Our analysis showed 317.53 square meters of ASH was affected during the 2006-2007 fishing season due to storm-mobilized, buoyed traps. Table A3.2 summarizes these steps.

Table A3.2 Estimating Monthly and Annual Area of Impact from Storm-Mobilized Buoyed Traps During the 2006-2007 Fishing Season

Month	Traps Fished in Federal Waters in the Region	No. of Federally Fished Traps Landing on ASH	No. Tropical Storms (3.5/yr)	Individual Trap Area of Impact from Tropical Storms (m^2)	No. Non-Topical Storms (18/yr)	Individual Trap Area of Impact from Tropical Storms (m^2)	Annual Area of Impact
Aug	58.49	8.77	0.875	4.96	0	0	38.08
Sep	55.96	8.39	0.875	4.96	0	0	36.43
Oct	53.78	8.07	0.875	4.96	2.57	1.815	72.64
Nov	51.57	7.73	0.875	4.96	2.57	1.815	69.65
Dec	46.78	7.02	0	0	2.57	1.815	32.73
Jan	40.08	6.01	0	0	2.57	1.815	28.04
Feb	32.47	4.87	0	0	2.57	1.815	22.72
Mar	24.64	3.70	0	0	2.57	1.815	17.24
Average	45.47	6.82	--	--	--	--	39.69
Total	363.77	54.56	--	--	--	--	317.53

Quantifying Adverse Effects to Acropora cervicornis in the Upper Keys

We estimated an *A. cervicornis* density of 0.0078 colonies/square meter of ASH, in areas open and closed to fishing in the Upper Keys, from Miller et al. (2007). By multiplying this estimate by the area of ASH in the Upper Keys impacted by storm-mobilized traps (317.53 square meters), we estimated 2.47 *A. cervicornis* colonies were affected during the 2006-2007 fishing season. By multiplying the number of colonies impacted (2.47) by the average area of each *A. cervicornis* colony [0.021 square meters; derived from Miller et al. (2007)], we estimated 0.052 square meter of *A. cervicornis* was adversely impacted by spiny lobster trap mobilization in the Upper Keys, during the 2006-2007 fishing season.

Adverse Effects to Acropora in the Remaining Regions During the 2004-2005 Through 2006-2007 Fishing Seasons

Throughout all regions of the Florida Keys, we estimate 351.33 square meters of *A. cervicornis* and 6.89 square meters of *A. palmata* were adversely affected by mobilized, buoyed spiny lobster traps during the 2004-2005 through 2006-2007 fishing seasons. Table A3.3 summarizes the constants used in the analyses that remained the same across all fishing seasons. Tables A3.4 and A3.5 summarize the resulting calculations from each analysis.

Table A3.3 Constants Used in Storm-Mobilized, Buoyed Trap Impact Analyses for Both Species

Parameter		Region		
		Upper Keys	Middle Keys	Lower Keys
Avg. Per Trap Area of Impact from Tropical System (m^2)[a]		4.96	4.96	4.96
Avg. No. of Tropical Storms Occurring Monthly (Aug.-Nov.)		0.875	0.875	0.875
Avg. Per Trap Area of Impact One Non-Tropical Weather Events (m^2)[a]		1.815	1.815	1.815
Avg. No. of Non-Tropical Weather Events Occurring Monthly (Oct.-Apr.)[a]		2.57	2.57	2.57
Area of ASH (m^2)[b]		83,712,586	54,579,251	45,989,091
Percentage of Traps Landing on ASH[c]	*A. cervicornis*	15	15	15
	A. palmata	4	4	4
Colonial Density (no./m^2)[d]	*A. cervicornis*	0.0078	0.0013	0.0394
	A. palmata	0.0094	0.0008	0.0297
Total No. of *Acropora* colonies in ASH	*A. cervicornis*	652,958	70,953	1,811,970
	A. palmata	136,452	112,870	31,372
Avg. Size (Surface Area) of Each Colony (m^2)[d]	*A. cervicornis*	0.021	0.014	0.0186
	A. palmata	0.122	0.101	0.148

[a]Lewis et al. (in review); [b]NMFS unpublished data; [c]Matthews 2003; [d]Derived from Miller et al. 2007

Table A3.4 Impacts of Storm-Mobilized, Buoyed Traps on *Acropora cervicornis*

Upper Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of All Federal Effort by Region	0.015	0.213	0.124	--
No. Traps Used in Federal Waters by Region	79.47	1,036.96	363.77	1,480.19
No. of Traps Used Landing on ASH	11.92	155.54	54.56	222.03
No. of Traps on ASH Mobilized by Tropical Weather Events	3.75	48.94	17.17	69.86
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	16.28	212.39	74.51	303.17
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	3.45	45.05	15.80	64.30
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	31.09	405.62	142.29	579.00
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	4.72	61.56	21.60	87.87
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	22.01	287.15	100.73	409.89
Area of ASH Impacted Annually by Mobilized Traps (m^2)	69.37	905.16	317.53	1,292.06
No. *A. cervicornis* Colonies Impacted	0.541	7.060	2.477	10.078
Area of *A. cervicornis* Impacted by Mobilized Traps (m^2)	**0.011**	**0.148**	**0.052**	**0.21**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.4 Continued

Middle Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	62.17	67.17	42.70	--
No. Traps Used in Federal Waters by Region	334,071.67	326,787.88	125,093.35	785,952.90
No. of Traps Used Landing on ASH	50,110.75	49,018.18	18,764.00	117,892.94
No. of Traps on ASH Mobilized by Tropical Weather Events	15,765.97	15,422.22	5,903.58	37,091.77
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	68,424.30	66,932.44	25,621.52	160,978.26
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	14,512.23	14,195.82	5,434.11	34,142.17
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	130,676.12	127,826.98	48,931.76	307,434.85
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	19,832.55	19,400.14	7,426.31	46,659.00
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	92,509.93	90,492.93	34,640.40	217,643.25
Area of ASH Impacted Annually by Mobilized Traps (m^2)	291,610.34	285,252.34	109,193.68	686,056.37
No. *A. cervicornis* Colonies Impacted	379.09	370.83	141.95	891.87
Area of *A. cervicornis* Impacted by Mobilized Traps (m^2)	**5.31**	**5.19**	**1.99**	**12.49**

Lower Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[e]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[f]	18.10	16.31	10.09	--
% of Federal Effort by Region	37.81	32.61	57.18	--
No. Traps Used in Federal Waters by Region	203,177.14	158,650.24	167,533.95	529,361.33
No. of Traps Used Landing on ASH	30,476.57	23,797.54	25,130.09	79,404.20
No. of Traps on ASH Mobilized by Tropical Weather Events	9,588.61	7,487.24	7,906.49	24,982.34
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	41,614.58	32,494.62	34,314.17	108,423.37
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	8,826.11	6,891.84	7,277.75	22,995.71
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	79,475.16	62,057.93	65,532.90	207,066.00
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	12,061.85	9,418.45	9,945.85	31,426.15
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	56,263.08	43,932.85	46,392.90	146,588.84
Area of ASH Impacted Annually by Mobilized Traps (m^2)	177,352.83	138,485.40	146,239.97	462,078.21
No. *A. cervicornis* Colonies Impacted	6,987.70	5,456.32	5,761.85	18,205.88
Area of *A. cervicornis* Impacted by Mobilized Traps (m^2)	**129.97**	**101.49**	**107.17**	**338.63**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.4 Continued

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Traps Used Landing on ASH	80,599.24	72,971.26	43,948.66	197,519.16
No. of Traps on ASH Mobilized by Tropical Weather Events	25,358.33	22,958.40	13,827.24	62,143.97
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	110,055.16	99,639.45	60,010.20	269,704.81
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	23,341.80	21,132.71	12,727.67	57,202.17
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	210,182.37	190,290.53	114,606.95	515,079.84
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	31,899.11	28,880.16	17,393.75	78,173.02
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	148,795.02	134,712.93	81,134.03	364,641.98
Area of ASH Impacted Annually by Mobilized Traps (m^2)	469,032.54	424,642.90	255,751.18	1,149,426.63
No. *A. cervicornis* Colonies Impacted	7,367.34	5,834.21	5,906.28	19,107.83
Area of *A. cervicornis* Impacted by Mobilized Traps (m^2)	**135.29**	**106.83**	**109.21**	**351.33**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.5 Impacts of Storm-Mobilized Buoyed Traps on *Acropora palmata*

Upper Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	0.015	0.213	0.124	--
No. Traps Used in Federal Waters by Region	79.47	1,036.96	363.77	1,480.19
No. of Traps Used Landing on ASH	3.18	41.48	363.77	408.42
No. of Traps on ASH Mobilized by Tropical Weather Events	1.00	13.05	4.58	18.63
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	4.34	56.64	19.87	80.85
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	0.92	12.01	4.21	17.15
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	8.29	108.16	37.94	154.40
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	1.26	16.42	5.76	23.43
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	5.87	76.57	26.86	109.30
Area of ASH Impacted Annually by Mobilized Traps (m^2)	18.50	241.37	84.67	344.55
No. *A. palmata* Colonies Impacted	0.030	0.393	0.138	0.562
Area of *A. palmata* Impacted by Mobilized Traps (m^2)	**0.0006**	**0.0083**	**0.0029**	**0.0118**
Middle Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	62.17	67.17	42.70	--
No. Traps Used in Federal Waters by Region	334,071.67	326,787.88	125,093.35	785,952.90
No. of Traps Used Landing on ASH	13,362.87	49,018.18	18,764.00	81,145.05
No. of Traps on ASH Mobilized by Tropical Weather Events	4,204.26	4,112.59	1,574.29	9,891.14
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	18,246.48	17,848.65	6,832.41	42,927.54
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	3,869.93	3,785.55	1,449.10	9,104.58
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	34,846.96	34,087.19	13,048.47	81,982.63
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	5,288.68	5,173.37	1,980.35	12,442.40
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	24,669.31	24,131.45	9,237.44	58,038.20
Area of ASH Impacted Annually by Mobilized Traps (m^2)	77,762.76	76,067.29	29,118.31	182,948.36
No. *A. palmata* Colonies Impacted	160.81	157.31	60.22	378.34
Area of *A. palmata* Impacted by Mobilized Traps (m^2)	**2.25**	**2.20**	**0.84**	**5.30**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.5 Continued

Lower Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	37.81	32.61	57.18	--
No. Traps Used in Federal Waters by Region	203,177.14	158,650.24	167,533.95	529,361.33
No. of Traps Used Landing on ASH	8,127.09	23,797.54	6,701.36	38,625.98
No. of Traps on ASH Mobilized by Tropical Weather Events	2,556.96	1,996.60	2,108.40	6,661.96
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	11,097.22	8,665.23	9,150.45	28,912.90
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	2,353.63	1,837.82	1,940.73	6,132.19
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	21,193.38	16,548.78	17,475.44	55,217.60
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	3,216.49	2,511.59	2,652.23	8,380.31
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	15,003.49	11,715.43	12,371.44	39,090.36
Area of ASH Impacted Annually by Mobilized Traps (m^2)	47,294.09	36,929.44	38,997.33	123,220.85
No. *A. palmata* Colonies Impacted	32.63	25.48	26.91	85.02
Area of *A. palmata* Impacted by Mobilized Traps (m^2)	**0.61**	**0.47**	**0.50**	**1.58**
Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Traps Used Landing on ASH	21,493.13	72,857.20	25,829.13	120,179.45
No. of Traps on ASH Mobilized by Tropical Weather Events	6,762.22	6,122.24	3,687.26	16,571.72
Area of ASH Impacted by Traps Mobilized During Tropical Weather Events (m^2)	29,348.04	26,570.52	16,002.72	71,921.28
No. of Traps on ASH Affected by Tropical and Non-Tropical Weather Events	6,224.48	5,635.39	3,394.05	15,253.91
Area of ASH Impacted by Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	56,048.63	50,744.14	30,561.85	137,354.62
No. of Traps on ASH Mobilized by Non-Tropical Weather Events	8,506.43	7,701.37	4,638.33	20,846.14
Area of ASH Impacted by Traps Mobilized During Non-Tropical Weather Events (m^2)	39,678.67	35,923.45	21,635.74	97,237.86
Area of ASH Impacted Annually by Mobilized Traps (m^2)	125,075.34	113,238.11	68,200.32	306,513.77
No. *A. palmata* Colonies Impacted	193.48	183.18	87.26	463.92
Area of *A. palmata* Impacted by Mobilized Traps (m^2)	**2.86**	**2.68**	**1.35**	**6.89**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Quantifying Adverse Effects to *Acropora* from Storm-Mobilized, Derelict Spiny Lobster Traps Over the 2004-2005 Through 2006-2007 Fishing Seasons

Since we addressed the impacts of storm-mobilized, buoyed traps in the previous section, our analysis now moves to estimating the impacts of storm-mobilized, unbuoyed traps lost in the environment. A number of traps are lost annually due to storm events, accidental cut-offs, etc., where the buoy is lost and fishers can no longer use the trap. We refer to these unbuoyed lost traps as 'derelict'. Derelict traps can adversely affect *Acropora* when they are mobilized by storm events. Our analysis assumes that after two years a derelict trap will have degraded to a point where it no longer poses a threat to *Acropora* (T. Matthews, FFWCC, pers. comm. 2007). This analysis uses the same basic process described in the previous section. However, it describes the process for estimating the number of traps lost, the number of derelict traps remaining, and how we quantified the impacts of storm-mobilized derelict traps. Tables A3.7 through A3.9 provide the information used and results of the analyses for all fishing years.

Estimating the Derelict Spiny Lobster Trap Impacts to ASH in the Upper Keys During the 2006-2007 Fishing Season

We started by using the same steps listed above to estimate the number of traps fished in the federal waters of the region each month (see Table A3.1). To estimate the number of those traps that became derelict, we multiplied those figures by the 20 percent trap loss rate estimated from FFWCC commercial fisheries mail surveys (unpublished data). Next, we multiplied our estimates of derelict traps by the mean percentage of lost traps recovered annually (5.5 percent, [FDEP 2001]) through marine debris recovery programs. Because specific trap degradation rates are unknown, we assumed half of the unrecovered traps degraded to a point where they would not damage *Acropora*. Therefore, we reduced our estimates of unrecovered derelict traps by half.

We multiplied our estimate of the number of derelict traps remaining in the environment by percentage of all traps likely to end up on ASH (15 percent). This produced an estimate of the number of derelict traps that landed on ASH in the Upper Keys, each month during the 2006-2007 fishing season. These values were then substituted into the analysis above in place of the federally fished traps landing on ASH.

Since the impacts of trap mobilization from tropical weather events are thought to be so great, we believe it is reasonable to use the largest area of impact recorded by Lewis et al. (in review) (4.96 square meters) when calculating impacts from these events. However, when evaluating the storm-mobilization impacts from non-tropical weather events we used the area of impact observed by Lewis et al. (in review) (0.75 square meters) for derelict traps. Table A3.6 summarizes these changes.

Table A3.6 Estimating Monthly and Annual Area of Impact from Storm-Mobilized Derelict Traps During the 2006-2007 Fishing Season

Month	No. Derelict Traps Remaining After Degradation	No. of Derelict Traps Landing on ASH	No. Tropical Storms (3.5/yr)	Individual Trap Area of Impact from Tropical Storms (m^2)	No. Non-Topical Storms (18/yr)	Individual Trap Area of Impact from Non-Tropical Storms (m^2)	Annual Area of Impact
Aug	5.53	0.83	0.875	4.96	0	0	3.60
Sep	5.29	0.79	0.875	4.96	0	0	3.44
Oct	5.08	0.76	0.875	4.96	2.57	0.75	4.78
Nov	4.87	0.73	0.875	4.96	2.57	0.75	4.58
Dec	4.42	0.66	0	0	2.57	0.75	1.28
Jan	3.79	0.57	0	0	2.57	0.75	1.10
Feb	3.07	0.46	0	0	2.57	0.75	0.89
Mar	2.33	0.35	0	0	2.57	0.75	0.67
Average	4.30	0.64	--	--	--	--	2.54
Total	34.38	5.16	--	--	--	--	20.33

Recalculating the area of ASH and number of *A. cervicornis* colonies impacted annually, we estimate 0.003 square meter of *A. cervicornis* was adversely impacted by mobilized, derelict traps off the Upper Keys after the 2006-2007 fishing season.

Adverse Effects to Acropora in the Remaining Regions During the 2004-2005 Through 2006-2007 Fishing Seasons

Throughout all regions of the Florida Keys, we estimate 6.03 square meters of *A. cervicornis* and 0.46 square meter of *A. palmata* were adversely affected by mobilized, derelict spiny lobster traps over these fishing seasons. Since the steps used to quantify the adverse effects to *Acropora* in the remaining regions of the Florida Keys are identical to the ones above, we do not provide a narrative of those calculations here. Table A3.7 summarizes the constants used in the analyses that remained the same across all fishing seasons. Tables A3.8 and A3.9 summarize the resulting calculations from each analysis.

Table A3.7 Constants Used in Storm-Mobilized, Derelict Trap Impact Analyses for Both Species

Parameter		Region		
		Upper Keys	Middle Keys	Lower Keys
Percentage of Trap Lost Annually[a]		20	20	20
Annual Average Percentage of Lost Trap Recovered[a]		5.5	5.5	5.5
Avg. Per Trap Area of Impact from Tropical System (m^2)[b]		4.96	4.96	4.96
Avg. No. of Tropical Storms Occurring Monthly (Aug.-Nov.)		0.875	0.875	0.875
Avg. Per Trap Area of Impact One Non-Tropical Weather Events (m^2)[b]		0.75	0.75	0.75
Avg. No. of Non-Tropical Weather Events Occurring Monthly (Oct.-Apr.)[b]		2.57	2.57	2.57
Area of ASH (m^2)[c]		83,712,586	54,579,251	45,989,091
Percentage of Traps Landing on ASH[d]	*A. cervicornis*	15	15	15
	A. palmata	4	4	4
Colonial Density (no./m^2)[e]	*A. cervicornis*	0.0078	0.0013	0.0394
	A. palmata	0.0094	0.0008	0.0297
Total No. of *Acropora* colonies in ASH	*A. cervicornis*	652,958	70,953	1,811,970
	A. palmata	136,452	112,870	31,372
Avg. Size (Surface Area) of Each Colony (m^2)[e]	*A. cervicornis*	0.021	0.014	0.0186
	A. palmata	0.122	0.101	0.148

[a]FDEP 2001; [b]Lewis et al. (in review); [c]NMFS unpublished data; [d]Matthews 2003; [e] Derived from Miller et al. 2007

Table A3.8 Impacts of Storm-Mobilized, Derelict Traps on *Acropora cervicornis*

Upper Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	0.015	0.213	0.124	--
No. Traps Used in Federal Waters by Region	79.47	1,036.96	363.77	1,480.19
No. of Derelict Traps in Federal Waters	15.89	207.39	72.75	296.04
No. of Derelict Traps in Federal Waters Recovered	0.87	11.41	4.00	16.28
No. of Derelict Traps in Federal Waters Remaining	15.02	195.98	68.75	279.76
No. of Derelict Traps in Federal Waters After Degradation	7.51	97.99	34.38	139.88
No. of Derelict Traps in Federal Waters Affecting ASH	1.13	14.70	5.16	20.98
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	0.35	4.62	1.62	6.60
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	1.54	20.07	7.04	28.65
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	0.33	4.26	1.49	6.08
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	2.04	26.68	9.36	38.08
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	0.45	5.82	2.04	8.30
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	0.86	13.94	3.93	18.73
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	4.44	60.69	20.33	85.46
No. *A. cervicornis* Colonies Impacted	0.035	0.473	0.159	0.667
Area of *A. cervicornis* Impacted by Mobilized Derelict Traps (m^2)	**0.001**	**0.010**	**0.003**	**0.014**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.8 Continued

Middle Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	62.17	67.17	42.70	--
No. Traps Used in Federal Waters by Region	334,071.67	326,787.88	125,093.35	785,952.90
No. of Derelict Traps in Federal Waters	66,814.33	65357.58	25,018.67	157,190.58
No. of Derelict Traps in Federal Waters Recovered	3,674.79	3,594.67	1,376.03	8,645.48
No. of Derelict Traps in Federal Waters Remaining	63,139.55	61,762.91	23,642.64	148,545.10
No. of Derelict Traps in Federal Waters After Degradation	31,569.77	30,881.45	11,821.32	74,272.55
No. of Derelict Traps in Federal Waters Affecting ASH	1,262.79	1,235.26	472.85	2,970.90
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	397.30	388.64	148.77	934.71
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	1,724.29	1,686.70	645.66	4,056.65
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	365.71	357.73	136.94	860.38
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	2,292.08	2,242.10	858.27	5,392.45
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	499.78	488.88	187.14	1,175.81
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	963.33	2,039.78	360.72	3,363.83
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	4,979.70	5,968.58	1,864.65	12,812.93
No. *A. cervicornis* Colonies Impacted	6.47	7.76	2.42	16.66
Area of *A. cervicornis* Impacted by Mobilized Derelict Traps (m^2)	**0.09**	**0.11**	**0.03**	**0.23**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.8 Continued

Lower Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	37.81	32.61	57.18	--
No. Traps Used in Federal Waters by Region	203,177.14	158,650.24	167,533.95	529,361.33
No. of Derelict Traps in Federal Waters	40,635.43	31,730.05	33,506.79	105,872.27
No. of Derelict Traps in Federal Waters Recovered	2,234.95	1,745.15	1,842.87	5,822.97
No. of Derelict Traps in Federal Waters Remaining	38,400.48	29,984.89	31,663.92	100,049.29
No. of Derelict Traps in Federal Waters After Degradation	19,200.24	14,992.45	15,831.96	50,024.65
No. of Derelict Traps in Federal Waters Affecting ASH	768.01	599.70	633.28	2,000.99
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	241.63	188.68	199.24	629.56
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	1,048.69	818.86	864.72	2,732.27
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	222.42	173.67	183.40	579.49
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	1,394.00	1,088.50	1,149.46	3,631.96
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	303.96	237.35	250.64	791.94
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	585.88	457.48	483.10	1,526.46
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	3,028.57	2,364.85	2,497.27	7,890.70
No. *A. cervicornis* Colonies Impacted	119.33	93.18	98.39	310.89
Area of *A. cervicornis* Impacted by Mobilized Derelict Traps (m^2)	**2.22**	**1.73**	**1.83**	**5.78**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.8 Continued

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	--	--	--	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Derelict Traps in Federal Waters	107,465.66	97,295.01	58,598.21	263,358.88
No. of Derelict Traps in Federal Waters Recovered	5,910.61	5,351.23	3,222.90	14,484.74
No. of Derelict Traps in Federal Waters Remaining	101,555.05	91,943.79	55,375.31	248,874.15
No. of Derelict Traps in Federal Waters After Degradation	50,777.52	45,971.89	27,687.66	124,437.07
No. of Derelict Traps in Federal Waters Affecting ASH	2,031.93	1,849.65	1,111.29	4,992.87
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	639.29	581.94	349.64	1,570.87
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	2,774.52	2,525.63	1,517.42	6,817.57
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	588.45	535.67	321.83	1,445.95
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	3,688.13	3,357.29	2,017.08	9,062.50
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	804.18	732.05	439.82	1,976.05
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	1,550.07	2,511.21	847.75	4,909.02
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	8,012.71	8,394.12	4,382.26	20,789.09
No. *A. cervicornis* Colonies Impacted	125.83	101.41	100.98	328.22
Area of *A. cervicornis* Impacted by Mobilized Derelict Traps (m^2)	**2.31**	**1.85**	**1.87**	**6.03**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.9 Impacts of Storm-Mobilized, Derelict Traps on *Acropora palmata*

Upper Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	0.015	0.213	0.124	--
No. Traps Used in Federal Waters by Region	79.47	1,036.96	363.77	1,480.19
No. of Derelict Traps in Federal Waters	15.89	207.39	72.75	296.04
No. of Derelict Traps in Federal Waters Recovered	0.87	11.41	4.00	16.28
No. of Derelict Traps in Federal Waters Remaining	15.02	195.98	68.75	279.76
No. of Derelict Traps in Federal Waters After Degradation	7.51	97.99	34.38	139.88
No. of Derelict Traps in Federal Waters Affecting ASH	0.30	3.92	1.38	5.60
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	0.09	1.23	0.43	1.76
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	0.41	5.35	1.88	7.64
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	0.09	1.14	0.40	1.62
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	0.55	7.11	2.50	10.16
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	0.12	1.55	0.54	2.21
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	0.23	3.72	1.05	5.00
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	1.18	16.18	5.42	22.79
No. *A. palmata* Colonies Impacted	0.002	0.025	0.009	0.036
Area of *A. palmata* Impacted by Mobilized Derelict Traps (m^2)	**0.00004**	**0.00052**	**0.00019**	**0.00075**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.9 Continued

Middle Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	62.17	67.17	42.70	--
No. Traps Used in Federal Waters by Region	334,071.67	326,787.88	125,093.35	785,952.90
No. of Derelict Traps in Federal Waters	66,814.33	65,357.58	25,018.67	157,190.58
No. of Derelict Traps in Federal Waters Recovered	3,674.79	3,594.67	1,376.03	8,645.48
No. of Derelict Traps in Federal Waters Remaining	63,139.55	61,762.91	23,642.64	148,545.10
No. of Derelict Traps in Federal Waters After Degradation	31,569.77	30,881.45	11,821.32	74,272.55
No. of Derelict Traps in Federal Waters Affecting ASH	1,262.79	1,235.26	472.85	2,970.90
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	397.30	388.64	148.77	934.71
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	1,724.29	1,686.70	645.66	4,056.65
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	365.71	357.73	136.94	860.38
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	2,292.08	2,242.10	858.27	5,392.45
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	499.78	488.88	187.14	1,175.81
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	963.33	2,039.78	360.72	3,363.83
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	4,979.70	5,968.58	1,864.65	12,812.93
No. *A. palmata* Colonies Impacted	10.30	11.71	3.86	25.86
Area of *A. palmata* Impacted by Mobilized Derelict Traps (m^2)	**0.14**	**0.16**	**0.05**	**0.36**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.9 Continued

Lower Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	37.81	32.61	57.18	--
No. Traps Used in Federal Waters by Region	203,177.14	158,650.24	167,533.95	529,361.33
No. of Derelict Traps in Federal Waters	40,635.43	31,730.05	33,506.79	105,872.27
No. of Derelict Traps in Federal Waters Recovered	2,234.95	1,745.15	1,842.87	5,822.97
No. of Derelict Traps in Federal Waters Remaining	38,400.48	29,984.89	31,663.92	100,049.29
No. of Derelict Traps in Federal Waters After Degradation	19,200.24	14,992.45	15,831.96	50,024.65
No. of Derelict Traps in Federal Waters Affecting ASH	768.01	599.70	633.28	2,000.99
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	241.63	188.68	199.24	629.56
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	1,048.69	818.86	864.72	2,732.27
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	222.42	173.67	183.40	579.49
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	1,394.00	1,088.50	1,149.46	3,631.96
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	303.96	237.35	250.64	791.94
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	585.88	457.48	483.10	1,526.46
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	3,028.57	2,364.85	2,497.27	7,890.70
No. *A. palmata* Colonies Impacted	2.09	1.53	1.72	5.34
Area of *A. palmata* Impacted by Mobilized Derelict Traps (m^2)	**0.04**	**0.03**	**0.03**	**0.10**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Table A3.9 Continued

Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[b]	18.10	16.31	10.09	--
% of Federal Effort by Region	--	--	--	--
No. Traps Used in Federal Waters by Region	537,328.28	486,475.07	292,991.07	1,316,794.42
No. of Derelict Traps in Federal Waters	107,465.66	97,295.01	58,598.21	263,358.88
No. of Derelict Traps in Federal Waters Recovered	5,910.61	5,351.23	3,222.90	14,484.74
No. of Derelict Traps in Federal Waters Remaining	101,555.05	91,943.79	55,375.31	248,874.15
No. of Derelict Traps in Federal Waters After Degradation	50,777.52	45,971.89	27,687.66	124,437.07
No. of Derelict Traps in Federal Waters Affecting ASH	2,031.10	1,838.88	1,107.51	4,977.48
No. of Derelict Traps on ASH Mobilized by Tropical Weather Events	639.03	578.55	348.45	1,566.03
Area of ASH Impacted by Derelict Traps Mobilized During Tropical Weather Events (m^2)	2,773.39	2,510.91	1,512.26	6,796.56
No. of Derelict Traps on ASH Affected by Tropical and Non-Tropical Weather Events	588.21	532.54	320.74	1,441.49
Area of ASH Impacted by Derelict Traps Mobilized During Tropical and Non-Tropical Weather Events (m^2)	3,686.63	3,337.72	2,010.22	9,034.57
No. of Derelict Traps on ASH Mobilized by Non-Tropical Weather Events	803.86	727.78	438.32	1,969.96
Area of ASH Impacted by Derelict Traps Mobilized During Non-Tropical Weather Events (m^2)	1,549.44	2,500.98	844.87	4,895.29
Area of ASH Impacted Annually by Mobilized Derelict Traps (m^2)	8,009.45	8,349.62	4,367.34	20,726.42
No. *A. palmata* Colonies Impacted	12.39	13.26	5.59	31.24
Area of *A. palmata* Impacted by Mobilized Derelict Traps (m^2)	**0.18**	**0.19**	**0.09**	**0.46**

[a] FFWCC 2007; [b] Derived from FFWCC, unpublished data

Appendix 4 Spiny Lobster Trap Effects on *Acropora* from Routine Fishing

Quantifying Adverse Impacts to *Acropora* from Routine Spiny Lobster Fishing Between 2004-2005 Through 2006-2007

The following illustrates in more detail the analysis conducted in section 5.5.2.4 on the impacts of routine spiny lobster fishing to *Acropora*. In this analysis, we quantify the impacts from traps being deployed during fishing (i.e., the impacts of traps being pulled off of or falling to the seafloor) or "trap pulls". Our analysis makes certain assumptions to overcome gaps in our knowledge. We use number of spiny lobster trap tags as a surrogate for the number spiny lobster traps. Since every spiny lobster trap must have a single trap tag, we assume that a spiny lobster tag translates to a single spiny lobster trap. To be conservative, we assume that all traps issued in the fishery will be used during the season. Additionally, because an individual trap can be pulled many times during a fishing season, our estimate of the number of traps pulled annually is greater than the number of individual traps issued. We also assume traps were set only in areas open to fishing; therefore, we used the average *Acropora* colonial density and size estimates calculated only for areas open to fishing.

To quantify the extent of adverse affects to *Acropora*, we conducted six different analyses, one for each species of *Acropora*, in each region of the Florida Keys (i.e., Upper, Middle, and Lower). As noted in Section 5.5.2.1, because of species distribution, we assume 4 percent of all federally fished traps will affect habitat supporting *A. palmata*, while we believe 15 percent of all federally fished traps will affect habitat supporting *A. cervicornis*. For consistency with the *Acropora* abundance and density data provided in Miller et al. (2007), our estimates of federal trap fishing effort have been segregated, to the greatest extent possible, to match the regions as they were defined in those reports. In the interest of brevity, only the narrative of the analysis conducted for *A. cervicornis* during the 2006-2007 fishing year in the Upper Keys appears below. The remaining analyses of routine fishing impacts use the same steps outlined below. Tables A4.2 through A4.4 provide the information used and results of the analyses for all fishing years.

Estimating the Spiny Lobster Trap Impacts to ASH in the Upper Keys During the 2006-2007 Fishing Season

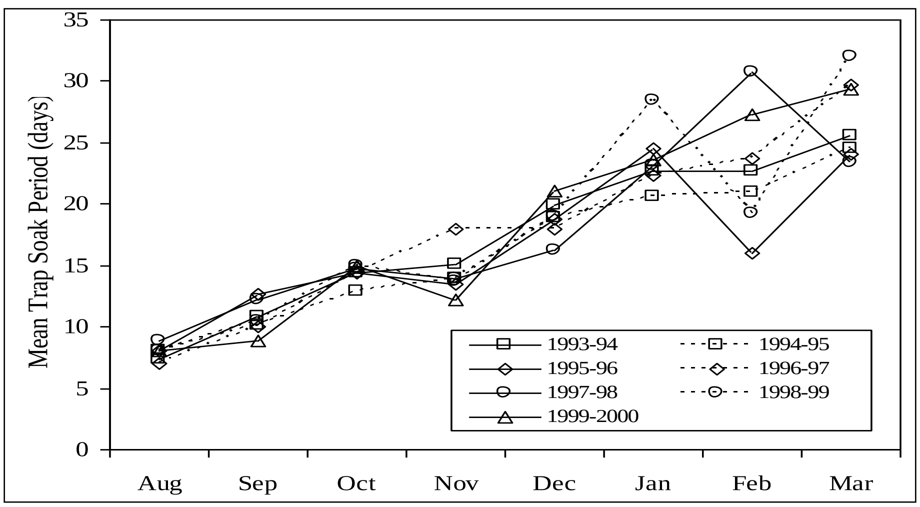
The FFWCC issued 466,686 spiny lobster tags for the 2006-2007 fishing season. By multiplying that figure by the percentage of traps used each month during the fishing season (see Table A4.1) and summing the results, we estimated the total number of traps used each month. Matthews (2001) also reported the average soak time for each trap, in days per month, during an average season (see Figure A4.1.). Dividing the number of days in each month by the average soak time for each month we estimated the number of times an individual trap was pulled each month. By multiplying the average number of times an individual trap was pulled each month, by the number of traps used each month, we calculated the number of trap pulls each month. Summing those monthly values provided an estimate of 6,434,135 individual trap pulls in the entire fishery during the 2006-2007 fishing season. Using FFWCC Trip Ticket information, we estimated that 10.09 percent of all traps fished during the 2006-2007 fishing season were used in federal waters. Using that same database, we estimated 0.12 percent of all federally-fished traps were used in the Upper Keys. By multiplying the total number of trap pulls (6,434,135) by the percentage of trap pulls occurring in federal waters (10.09 percent), we estimated 649,204 trap pulls occurred in federal waters. Multiplying that figure by the percent of all federally-fished traps used in the Upper Keys (0.12 percent), we estimated 779.41 trap pulls occurred in the region during the season.

We estimated 116.91 pulled traps landed on ASH during the fishing season by multiplying our estimate of the number of traps pulled (779.41) by the percentage of traps that land on ASH (15 percent; Matthews [2003]). Since the footprint of each trap is approximately 0.49 square meter, the area of ASH impacted by those traps was 57.29 square meters.

Table A4.1 Percentage of Traps Used Each Month by Fishing Season
Source: Matthews 2001

	1993/94	1994/95	1995/96	1996/97	1997/98	1999/2000	Average by Month
August	100.00	100.00	100.00	100.00	100.00	100.00	100.00
September	97.63	98.18	94.73	96.80	89.34	97.36	95.67
October	96.69	95.83	92.75	96.33	87.52	82.56	91.95
November	90.00	91.11	89.47	92.70	90.35	75.35	88.16
December	80.08	85.04	82.40	84.48	79.18	68.62	79.97
January	68.14	74.09	71.33	71.48	67.50	58.57	68.52
February	58.67	62.06	59.75	55.29	51.25	46.12	55.52
March	45.12	47.79	47.78	42.94	35.90	33.25	42.13
Average by Yr	79.54	81.76	79.78	80.00	75.13	70.23	77.74

Figure A4.1 Mean Soak Time for Spiny Lobster Traps by Month
Source: Matthews 2001



Quantifying Adverse Effects to Acropora cervicornis in the Upper Keys
We estimated an *A. cervicornis* density of 0.0094 colonies/square meter of ASH, in areas open to fishing in the Upper Keys, from Miller et al. (2007). By multiplying this estimate by the area of ASH in the Upper Keys impacted by routine fishing (57.29 square meters), we estimated 0.54 *A. cervicornis* colonies were affected during the 2006-2007 fishing season. By multiplying the number of colonies impacted (0.54) by the average area of each *A. cervicornis* colonies [0.0223 square meter; derived from Miller et al. (2007)], we estimated 0.012 square meter of *A. cervicornis* was adversely impacted by spiny lobster trap fishing in the Upper Keys, during the 2006-2007 fishing season.

Adverse Effects to Acropora in the Remaining Regions During the 2004-2005 Through 2006-2007 Fishing Seasons

Throughout all regions of the Florida Keys, we estimate 124.73 square meters of *A. cervicornis* and 0.062 square meter of *A. palmata* were adversely affected by routine spiny lobster fishing during the 2004-2005 through 2006-2007 fishing seasons. Table A4.2 summarizes the constants used in the analyses that remained the same across all fishing seasons. Tables A4.3 and A4.4 summarize the resulting calculations from each analysis.

Table A4.2 Constants Used in Routine Fishing Impact Analyses for Both Species

Parameter		Region: Upper Keys	Middle Keys	Lower Keys
Percentage of Traps Landing on ASH[a]	*A. cervicornis*	15	15	15
	A. palmata	4	4	4
Colonial Density (no./m^2)[b]	*A. cervicornis*	0.0094	0.0008	0.0297
	A. palmata	0.00031	0	0.00002
Avg. Size (Surface Area) of Each Colony (m^2)[b]	*A. cervicornis*	0.223	0.0054	0.0285
	A. palmata	0.1463	0	0.130
Total No. of *Acropora* colonies in ASH	*A. cervicornis*	786,898	43,663	1,365,876
	A. palmata	25,921	0	920
Spiny Lobster Trap Footprint (m^2)		0.49	0.49	0.49
Area of ASH (m^2)[c]		83,712,586	54,579,251	45,989,091

[a]Matthews 2003; [b] Derived from Miller et al. 2007;[c]NMFS unpublished data;

Table A4.3 Impacts of Routine Spiny Lobster Fishing on *Acropora cervicornis*

Upper Keys	Fishing Season: 2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Pulled During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
% of Federal Effort by Region	0.01	0.21	0.12	--
No. Traps Pulled in Federal Waters by Region	119.12	2,264.70	779.41	3,163.23
No. of Individual Traps Used Landing on ASH	17.87	339.71	116.91	474.48
Area of ASH impacted by traps (m^2)	8.76	166.46	57.29	232.50
No. *A. cervicornis* Colonies Impacted	0.08	1.56	0.54	2.19
Total Area of *A. cervicornis* Adversely Impacted (m^2)	**0.0018**	**0.0349**	**0.0120**	**0.0487**

Middle Keys	Fishing Season: 2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions[d]	18.10	16.31	10.09	--
% of Federal Effort by Region	62.17	67.17	42.69	--
No. Traps Pulled in Federal Waters by Region	740,544.93	724,380.56	277,275.42	1,742,200.91
No. of Individual Traps Used Landing on ASH	111,081.74	108,657.08	41,591.31	261,330.14
Area of ASH impacted by traps (m^2)	54,430.05	53,241.97	20,379.74	128,051.77
No. *A. cervicornis* Colonies Impacted	43.54	42.59	16.30	102.44
Total Area of *A. cervicornis* Adversely Impacted (m^2)	**0.24**	**0.23**	**0.09**	**0.55**

[a] FFWCC 2007

Table A4.3 Continued

Lower Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
% of Federal Effort by Region	37.81	32.61	57.18	--
No. Traps Pulled in Federal Waters by Region	450,378.06	351,675.60	371,389.29	1,173,442.94
No. of Individual Traps Used Landing on ASH	67,556.71	52,751.34	55,708.39	176,016.44
Area of ASH impacted by traps (m^2)	33,102.79	25,848.16	27,297.11	86,248.06
No. *A. cervicornis* Colonies Impacted	983.15	767.69	810.72	2,561.57
Total Area of *A. cervicornis* Adversely Impacted (m^2)	**28.02**	**21.88**	**23.11**	**73.00**
Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
No. Traps Pulled in Federal Waters by Region	1,191,042.10	1,078,320.85	649,444.12	2,918,807.07
No. of Individual Traps Used Landing on ASH	178,656.32	161,748.13	97,416.62	437,821.06
Area of ASH impacted by traps (m^2)	87,541.59	79,256.58	47,734.14	166,798.18
No. *A. cervicornis* Colonies Impacted	1,026.78	811.85	827.57	2,666.19
Total Area of *A. cervicornis* Adversely Impacted (m^2)	**28.26**	**23.37**	**73.10**	**124.73**

[a] FFWCC 2007

Table A4.4 Impacts of Routine Spiny Lobster Fishing on *Acropora. palmata*

Upper Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
% of Federal Effort by Region	0.01	0.21	0.12	--
No. Traps Pulled in Federal Waters by Region	119.12	2,264.70	779.41	3,163.23
No. of Individual Traps Used Landing on ASH	4.76	90.59	31.18	126.53
Area of ASH impacted by traps (m^2)	2.33	44.39	15.28	62.00
No. *A. palmata* Colonies Impacted	0.001	0.014	0.005	0.02
Total Area of *A. palmata* Adversely Impacted (m^2)	**0.0001**	**0.0020**	**0.0007**	**0.0028**
Middle Keys*				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
% of Federal Effort by Region	62.17	67.17	42.69	--
No. Traps Pulled in Federal Waters by Region	740,544.93	724,380.56	277,275.42	1,742,200.91
No. of Individual Traps Used Landing on ASH	29,621.80	28,975.22	11,091.02	69,688.04
Area of ASH impacted by traps (m^2)	14,514.68	14,197.86	5,434.60	34,147.14
No. *A. palmata* Colonies Impacted	0.00	0.00	0.00	0.00
Total Area of *A. palmata* Adversely Impacted (m^2)	**0.00**	**0.00**	**0.00**	**0.00**

[a] FFWCC, unpublished data

*Note: No *A. palmata* was found in the Middle Keys in areas open to fishing.

Table A4.4 Continued

Lower Keys				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
% of Federal Effort by Region	37.81	32.61	57.18	--
No. Traps Pulled in Federal Waters by Region	450,378.06	351,675.60	371,389.29	1,173,442.94
No. of Individual Traps Used Landing on ASH	18,015.12	14,067.02	14,855.57	46,937.72
Area of ASH impacted by traps (m^2)	8,827.41	6,892.84	7,279.23	22,999.48
No. *A. palmata* Colonies Impacted	0.18	0.14	0.15	0.46
Total Area of *A. palmata* Adversely Impacted (m^2)	**0.02**	**0.02**	**0.02**	**0.06**
Total for All Regions				
	Fishing Season			
	2004-2005	2005-2006	2006-2007	2004-2005 through 2006-2007
Total Traps Issued[a]	477,227	479,536	466,686	1,423,449
Total Traps Used During Season	6,579,462	6,611,296	6,434,135	19,624,892
% of All (State & Federal) Traps Pulled in Federal Waters for All Regions	18.10	16.31	10.09	--
No. Traps Pulled in Federal Waters by Region	1,191,042.10	1,078,320.85	649,444.12	2,918,807.07
No. of Individual Traps Used Landing on ASH	47,641.68	43,132.83	25,977.76	116,752.28
Area of ASH impacted by traps (m^2)	23,344.43	21,135.09	12,729.10	44,479.51
No. *A. palmata* Colonies Impacted	0.18	0.15	0.15	0.48
Total Area of *A. palmata* Adversely Impacted (m^2)	**0.023**	**0.020**	**0.020**	**0.062**

[a] FFWCC 2007