7/5/01

GENERIC AMENDMENT ADDRESSING THE ESTABLISHMENT OF THE TORTUGAS MARINE RESERVES IN THE FOLLOWING FISHERY MANAGEMENT PLANS OF THE GULF OF MEXICO:

- COASTAL MIGRATORY PELAGICS FISHERY MANAGEMENT PLAN (Amendment 13)
- CORAL AND CORAL REEFS FISHERY MANAGEMENT PLAN (Amendment 4)
- RED DRUM FISHERY MANAGEMENT PLAN (Amendment 4)
- REEF FISH FISHERY MANAGEMENT PLAN (Amendment 19)
- SHRIMP FISHERY MANAGEMENT PLAN (Amendment 12)
- SPINY LOBSTER FISHERY MANAGEMENT PLAN (Amendment 7)
- STONE CRAB FISHERY MANAGEMENT PLAN (Amendment 8)

(INCLUDES AN IRFA, RIR, AND A FSEIS)

(EFH AMENDMENT 2)

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TABLE OF CONTENTS

1.0 LIST OF TABLES AND FIGURES

TABLES:

FIGURES:

APPENDICES: (15.1 Gulf of Mexico FMP Area Closures)

2.0 ABBREVIATIONS USED IN THIS DOCUMENT

ABC	Acceptable Biological Catch
AP	Advisory Panel
BCA	Benefit-Cost Analysis
BRD	Bycatch Reduction Device
CL	Carapace Length
Council	Gulf of Mexico Fishery Management Council
CPUE	Catch Per Unit Effort
DOC	Department of Commerce
DRTO	Dry Tortugas National Park
DSEIS	Draft Supplemental Environmental Impact Statement
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FKNMS	Florida Keys National Marine Sanctuary
FL	Fork Length
FMP	Fishery Management Plan
FSEIS	Final Supplemental Environmental Impact Statement
GIS	Geographic Information System
HAPC	Habitat Area of Particular Concern
HMS	Highly Migratory Species
IRFA	Initial Regulatory Flexibility Analysis
ITQ	Individual Transferable Quota
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPS	National Park Service
OY	Optimum Yield
RA	Regional Administrator
RFA	Regulatory Flexibility Act
RFSAP	Reef Fish Stock Assessment Panel
RIR	Regulatory Impact Review
SAFMC	South Atlantic Fishery Management Council
SAV	Submerged Aquatic Vegetation
SIA	Social Impact Assessment
SMZ	Special Management Zone
SPR	Spawning Potential Ratio
SSC	Scientific and Statistical Committee
TAC	Total Allowable Catch
TERSA	Tortugas Ecological Reserve Study Area
TL	Total Length
WG	Working Group (Tortugas 2000)

3.0 INTRODUCTION

This amendment addresses the establishment of marine reserves in the vicinity of the Dry Tortugas, Florida. The Florida Keys National Marine Sanctuary (FKNMS), in accordance with its management plan, developed proposed boundaries for an ecological reserve based on the significant marine resources on Tortugas Bank, Riley's Hump, and adjacent areas. The purpose of this amendment is to establish fishery regulations under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) within portions of the proposed ecological reserve that reside in Federal waters. These regulations will then be adopted as Sanctuary regulations, as outlined in the Protocol for Cooperative Fisheries Management of the FKNMS Final Management Plan (NOAA 1996).

4.0 HISTORY OF MANAGEMENT

The following history includes only those management measures that pertain to the status of stocks found within the Tortugas Ecological Reserve Study Area (TERSA), essential fish habitat (EFH), marine reserves, or other related issues.

4.1 Management Activities Other Than Regulatory Amendments

The Stone Crab Fishery Management Plan (FMP) was implemented in September 1979 to establish a permanent seasonal closure off Florida Bay to shrimp trawling each year from January 1 through May 20 (**Appendix 15.1, Figure 4**). This measure, which was negotiated between the shrimp and stone crab industries, replaced a temporary closure established by the U.S. Coast Guard and NMFS to resolve an armed conflict over fishing areas for gear used in each fishery. The FMP also extended the Florida rules for the stone crab fishery into the exclusive economic zone (EEZ).

The Shrimp FMP was implemented in May 1981. The primary objective of the plan was to enhance yield in volume and value by deferring harvest of small shrimp to provide for growth. Principle actions included: 1) establishing a cooperative Tortugas Shrimp Sanctuary with the state of Florida to close a shrimp trawling area where small pink shrimp comprise the majority of the population most of the time (**Appendix 15.1, Figure 2**); and 2) a cooperative 45 to 60-day seasonal closure with the state of Texas to protect small brown shrimp emigrating from bay nursery areas (**Appendix 15.1, Figure 4**).

Amendment 1 to the Shrimp FMP was implemented in 1981. The amendment provided the Regional Administrator of NMFS with the authority (after conferring with the Council) to adjust by regulatory amendment the size of the Tortugas Sanctuary or the extent of the Texas closure, or to eliminate either closure for one year.

The FMP for Spiny Lobster in the Gulf of Mexico and South Atlantic was implemented on July 2, 1982 (47 FR 29203). The 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 management measures: specified minimum size limit and closed season; required degradable panels; prohibited the use of spears or hooks; limited attractants to 200 per vessel; required attractants to be held in shaded box; required trap number and color code be displayed; created a special recreational 2-day season before the commercial season; prohibited possession of egg-bearing lobster; and required reporting of landings.

Amendment 1 to the Stone Crab FMP was implemented on November 8, 1982 (47 FR 41757), and specified a procedure for modifying the zoned area to resolve the gear conflict.

The Fishery Management Plan for Coastal Migratory Pelagic Resources in the Gulf of Mexico and South Atlantic (FMP) and Environmental Assessment (EA), approved in 1982 and implemented by regulations effective in February of 1983, treated king and Spanish mackerel each as one U.S. stock. Allocations were established for recreational and commercial fisheries, and the commercial allocation was divided between net and hook-and-line fishermen.

The Coral and Coral Reef FMP, implemented in 1984, described the coral communities throughout the jurisdictions of the Gulf of Mexico (Council) and South Atlantic Fishery Management Councils (SAFMC). The FMP prohibited harvest of stony coral and seafans (*Gorgonia flabellum* and *Gorgonia ventalina*) except by scientific permit. It established Habitat Areas of Particular Concern (HAPC) in the Gulf and South Atlantic where the use of any fishing gear interfacing with the bottom (i.e., bottom trawls, traps, pots, and bottom longlines) was prohibited (**Appendix 15.1, Figure 8**). It also regulated the use of chemicals used by fish collectors near coral reefs.

Amendment 2 to the Stone Crab FMP, implemented in August 1984, established permanent and seasonally variable zones for shrimping or stone crab fishing to resolve a gear conflict (**Appendix 15.1, Figure 6**). These zones can be modified through a framework procedure.

The Reef Fish FMP was implemented in November 1984. The regulations, designed to rebuild declining reef fish stocks, included: (1) prohibitions on the use of fish traps, roller trawls or "rock hopper" trawls, and powerhead-equipped spear guns within an inshore stressed area (**Appendix 15.1, Figure 9**); and (2) prohibitions on the harvest of reef fish with poisons and explosives.

Amendment 1 to the Coastal Migratory Pelagics FMP and its Environmental Impact Statement (EIS), implemented in September of 1985, provided a framework procedure for pre-season adjustment of total allowable catch (TAC), revised king mackerel maximum sustainable yield (MSY) downward, recognized separate Atlantic and Gulf migratory groups of king mackerel, and established fishing permits and bag limits for king mackerel. Commercial allocations among gear users were eliminated. The Gulf commercial allocation for king mackerel was divided into eastern and western zones for the purpose of regional allocation.

Amendment 3 to the Stone Crab FMP was implemented on September 25, 1985 (51 FR 30663), and included management measures to enhance survival of crabs held on board vessels and prohibited harvest of egg-bearing female crabs.

Amendment 2 to the Coastal Migratory Pelagics FMP with EA, implemented in July of 1987, revised Spanish mackerel MSY downward, recognized two migratory groups, and set commercial quotas and bag limits. Charterboat permits were required, and it was clarified that TAC for overfished stocks must be set below the upper range of acceptable biological catch (ABC). The use of purse seines on overfished stocks was prohibited.

Amendment 1 to the Spiny Lobster FMP was implemented on July 15, 1987 (52 FR 22659) with certain rules deferred and implemented on May 16, 1988 (53 FR 17196) and on July 30, 1990 (55 FR 26448). This amendment updated the FMP rules to be more compatible with that of Florida (State). The management measures included: limiting attractants to 100 per vessel, requiring live wells, requiring a commercial vessel permit, provided for a recreational permit, limited recreational possession to 6 lobsters, modified the special 2-day recreational season before commercial season, modified the duration of the closed commercial season, provided a 10-day trap retrieval period, prohibited possession of egg-bearing spiny lobster, specified the minimum size limit for tails, provided for a tail separation permit, and prohibited possession of egg-bearing slipper lobster.

Amendment 2 to the Spiny Lobster FMP was approved on October 27, 1989 (54 FR 48059) and provided a regulatory amendment procedure for instituting future compatible State and federal rules without amending the FMP.

Amendment 1 to the Reef Fish FMP, implemented in 1990, established longline/buoy gear prohibited areas in the eastern Gulf at the 20-fathom contour and in the central-western Gulf at the 50-fathom contour (**Appendix 15.1, Figure 7**). The prohibited area in the central-western Gulf essentially eliminated the directed fishery on the very large red snapper (spawners) which tended to be very sparsely distributed over the bottom, and therefore not easily harvested with other gear.

Amendment 3 to the Coastal Migratory Pelagics FMP with EA, was partially approved in 1989, revised, resubmitted, and approved in 1990. It prohibited drift gill nets for coastal pelagics and purse seines for the overfished groups of mackerels.

Amendment 5 to the Coastal Migratory Pelagics FMP with EA, implemented in August 1990, made a number of changes in the management regime which: revised the definition of "overfishing"; added cobia to the annual stock assessment procedure; provided that the SAFMC will be responsible for pre-season adjustments of TACs and bag limits for the Atlantic migratory groups of mackerels while the Council will be responsible for Gulf migratory groups; redefined recreational bag limits as daily limits; deleted a provision that

specified that bag limit catches of mackerel may be sold; provided guidelines for corporate commercial vessel permits; specified that Gulf group king mackerel may be taken only by hook-and-line and run-around gill nets; imposed a bag limit of two cobia per person per day for all fishermen; established a minimum size of 12-inch (30.5 cm.) fork length (FL) or 14-inch (35.6 cm.) total length (TL) for king mackerel and included a definition of "conflict" to provide guidance to the Secretary.

Amendment 2 to the Reef Fish FMP, implemented in 1990, prohibited the harvest of jewfish to provide complete protection for this species in federal waters in response to indications that the population abundance throughout its range was greatly depressed. This amendment was initially implemented by emergency rule.

Amendment 1 to the Coral and Coral Reefs FMP, implemented in 1991, further defined the management unit to include octocorals, defined the Optimum Yield (OY) for coral reefs, stony corals, sea fans (*Gorgonia flabellum* and *Gorgonia ventalina*), and octocorals, defined overfishing, and established a permit system and reporting requirements for the collection of octocorals.

Amendment 4 to the Reef Fish FMP implemented in May 1982, established a moratorium on the issuance of new reef fish permits for a maximum period of three years. The moratorium was created to moderate short term future increases in fishing effort and to attempt to stabilize fishing mortality while the Council considers a more comprehensive effort limitation program. It allows the transfer of permits between vessels owned by the permittee or between vessels owned by the permittee or between individuals when the permitted vessel is transferred. Amendment 4 also changed the time of the year that TAC is specified from April to August and included additional species in the reef fish management unit.

Amendment 6 to the Shrimp FMP, implemented in 1993, eliminated the annual reports and reviews of the Tortugas Shrimp Sanctuary in favor of monitoring and an annual stock assessment. Three seasonally opened areas within the sanctuary continued to open seasonally, without need for annual action (**Appendix 15.1, Figure 2**). A proposed definition of overfishing of white shrimp was rejected by the National Marine Fisheries Service (NMFS) as not being based on the best available data.

Amendment 5 to the Reef Fish FMP, implemented in February 1994, established restrictions on the use of fish traps in the Gulf of Mexico EEZ, implemented a three-year moratorium on the use of fish traps by creating a fish trap endorsement and issuing the endorsement only to fishermen who had submitted logbook records of reef fish landings from fish traps between January 1, 1991 and November 19, 1992, required that all finfish except for oceanic migratory species be landed with head and fins attached and closed the region of Riley's Hump (near Dry Tortugas, Florida) to all fishing during May and June to protect mutton snapper spawning aggregations (Figure 1).

Amendment 7 to the Coastal Migratory Pelagic FMP, implemented in September 1994, equally divided the Gulf commercial allocation in the Eastern Zone and the Dade-Monroe County line in Florida. The suballocation for the area from Monroe County through Western Florida is equally divided between commercial hook-and-line and net gear users.

Amendment 2 to the Coral and Coral Reefs FMP, implemented in July 1994, established area closures, vessel trip limits, gear restrictions, permits for live rock harvest and aquaculture, restricted access, a phase-out of harvest by 1997, and a redefinition of octocorals.

Amendment 3 to the Coral and Coral Reefs FMP, implemented in 1995, was prepared to provide additional management to the harvest of live rock in the Gulf of Mexico. Live rock is an assemblage of living marine organisms attached to a hard substrate such as dead coral or limestone. This amendment provided further live rock regulation including an annual quota during phase-out, revision of trip limits, closed area off Florida's Panhandle, redefinition of allowable octocorals, and limited personal use of live rock harvest.

Amendment 5 to the Stone Crab FMP was implemented in April 1995 and placed a three-year moratorium on registration of stone crab vessels by the Regional Administrator (RA) of the NMFS. This was done for the period, April 15, 1995 - June 30, 1998, because the Florida Legislature proposed a state moratorium on issuance of permits while the industry considered development of a limited access system. Amendment 5 also included a protocol and procedure (framework measure) under which the RA could approve for implementation in the EEZ certain types of rules proposed by the state of Florida after review by the Advisory Panel (AP), Scientific and Statistical Committee (SSC), and the Council. Amendment 5 also updated the description of the fishery habitat and the factors affecting this habitat.

Amendment 14 to the Reef Fish FMP, implemented in March and April 1997, provided for a ten-year phase-out for the fish trap fishery; allowed transfer of fish trap endorsements for the first two years and thereafter only upon death or disability of the endorsement holder, to another vessel owned by the same entity, or to any of the 56 individuals who were fishing traps after November 19, 1992 and were excluded by the moratorium; and prohibited the use of fish traps west of Cape San Blas, Florida. The amendment also provided the RA of NMFS with authority to reopen a fishery prematurely closed before the allocation was reached and modified the provisions for transfer of commercial reef fish vessel permits.

Amendment 8 to the Coastal Migratory Pelagic FMP, implemented in March 1998, made the following changes to the management regime: clarified ambiguity about allowable gear specifications for the Gulf group king mackerel fishery by allowing only hook-and-line and run-around gill nets. However, catch by permitted, multi-species vessels and bycatch allowances for purse seines were maintained; established the Council's intent to evaluate the impacts of permanent jurisdictional boundaries between the GMFMC and SAFMC and separate FMPs for coastal pelagics in these areas; established a moratorium on commercial king mackerel permits until no later than October 15, 2000, with a qualification date for

initial participation of October 16, 1995; increased the income requirement for a king or Spanish mackerel permit to 25 percent of earned income or $10,000 from commercial sale of catch or charter or head boat fishing in 1 of the 3 previous calendar years, but allowed for a 1-year grace period to qualify under permits that are transferred; legalized retention of up to 5 cut-off (barracuda damaged) king mackerel on vessels with commercial trip limits; set an OY target at 30 percent static spawning potential ratio (SPR); provided the SAFMC with authority to set vessel trip limits, closed seasons or areas, and gear restrictions for Gulf group king mackerel in the North Area of the Eastern Zone (Dade/Monroe to Volusia/Flagler County lines); established various data consideration and reporting requirements under the Framework Procedure; and modified the seasonal framework adjustment measures and specifications.

Amendment 15 to the Reef Fish FMP implemented in 1998 prohibits harvest of reef fish from traps other than permitted reef fish traps, stone crab traps, or spiny lobster traps; permanently increases the vermilion snapper size limit from 8 inches to 10 inches total length; removes black sea bass, rock sea bass, bank sea bass, and all species of grunts and porgies from the Reef Fish FMP; closes the commercial greater amberjack fishery Gulfwide during the months of March, April, and May; and removes sand perch from the recreational 20-reef fish aggregate bag limit.

Amendment 16A to the Reef Fish FMP was submitted to NMFS in June 1998 and had been partially approved and was implemented in 1999. The approved measures provide: (1) that the possession o reef fish exhibiting the condition of trap rash on board any vessel with a reef fish permit that is fishing spiny lobster or stone crab traps is prima facie evidence of illegal trap use and is prohibited except for vessels possessing a valid fish trap endorsement; (2) that NMFS establish a system design, implementation schedule, and protocol to require implementation of a vessel monitoring system (VMS) for vessels engaged in the fish trap fishery, with the cost of the vessel equipment, installation, and maintenance to be paid or arranged by the owners as appropriate; and, (3) that fish trap vessels submit trip initiation and trip termination reports. Prior to implementing this additional reporting requirement, there will be a one-month fish trap inspection/compliance/education period, at a time determined by the NMFS Regional Administrator and published in the Federal Register. During this window of opportunity, fish trap fishermen will be required to have an appointment with NMFS enforcement for the purpose of having their trap gear, permits, and vessels available for inspection. The disapproved measured pertains to the prohibition to fish traps south of 25.05 degrees north latitude beginning February 7, 2001. The status quo 10-year phase-out of fish traps in areas in the Gulf EEZ is maintained.

Amendment 16B to the Reef Fish FMP was implemented in 1999. It (1) sets a slot limit of 14 to 22 inches FL for banded rudderfish and lesser amberjack for both the commercial and recreational fisheries; (2) removes queen triggerfish from the Reef Fish FMP; (3) removes the distinction between reef fish species in the management unit and those in the fishery but

not in the management unit, with the intent that sand perch and dwarf sand perch will not be included in the aggregate reef fish bag limit; (4) adopts a 12-inch TL minimum size limit for cubera snapper, dog snapper, mahogany snapper, schoolmaster, gray triggerfish, and hogfish and 16-inch TL minimum size limit for mutton snapper and scamp; (5) adopts a recreational bag limit of 5 hogfish per person for the entire Gulf EEZ; and , (6) sets a recreational bag limit of 1 speckled hind and 1 warsaw grouper per vessel, with the prohibition on the sale of these species when caught under the bag limit.

The Generic Amendment for Addressing Essential Fish Habitat Requirements (Essential Fish Habitat Amendment 1) was submitted to NMFS in October 1998 and was partially approved in March 1999. Essential Fish Habitat Amendment 1 was developed to meet the EFH requirements of the Magnuson-Stevens Act to identify and describe EFH for managed species in the Gulf of Mexico. Threats to EFH and conservation recommendations are also included in the amendment.

Amendment 10 to the Coastal Migratory Pelagics FMP (joint FMP) incorporated EFH provisions for the SAFMC. This amendment was implemented in July 2000.

4.2 Regulatory Amendments

A November 1992 regulatory amendment to the Spiny Lobster FMP adopted Florida's spiny lobster trap certificate, trap reduction, and trap identification programs and prohibited the development of a trawl fishery for spiny lobster.

An August 1999 regulatory amendment to the Reef Fish FMP increased the commercial size limit for gag from 20 to 24 inches TL and the recreational size limit for gag from 20 to 22 inches TL with a 1-inch increase in size each year thereafter until it reaches 24 inches TL. It prohibited commercial sale of gag, black, and red groupers each year from February 15 to March 15 (during the peak of gag spawning season). It also established 2 marine reserves on gag spawning aggregation sites that will be closed year-round to all fishing. The 2 sites cover 219 square nautical miles near the 40-fathom contour, off west central Florida (**Appendix 15.1, Figure 8**).

5.0 PROBLEM REQUIRING A PLAN AMENDMENT

In 1999, there were 4 Gulf of Mexico reef fish species classified as overfished and 1 species classified as approaching an overfished condition; the status of 58 other species is unknown. Several other managed species are also considered to be overfished or fully exploited. Throughout the Florida Keys, including the Tortugas region, there appears to be a serious overfishing problem (See Section 11.5.4). Using two statistically independent data sources on reef fish -- fishery-independent diver observations and fishery-dependent charter fishing catches -- Ault et al. (1998) documented that 13 of 16 groupers (*Epinephilinae*), 7 of 13 snappers (*Lutjanidae*), one wrasse (*Labridae*), and 2 of 5 grunts (*Haemulidae*) are below the 30% SPR overfishing minimum. Some stocks appear to have been chronically overfished

since the late 1970s. According to those authors, the Florida Keys reef fishery exhibits classic “serial overfishing” in which the largest, most desirable, and vulnerable species are depleted by fishing.

Conventional fisheries management has focused on limiting effort in order to ensure sustainable fisheries. However, problems arise from difficulties in setting safe harvest levels, inadequate monitoring, and effort control. Furthermore, if limiting effort succeeds in enhancing a stock, any increased entry of fishermen into the fishery can diminish potential benefits. When the number of vessels or participants is limited, improvements in fishing technology that can increase catch efficiency tend to negate any conservation benefits.

Measures intended to decrease fishing efficiency often can be circumvented by fishermen. For example, trip limits are ineffective if the number of trips is increased. Possession limits become ineffective if fishermen "high grade," or discard smaller fish when larger fish are subsequently caught. Size limits often leads to increases in undersized discards, unless capture of smaller individuals can be avoided. As a result of these limitations, the concept of creating areas permanently closed to fishing -- "no-take marine reserves" -- is gaining momentum (Roberts 1997; Bohnsack 1993). In some cases, protecting areas from fishing could be more effective and less obtrusive than other management approaches.

Marine reserves also have the potential to prevent damage to EFH. All fishing activities have an effect on the marine environment, and therefore the associated habitat. Impacts range from the extraction of a species which skews community composition and diversity to reduction of habitat complexity through direct physical impacts of fishing gear (Barnette 1999). Impacts on EFH have been documented for various gear such as trawls, traps, and bottom longlines (Table 1). Furthermore, damage from anchoring related to both recreational and commercial fishing activities have the potential to degrade EFH (e.g., coral reefs and hardbottom communities). Therefore, marine reserves have the potential to effectively conserve EFH, whereas management alternatives such as gear-specific prohibitions may not adequately protect critical habitat. Tortugas South encompasses Riley's Hump which was characterized as the last known major spawning aggregation site for mutton snapper and definitely is critical habitat.

Table 1. Summary of Potential Direct Gear Impacts to Essential Fish Habitat in the Gulf of Mexico, South Atlantic, and Caribbean Developed During the December NOAA Fisheries EFH Workshop (High + + +, Medium + +, Low +, Negligible 0, Unknown ?).

	HABITAT TYPE							
GEAR TYPE	**MUD**	**SAND**	**SAV**	**RUBBLE**	**HARDBOTTOM**	**OTHER**		**REFERENCE[1]**
Otter trawl	+ +	+ +	+ +	+	+ +			Berkeley et al. 1985
Otter trawl w/ chain sweep	+ +	+ +	+ + +	+	+ + +			Sainsbury et al. 1997
Roller-rigged trawl	+ +	+ +		+	+ + +			Van Dolah et al. 1987
Trawl (unspecified)	+	+			+ + +			Van Dolah et al. 1991
Scallop dredge	+ +	+ +	+ +	+ + +	+ + +			Auster et al. 1996
Oyster dredge	+ +	+ +	+ + +	+ +		+ + +	oyster reef	Barnette 1999
Hydraulic dredge	+ + +	+ + +	+ + +	+ + +		?	oyster reef	Godcharles 1971
Handline; hook-and-line					+			Barnette 1999
Bottom longline	+	+			+			SAFMC 1991
Fish trap	?	?	+ +		+ +	+	algal plain	Quandt 1999
Crab trap	?	0	+					Eno et al. 1996
Lobster trap	?	0	+		+ +			Eno et al. 1996
Clam kicking	+ + +	+ + +	+ + +	+ + +				Peterson et al. 1987
Roller-frame trawl	+	0	0		+			Berkely et al. 1985
Rake	+ +	+ +	+ +	+ +		+ + +	oyster reef	Barnette 1999
Patent tongs	+ +	+ +	+ + +	+ +		+ + +	oyster reef	Barnette 1999
Midwater trawl						0	midwater	Auster et al. 1996
Bandit gear					+			Barnette 1999
Buoy gear					+			Barnette 1999
Trolling gear					+			CFMC 1999
Trot line	+	+	+					Barnette 1999
Cast net	+		+	+				De Sylva 1954
Haul seine	+	+	+			+ +	cumulative	Sadzinski et al. 1996
Hand/Beach seine			+			+		Barnette 1999
Push net			+					De Sylva 1954
Purse seine	+	+	?			0	midwater	Auster et al. 1992
Gill net	+	+	+	?	+			Carr 1988
Fyke net	+	+	+					Barnette 1999
Trammel net	+	+	+			0	estuarine	Barnette 1999
Pound net	0	0	0			0	estuarine	Barnette 1999
Butterfly net	0	0	0			0	estuarine	Barnette 1999
Skimmer	+	+	+					
Spear		0			+			GMFMC 1993

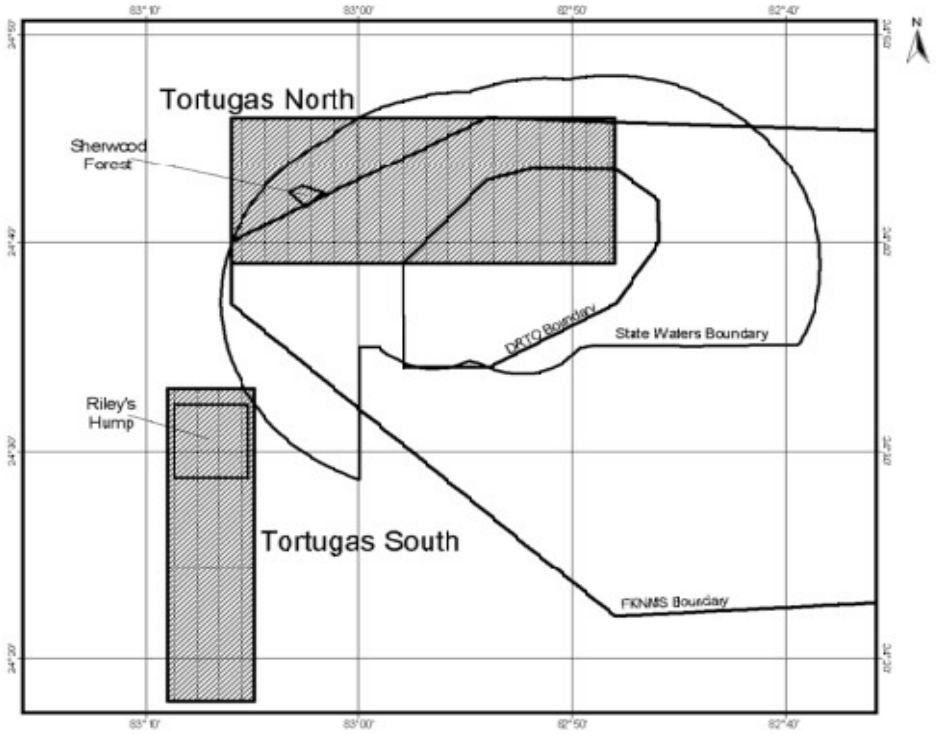
Powerhead		**0**			**0**	**0**	pelagic	Barnette 1999
Hand harvest		**0**		+	+ +			Barnette 1999
Snare		**0**			+			Barnette 1999
Slurp gun		**0**		**0** / +	**0** / +			Barnette 1999
Bully net	**0**	**0**	**0**		+			Barnette 1999
Hoop net	+	+	+		+			Barnette 1999
Harpoon						**0**	pelagic	Barnette 1999
Hand/Dip net					+			Barnette 1999
Allowable chemical					+			Japp and Wheaton 1975
Channel net	+	+	+					
Barrier net	**?**	**?**	**?**	**?**	+			Barnette 1999
PROHIBITED GEAR								
Explosives	+ + +	+ + +	+ + +	+ + +	+ + +			Alcala and Gomez 1987
Cyanide/Bleach					+ + +			Barber and Pratt 1998

[1]For further references, consult the Annotated Bibliography on Fishing Impacts to Habitat (Rester 2000).

Establishing an ecological reserve in the Tortugas region has been planned by the FKNMS since 1991. The consideration of temporal and geographic zoning to ensure protection of FKNMS resources is mandated under Section 7 (a) (2) of the Florida Keys National Marine Sanctuary and Protection Act. An administrative record has been established for taking this action and is documented in the Draft and Final EIS/Management Plans for the Sanctuary (Department of Commerce [DOC] 1995 and 1996). The Final Management Plan for the FKNMS establishes a mandate for creating the Sanctuary's second ecological reserve.

The FKNMS established the Tortugas 2000 Working Group (WG) in 1998 in order to develop designation criteria and eventually select a preferred alternative for an ecological reserve in the Tortugas region. The WG consisted of individuals who each represented a particular user group that may be impacted by the ecological reserve. The WG included recreational fishermen, commercial fishermen, recreational divers, charter boat fishermen, environmental groups, academics, tropical collectors, and managers. Criteria for designating the marine reserve, in order of importance, included: (1) biodiversity and habitat; (2) fisheries sustainability; (3) enforcement and compliance; (4) sufficient size; (5) socioeconomic impacts; and (6) use as a reference and monitoring area. Based on these criteria, the preferred alternative (Figure 1) was selected by consensus on May 22, 1999.

Figure 1. Jurisdictional and proposed marine reserve (Tortugas North and Tortugas South) boundaries.



Ms. Penny Dalton, NOAA Assistant Administrator for Fisheries and Dr. Jeffrey Benoit, Director of Office of Ocean and Coastal Resources, National Ocean Service (NOS), in their letter of November 10, 1999 (Appendix 15.3), asked the Council to proceed with development of a FMP amendment to implement the [Tortugas 2000] ecological reserve and to prepare regulations prohibiting fishing within the proposed reserve. In the process of adopting the Council/NMFS regulations, the regulations of the FKNMS will be modified to include these areas as indicated in Dr. Benoit's letter of October 22, 1999 (Appendix 15.2), to the Council. In this letter, Dr. Benoit sets forth criteria that NOS asks the Council to address in the formal consultation process provided for under Section 304 of the National Marine Sanctuaries Act (NMSA).

6.0 PURPOSE AND NEED FOR ACTION

6.1 History of Marine Reserves

Since the early 1960s there have been initiatives for the creation of marine reserves under non-emergency situations. Knowing that marine resources would become increasingly exploited as population increased and fishing technology advanced, there have been numerous recommendations for the creation of marine reserves (Björklund 1974).

Some marine reserves have been established with the primary objective to protect older and larger fish. The benefits derived from this include the protection of critical spawning stock biomass, intra-specific genetic diversity, population age-structure, recruitment supply, and ecosystem balance while maintaining reef fish fisheries. It has been proposed that marine reserves are most effective in addressing the problem of recruitment overfishing, especially for sedentary species. Thus, they serve to maintain ecosystem balance and productivity.

Table 2: Reported effects of marine reserve protection on fish size (Roberts and Polunin 1991).

MARINE RESERVE	FINDINGS
Banyuls-Cerbere Marine Reserve, France (Bell 1983)	Overall modal size class for 18 species vulnerable to fishing larger in reserve than fished control site. Same pattern for two sparids studied separately: *Diplodus vulgaris* and *D. sargus*.
Sumilon Island Reserve, Phillippines (Ross 1985)	The average weight of individual serranids in reserve was 1.9 and 2.0 times greater than in two control sites.
Southern Great Barrier Reef, Australia (Ayling and Ayling 1986)	*Plectropomus leopardus* on average nearly 10 cm longer on unfished than fished reefs, 78% over 35 cm total length versus only 46% in fished areas.
Malindi Marine Reserve, Kenya (McClanahan and Muthiga 1988)	Mean size of all fishes combined substantially greater in lagoons of protected versus fished reefs.
Boult Reef, Australia (Beinssen 1989)	*Plectropomus leopardus* (Serranidae) on average around 13 cm longer on Boult Reef (after 3.5 years protection from fishing) than on nearby Fitzroy Reef.
Tsitsikamma Coast National Park, South Africa (Buxton and Smale 1989)	Mean size of *Petrus rupestris* (Sparidae) in reserve 43.7 cm total length versus 23.4 cm in control area ($p<0.05$). No significant differences for two other sparids studied.

No-take marine reserves are believed to have been important in maintaining the high abundance of many species of reef fish in certain protected areas worldwide (Alcalá and Russ 1990; Roberts and Polunin 1991; Russ 1985). Ballantine (1991, 1995) reviewed the ecological, biological, social, scientific, and economic factors relevant to marine reserves. Roberts and Polunin (1991) reviewed the information available from marine reserves around the world. Tables 2 and 3, from Roberts and Polunin (1991), summarize the reported effects of marine reserves on fish size and abundance. Davis (1989) also summarized information on refugia and refers to specific cases of success. One successful example is in the Philippines where after five years the mean harvest per fisher, per day, had tripled, making production in adjacent areas extremely high. However, after 10 years the reserve was ransacked and in 2 years yields declined by 50%.

Table 3: Reported effects of marine reserve protection on fish abundance (Roberts and Polunin 1991; "Where statistical tests have been performed the significance levels are shown: * p<0.05; ** p<0.01; *** p<0.001; NS not significant.")

MARINE RESERVE	FINDINGS
Banyuls-Cerbere Marine Reserve, France (Bell 1983)	Overall density of 18 fished species over 2 times greater inside than outside reserve ***. Two sparids studied in detail showed the same pattern: *Diplodus vulgaris*** and *D. sargus** both 2.3-2.6 times more common in reserve.
Sumilon Island Reserve, Phillippines (Russ 1985)	Overall abundance of fish greater in reserve than two control sites*. Serranid densities 3* and 25* times greater in reserve; biomass 6* and 31* times greater.
Southern Great Barrier Reef, Australia (Ayling and Ayling 1986)	Overall density of *Plectropomus leopardus* (Serranidae) 16% greater on unfished than fished reefs (NS). Densities of individuals >35 cm long nearly 2 times greater on unfished reefs*.
Kenyan parks and reserves (Samoylis 1988)	No significant difference in overall, or commercial, fish abundance between three protection levels. Significantly greater serranid biomass in reserves than in unprotected areas *** or parks*.
Apo Island Reserve, Phillippines (Alcala 1988)	Mean overall fish density 1.4 times higher inside reserve than in control areas*.
Tsitsikamma Coast National Park, South Africa (Buxton and Smale 1989)	Two sparids, *Petrus rupestris* and *Chrysoblephus laticeps*, respectively 13* and 14** times more abundant in reserve than in control area. No difference for third species of sparid.
Looe Key Reef, Florida (Clark et al. 1989)	Lutjanid abundance increased 93% and haemulid by 439% following 2 years protection from spearfishing. All 15 spearfishing target species censused increase in density**.
3 reserves, Phillippines (White, quoted in Clark et. at. 1989)	Total fish abundance increased by 173%, 89% and 45% respectively in Apo, Pamilican and Balicasag reserves over a 1 year period of protection. Lutjanid abundances increased by 47%, 213%, and 2850%, respectively.
Sumilon Island Reserve, Phillippines (Russ and Alcala 1989)	Following collapse of protection, mean densities of fishes decreased by: 94% for lutjanids and lethrinids**, 60% for caesionids*, 55% for pomacentrids*, 60% for carangids and scombrids (NS), 45% for serranids (NS) and 79% for chaetodontids*. Densities of scarids and labrids increased by 182%** and 217%** respectively..
Malindi Marine Reserve, Kenya (McClanahan and Shafir 1990)	Total fish densities 3.6 times higher*** in the reserve lagoon than lagoons of unprotected reefs.

6.2 Marine Reserve Examples

Cape Canaveral, Florida

In 1962, approximately 22% of the waters of the Merritt Island National Wildlife Refuge was closed to public access due to security concerns at the nearby Kennedy Space Center. Johnson et al. (1999) sampled areas closed and open to fishing from November 1986 to January 1990. The results indicated that the no-fishing areas had significantly greater abundance and larger specimens than fished areas. Relative abundance (based on catch per unit effort) in no-fishing areas was 2.6 times greater than in the fished areas for total game fish, 2.4 times greater for spotted seatrout, *Cynoscion nebulosus*, 6.3 times greater for red drum, *Sciaenops ocellatus*, 12.8 times greater for black drum, *Pogonias cromis*, 5.3 times

greater for common snook, *Centropomus undecimalis*, and 2.6 times greater for striped mullet, *Mugil cephalus*. Median and maximum size of red drum, spotted seatrout, black drum, and striped mullet were also significantly greater in the unfished areas.

Saba, Netherland Antilles

Part of the reserve established in Saba has been closed to fishing since 1987 and the remainder is only subjected to light fishing pressure. Estimates in 1991 and 1993 indicate biomass to have increased in both the unfished areas (5 out of 6 target species) as well as in the fished areas (Roberts and Polunin 1993). Overall biomass of commercially important species increased by 60% and the average size of fish also increased. However, fishing pressure decreased during those years due to changes in the employment sector on the island.

Barbados

Rakitin and Kramer (1996) reported that reserves do indeed protect fish stock and that there is emigration of fish from these reserves. They showed that the mean size of fish was larger in the reserve for 18 of 24 species, that the abundance of larger fish was higher in the reserve, and that trap catches were high in the reserve and reserve boundaries, decreasing with distance from the protected area.

Belize

The Hol Chan Marine Reserve has been a no-take marine reserve since 1987. It is a small reserve (2.6 km^2) which Roberts and Polunin (1994) reported a standing stock of 340 g/m^2 in the center of the reserve and 77 g/m^2 in the periphery. This value on the periphery of the reserve is two times higher than that reported for adjacent fished areas. The larger size of commercially important fish in the reserve is expected to be significant to the replenishment process in the area since larger fish are typically more fecund.

New Zealand

Ballantine (1991) reviewed the experience in New Zealand with all types of marine reserves and concluded that even when not all species respond rapidly to protection, no-take marine reserves are the most successful. The response of the species depends on life history traits such as growth rates, reproductive output, migration patterns, etc. Marine reserves are most successful when they are established in areas where they are easily monitored and therefore protected. Results indicate that the boundaries of marine reserves are leaky, allowing users to have access to marine resources escaping the reserve; simultaneously, the resource will be protected for a longer period of time than if the reserves were not established. MacDiarmi and Breen (1992) reported that between 1978 and 1992 the density and mean size of spiny lobster (*Jasus edwardsii*) increased two years after the establishment of a marine reserve from Cape Rodney to Okakari Point. Populations of spiny lobster, especially of female lobster, increased in the reserve compared to 5 sites where commercial fishing was allowed. Although they do not dismiss the possibility that the increase in abundance could have occurred naturally, it was noted that the increase was threefold between 1978 and 1983 and

twofold between 1983 and 1990.

Not all the of the studies noted positive results. Cole et al. (1990) could not show significant differences in abundance of fish and invertebrates between sites sampled inside and outside of a reserve off Goat Island.

6.3 Purpose and Need

The Council had previously held Gulf-wide scoping meetings on the establishment of marine reserves and had developed a scoping document that summarized the potential benefits and problems associated with reserves. The Council had previously established two marine reserves off west central Florida (See Section 4.2). The Council also participated in the Tortugas 2000 WG that evaluated the TERSA to determine the locations for marine reserves that had a low to moderate impact on the users, while including nearly pristine habitat and/or critical EFH.

The Council felt there was a need to evaluate the benefits that might accrue from marine reserves and, therefore, endorsed the recommendations of the WG for the sites. The Tortugas' South site encompassed the last known active spawning aggregation site for mutton snapper in the Gulf at Riley's Hump. By expanding the size and duration of the closure for this site it should increase its effectiveness as a spawning aggregation site since previously Riley's Hump was closed only two months of the mutton snapper spawning period of May to November. It should also similarly benefit other reef fish species, such as yellowtail snapper, and red and black grouper, which have different spawning periods, by providing an undisturbed spawning site.

The Gulf Council portion of Tortugas North (13 square nautical miles) serves primarily as a buffer area to prohibit fishing vessel incursions into the pristine Sherwood Forest coral complex (See Figure 1). This site is of very little to moderate importance to the user groups (See Figures 11-18).

However, both of these areas will provide the Council the opportunity to assess the potential benefits of marine reserves in a coral-complex area. In both this case, and for the two marine reserves established in areas that are and previously were spawning aggregations sites for gag grouper and scamp (See Section 4.2), the Council has set a time interval over which the reserves will be evaluated before the period is extended or the reserves made permanent.

7.0 PROPOSED ACTIONS

7.1 Marine Reserves Area

Proposed Alternative: establish a marine reserve in the portion of the proposed Tortugas North Ecological Reserve (Figure 1) that resides in the EEZ.

Proposed Alternative: establish a marine reserve in the EEZ with the same boundaries as the proposed Tortugas South Ecological Reserve (Figure 1).

7.2 Marine Reserves Duration

Proposed Alternative: establish the marine reserves for a period of at least 10 years, to be evaluated at the same intervals the state of Florida evaluates the FKNMS (i.e., every 5 years starting in 2002, 2007, etc.). During these periods, the future status of the marine reserves will be considered by the Council and the FKNMS.

7.3 Marine Reserve Allowable Activities

Proposed Alternative: prohibit fishing for any species in the marine reserves.

Proposed Alternative: prohibit all fishing vessels from anchoring in the marine reserves, except in emergencies.

8.0 MANAGEMENT ALTERNATIVES AND REGULATORY IMPACT REVIEW

8.1 Introduction

The NMFS requires a Regulatory Impact Review (RIR), which includes an analysis of the economic effects of the preferred and alternative actions affecting federally managed fisheries. One of the purposes of the RIR is to comply with the requirements of Executive Order (E.O.) 12866. The RIR does the following: (1) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problem; (2) it serves as the basis for determining whether any proposed regulations are a "significant regulatory action" under certain criteria provided in E.O. 12866; and, (3) it assists the Councils and NMFS in selecting the regulatory approach that maximizes net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

This RIR analyzes the probable impacts that the alternatives for establishing the marine reserves would have on commercial and recreational fishing participants of the various affected fisheries in the Gulf of Mexico. The main source of information for this RIR is Leeworthy and Wiley (2000a). The geographic information system (GIS) maps (Figures 11-

18) show the distributions of commercial catch and recreation activity in the Tortugas Ecological Reserve Study Area (TERSA). It is worth pointing out at this stage that the impacts that may result from this generic amendment pertains to the effects of alternatives that affect fishing activities in the EEZ portions of the TERSA under the jurisdiction of the Gulf of Mexico Fishery Management Council. These areas are the EEZ segment of the Tortugas North Ecological Reserve and the entire Tortugas South Ecological Reserve.

8.2 Analytical Framework

In a standard benefit-cost analysis (BCA), the benefits and costs are identified, and to the extent practical, the benefits and costs are quantified. Benefits and costs in the BCA framework are usually limited to consumer's surpluses and producer's surpluses or economic rents. The approach utilized here is broader than the BCA approach. Here the consumer's surplus and economic rents are identified and quantified, where possible. Generally, it was concluded that economic rents did not exist in either the recreation industry or in the commercial fisheries (Leeworthy and Wiley 2000a). Consumer's surplus and economic rents are generally referred to as non-market economic values and are the appropriate inputs in a BCA. However, BCA is usually focused on economic efficiency arguments where it is assumed that the economy is at full employment and labor and capital are completely mobile. In addition, equity issues are also usually ignored in the calculus of BCA. This socioeconomic impact analysis recognizes the limitations of BCA.

A great deal of focus is placed on the market economic impacts as measured by direct revenue, costs and profits of the business firms directly affected by the "no-take" regulations. These impacts are then translated into the secondary or multiplier impacts on the local economy. For the recreational industry, the impact area is defined as Monroe County, Florida, and for the commercial fisheries the impact areas are Monroe County and Lee/Collier counties. For the commercial fisheries, the results presented here are an aggregation of the impacts on both Monroe and Lee/Collier counties. The market economic impacts include estimates of output/sales, income and employment.

The approach begins by first analyzing the boundary alternatives, assuming that the areas are no-take (Alternative 7). Analyses are presented for the recreational industry (broken down into consumptive and nonconsumptive), the commercial fisheries, and then other benefits (nonusers, scientific, and education values). The next step will analyze other alternatives. Other alternatives include the prohibition on anchoring of fishing vessels and allowable fishing activities. For these alternatives, there are no additional or incremental impact over the no-take alternative.

The approach used here proceeds in two basic steps for the recreational industry and the commercial fisheries. First, the impacts are estimated under the assumption that all the activities displaced result in complete loss. This is done by simply adding up all the activities within the geographic area defined by a marine reserve boundary and applying the appropriate economic parameters. In the second step, a qualitative approach is used to assess

whether the results from step 1 are likely to occur. Here, mitigating factors and offsetting factors are taken into account and an assessment is made as to whether net benefits of costs exist in the short and longer terms. Over the long term, the marine reserve is expected to generate replenishment effects to the fisheries. In the commercial reef fisheries, there may be some short-term losses, however over the longer term, the expectation is that there will be long-term benefits even to commercial reef fishermen and related dependent businesses.

Results are presented in three sections. Section 8.4.1 addresses the recreational industry. Consumptive recreational activities are separated from non-consumptive recreational activities since consumptive recreational activities would be displaced from the no-take areas and may potentially be negatively impacted, while non-consumptive activities will be beneficiaries of the no-take areas. Section 8.4.2 addresses the commercial fisheries which will all be displaced from the no-take areas and thus potentially negatively impacted. Section 8.6.3 addresses other potential benefits of the no-take areas including non-use economic values, scientific values, and educational values.

Definition of the Study Areas

For purposes of this analysis, there are three major study areas. The first is a 1,020 square mile area called the TERSA (Figure 1). This was the area selected by the FKNMS for analyzing different alternatives for the proposed Tortugas Ecological Reserve. All socioeconomic information was collected and organized in the TERSA at a geographical resolution of one square mile. Detailed descriptions of the data are included in section 8.4.1 for the recreational industry and in section 8.4.2 for the commercial fisheries. The second study area is located within the TERSA, consisting of the proposed Tortugas North and Tortugas South reserves. The third area covers the EEZ waters of the Tortugas North and the entire Tortugas South reserves.

8.3 Objectives

This amendment fulfills two specific objectives of the Reef Fish FMP (1980):

(1) Rebuild the declining reef fish stocks wherever they occur in the fishery; and
(2) Conserve and increase habitat for reef fish to increase reef fish populations and provide protection for juveniles.

This amendment also addresses management objectives of the Coral and Coral Reefs FMP (1982):

(1) Minimize, as appropriate, adverse human impacts on coral and coral reefs; and
(2) Increase public awareness of the importance and sensitivity of coral and coral reefs.

Furthermore, this amendment is consistent with the Council's habitat policy, as set forth in

the Council's Statement of Organization Practices and Procedures, which states:

> Recognizing that all species are dependent on the quantity and quality of their essential habitats, it is the policy of the Gulf of Mexico Fishery Management Council to:
>
> Protect, restore and improve habitats upon which commercial and recreational marine fisheries depend, to increase their extent and to improve their productive capacity for the benefit of present and future generations. (For purposes of this policy, habitat is defined to include all those things physical, chemical and biological that are necessary to the productivity of the species being managed).

8.4 Description of the Fishery

The following describes the fishing practices and characteristics of fishing participants in the TERSA. As mentioned earlier, the TERSA is a broad area covering approximately 1,020 square miles, and it is part of a much broader area designated as FMRI Areas 2.0 and 2.9. Within the TERSA are the proposed North and South Tortugas reserves, with the entire South Tortugas reserve and the EEZ portion of the North Tortugas reserve being within the jurisdiction of the Gulf Council.

8.4.1 Recreational Fishery

The recreation data was collected through 16 person-to-person and telephone interviews taking place in December 1998 through April 1999. Data was collected from both active operators in the study area and other individuals who are knowledgeable about the area and the activities that take place therein. Of the 16 interviews that took place, 50 percent were in-person and 50 percent were by telephone; 75 percent were active operators in the area and 25 percent were other knowledgeable individuals. The source of the list of potential respondents came from the Dry Tortugas National Park (DRTO), List of Incidental Business Permittees list, and as a result of discussions with current operators and other persons with experience in the area. Fishing Clubs were also considered as a source of data. Only one was found in the region and in an interview with a representative of the club it was determined that private boat usage in the study area was minimal. In the course of interviewing the commercial operators, when asked if they saw other boats when in the Tortugas, they consistently said that they did not. This question did not include the area inside Dry Tortugas National Park. Some members of the clubs said they fished in the park, but not in the 1,020 nautical square mile area outside the National Park called the Tortugas Ecological Reserve Study Area (TERSA). We were not able to identify any private households that did any activity in the TERSA.

In total, contact was attempted with 23 potential respondents – seven of whom we failed to contact with repeated attempts. Because we do not have any knowledge that the remaining potential respondents operate in the study area, it is believed that the current sample is the population of recreation operators in the area (i.e. for practical purposes, a census).

The data collected include the following variables: person-days of activity, revenue, cost and profit by activity. Because many of the respondents only operate in the area sporadically or during certain times of the year, the data was also collected by month. As will be shown later in this report, having seasonal data will also enable more accurate impact estimates to be calculated. The data was collected in four categories of activity: non-consumptive diving, spearfishing, diving for lobsters, and fishing (hook-and-line) which represent all of the recreational activities that could potentially be impacted.

In the TERSA, the variety and extent of participation in recreation activities is has been limited. Although the region is a unique ecosystem with unrivaled opportunity for recreation, the investment in time and money to get there and the lack of options for lodging keep it from becoming a highly sought-after destination. Visitation to Dry Tortugas National Park (DRTO) is very large and has been increasing dramatically (over the past 14 years visitation at DRTO has quadrupled, rising from 18,000 visitors in 1984 to an estimated 72,000 visitors in 1998). However, a small proportion of these visitors takes side trips outside of the National Park to participate in recreation activities. The majority of visitors to the TERSA are on multi-day trips for which recreation outside of the National Park is their main reason for going and visits to the Dry Tortugas National Park are either side trips or are for the purpose of anchoring for the night.

To operate in the DRTO, an operator must have an Incidental Business Permit (IBP). Although there is no institutionalized method of tracking the number of people who operate outside of the park boundaries, it is very unlikely that a business will operate in the vicinity without having an IBP. There are several operators who provide services in the DRTO, which are not relevant to the TERSA. These services include air taxi services, ferry services and walking tours/bird-watching services. The remainder of the IBP holders were contacted in a survey of recreational use.

In general the most significant conclusion is that there are very few people who operate outside of the DRTO boundaries. All of the respondents presented a very consistent story when asked about other boat traffic they see in the areas in which they operate. All respondents said they almost never see a private (non-charter) recreation boat outside of the park boundary - for practical purposes, the number of private household boats operating in the study area is zero. When they do see other boats they are generally able to identify the boats as being one of the other respondents to this survey.

Tables 4 and 5 summarize the major fishing related activities in the TERSA. With regard to the activities that take place outside of the park boundary, only one activity (diving) is non-consumptive and it represents 4.98 percent of the person days of activity. The majority of person days in consumptive activities were in fishing with 77.89 percent followed by Diving for Lobsters (8.23 percent) and Spearfishing (8.90 percent).

Table 4. Activity Participation in the TERSA.

	PERSON-DAYS (NUMBER)	PERSON-DAYS (PERCENT)
Diving for lobsters	1,730	8.23%
Diving (non-consumptive)	1,048	4.98%
Fishing	16,377	77.89%
Spearfishing	1,872	8.90%

Table 5. Totals for Commercial Charter/Party Operations in the TERSA.

Number of operations	12
Total person-days	21,027
Total revenue	$ 1,413,739
Total cost	$ 1,013,719
Total profit	$ 400,020

8.4.2 Commercial Fishery

The commercial fishery in the TERSA is a multi-species fishery. Four species or species groups comprise the commercial fishery of the TERSA: 1) Lobster (primarily spiny but some Spanish), 2) Shrimp (primarily pink but some rock), 3) Reef Fish (includes all finfish other than pelagics), and 4) King Mackerel. Some pelagic species (e.g., sharks, tuna, swordfish) are also caught along the western edge of the TERSA by longliners, but this was found to be minimal.

NMFS compiles statistics on catch and ex vessel value by species and by county where the catch is landed. FMRI has a "trip ticket" system and a saltwater product license (SPL) requirement for the commercial fisheries. The trip ticket system records, for each SPL holder, catch by species, area where caught, and the county where landed. In 1997, over nine million pounds with an ex vessel value of over $23 million were commercially caught in FMRI areas 2.0 and 2.9. Shrimp accounted for almost 68 percent of the total ex vessel value. Invertebrates (primarily spiny lobster) accounted for 18.64 percent, reef fish 9.73 percent, and pelagics 3.71 percent of the total ex vessel value. Of all the species caught in FMRI areas 2.0 and 2.9, about 4.9 million pounds worth $13 million were landed in Monroe County and about 4.2 million pounds worth $10 million were landed in Lee, Pinellas, St. Lucie, and Sarasota Counties. For these other (than Monroe County) counties, Lee County accounted for approximately 85 percent of the landings and ex-vessel values in 1997.

FMRI areas 2.0 and 2.9 are much too large relative to the TERSA, so a specialized data collection project was undertaken. The approach combined catch and trip information from FMRI's trip ticket system with interviews of fishermen that hold an SPL and had

commercially fished in FMRI areas 2.0 and 2.9. The objective was to identify the population of SPL holders that commercially fished in the TERSA, estimate their total catch and revenue, and obtain socioeconomic profiles of the commercial fishermen currently operating in the TERSA.

Overall, 105 to 110 SPL holders were identified as making up the population of commercial fishing operations in the TERSA. This population includes an estimated 164 vessels and a total number of crew (including captain) of 270. Table 6 below shows the distribution of the number of operations, vessels, and crew by species of fish caught in the TERSA.

Table 6. Number of Commercial Fishing Operations, Vessels, and Captain/Crew in the TERSA.

	Number of Operations[1,2]	Number of Vessels	Number of Captain/Crew
Lobster	30 (28)	31 (29)	87 (81)
Shrimp	28 (18)	75 (65)	213 (193)
Reef Fish	46 (42)	48 (44)	112 (102)
King Mackerel	17 (16)	17 (16)	34 (32)
Shark[3]	1 (1)	1 (1)	3 (3)
Total[4]	**105-110 (90)**	**164 (155)**	**270 (241)**

[1]Number of saltwater product license (SPL) holders.
[2]Sample numbers in parentheses next to population estimates.
[3]Approximately 15-18 longliners fish the western edge of the TERSA targeting pelagic species such as sharks, tunas, and swordfish, but the catch was minimal.
[4]Totals are less than additions across species because of multi-species fisheries.

Table 7 below summarizes the landings and ex-vessel revenues from commercial operations in the TERSA. In 1997, total TERSA catch was over 2.3 million pounds worth almost $6.9 million in harvest revenue. Lobsters accounted for over 40 percent of catch by weight, but over 54.5 percent of catch by value. This was followed by shrimp which accounted for almost 31 percent of catch by weight and about 28 percent of catch by value. Reef Fish accounted for about 25 percent of catch by weight and about 17 percent by value. And, king mackerel accounted for a little over 4 percent of catch by weight and a little over one percent of catch by value.

Table 7. Total Harvests and Ex-Vessel Values of Commercial Catch in the TERSA.

Species/Species Group	Pounds[1]	Percent	$/lb.[2]	Revenue[3]	Percent
Lobster	937,952	40.35	4.15	3,892,501	54.55
Reef Fish	574,642	24.72	2.06	1,183,763	16.59
King Mackerel	96,346	4.14	0.95	91,529	1.28
Shrimp	715,500	30.78	2.75	1,967,625	27.58
Total	2,324,440	100.00	2.96	7,135,418	100.00

[1]From Sample of TERSA Fishermen extrapolated to population estimates.
[2]From National Marine Fisheries Service, Key West Office. Landings and Ex Vessel Value of Monroe County Landings, 1997. For shrimp, the price used is $2.75, which is a weighted (by landings proportion) average of prices in Monroe County ($2.40) and Lee County ($3.12).
[3]Revenue equals pounds times $/lb.

While catches in FMRI areas 2.0 and 2.9 were landed in 11 counties in Florida, TERSA catches were landed in only three counties, namely, Monroe, Collier, and Lee Counties. The proportions of TERSA catches landed in Monroe County were 100 percent for lobster, 77.89 for reef fish, 90.53 percent for king mackerel, and 51.42 percent for shrimp. Table 8 below allocates the revenues from TERSA catches among the three counties (with Collier and Lee Counties combined). Although Monroe County accounted for a slightly higher landings of shrimp, Lee/Collier Counties registered more revenues from shrimp because of higher price per pound.

Table 8. Ex-vessel Revenues from Commercial Catch in the TERSA, by Species and Counties.

County	Lobster	Reef Fish	King Mackerel	Shrimp	Total
Monroe	3,892,501	922,033	82,861	882,984	5,780,379
Lee/Collier	0	261,730	8,668	1,084,641	1,355,039
Total	3,892,501	1,183,763	91,529	1,967,625	7,135,418

Table 9 below summarizes the various socio-demographic characteristics of commercial fishermen operating in the TERSA as compared to other Keys fishermen. TERSA fishermen appear to be younger, but have more experience fishing in Monroe County than either fishermen from the entire Florida Keys or those from the Lower Keys. Almost 63 percent of the TERSA fishermen have over 20 years experience fishing in Monroe County compared to 29.5 percent for fishermen from the entire Florida Keys and 30.7 percent of fishermen from the Lower Keys. TERSA fishermen also have considerable experience fishing in the TERSA. Over 64 percent of TERSA fishermen have fished in the TERSA of over 10 years and 47.2 percent have fished there for over 20 years.

TERSA fishermen, as fishermen throughout the Florida Keys, are predominantly Anglo-Americans. About 77 percent of TERSA fishermen are Anglo-American, 21 percent Hispanic, and two percent African American. There are slightly more Hispanic and African American fishermen that fish the TERSA in comparison to fishermen throughout the Florida Keys, but there are no significant differences between TERSA fishermen and Lower Keys fishermen.

Monroe County Commercial Fishermen, Inc. (MCCF) was the most popular organization among all fishermen, and membership rates did not differ between TERSA fishermen and other fishermen in the Florida Keys. For all other organizations, TERSA fishermen had significantly lower membership rates than other Florida Keys fishermen.

Almost 88 percent of TERSA fishermen are full-time commercial fishermen compared to 59 percent of other fishermen in the Florida Keys. About 11 percent of TERSA fishermen are charter boat fishermen holding a SPL, but do not rely on selling fish as part of their income. However, the mates aboard these charter boats sell an estimated 10 percent of the catch to supplement their incomes. About one percent of TERSA fishermen are part time commercial fishermen.

On average, TERSA fishermen earn 89 percent of their income from commercial fishing compared to 61 percent for all Florida Keys fishermen and 62 percent for fishermen in the Lower Keys. About 85 percent of TERSA fishermen get 100 percent of their incomes from commercial fishing. In addition, TERSA fishermen, on average, derive about 45 percent of their income from the TERSA. About five percent derive 100 percent of their income from the TERSA.

TERSA fishermen appear to support larger families than either fishermen in the entire Keys or those in the Lower Keys. Over 51 percent of TERSA fishermen support families of three or more compared to 38 percent for the entire Keys and 41.5 percent for the Lower Keys. On average, TERSA fishermen support 2.87 family members, including themselves, or 1.87 additional family members. Given our population estimate of 270 captain and crew operating in the TERSA, and assuming they (on average) support similar family sizes, we estimate that around 775 people are to some extent dependent on the commercial fisheries of the TERSA. This estimate would exclude those that might be more indirectly dependent on the commercial fishery through multiplier impacts from spending associated with the TERSA commercial fishery.

Primary Hauling Port and Fish House Usage. Key West/Stock Island is the primary hauling port or place where TERSA fishermen land their catch (74.4 %). The Naples/Ft. Myers/Ft. Myers Beach areas rank second with 15.5 percent of TERSA fishermen. The Naples/Ft. Myers/Ft. Myers Beach areas are primarily shrimp operations. Other Florida Keys sites (e.g., Big Pine Key, Marathon, and Tavenier) account for the remaining 10 percent.

About 41 percent of TERSA fishermen were associated with 13 different fish houses. The two top fish houses were Stock Island Lobster Company and Sea Lobster each accounting for about 19 percent of the fishermen that are associated with fish houses. These two fish houses are located in Key West/Stock Island.

Table 9. Profile of TERSA Fishermen Compared to Other Keys Fishermen.

	1997-1998	1994-1995[1]	
	TORTUGAS (%)	**ALL KEYS (%)**	**LOWER KEYS (%)**
		AGE	
18-30	13.3	10.5	8.0
31-40	18.9	18.6	16.0
41-50	36.7	30.3	32.5
51-60	20.0	23.4	23.9
OVER 60	11.1	17.1	19.6
		YEARS OF FISHING IN MONROE	
LESS THAN 1 YEAR	1.1	0.0	0.0
1-5 YEARS	6.7	17.0	19.0
6-10 YEARS	12.4	22.5	16.6
11-20 YEARS	16.9	31.0	33.7
21 OR MORE YEARS	62.9	29.5	30.7
		YEARS OF FISHING IN TERSA	
1-5 YEARS	10.1	N/A	N/A
6-10 YEARS	25.8	N/A	N/A
11-20 YEARS	16.9	N/A	N/A
21 OR MORE YEARS	47.2	N/A	N/A
		RACE/ETHNICITY	
ANGLO-AMERICAN	76.7	80.1	74.8
HISPANIC	21.1	18.2	23.9
AFRICAN-AMERICAN	2.2	0.9	1.2
OTHER	0.0	0.9	0.0
		MEMBERSHIP IN ORGANIZATIONS	
CONCH COALITION	7.0	16.9	12.3
OFF	12.0	19.0	14.1
MCCF	38.0	24.2	26.4
ENVIRONMENTAL	2.0	6.9	5.5

	OCCUPATION		
FULL-TIME COMMERCIAL FISHING	87.8	10.5	8.0
PART-TIME COMMERCIAL FISHING	1.1	18.6	16.0
CHARTER BOAT (SELL SOME CATCH)	11.1	30.3	32.5
	INCOME		
PERCENT INCOME FROM FISHING	89.1	61.0	62.3

1.01	**84.9% of Tortugas fishermen are full-time commercial fishermen earning 100% of their income from fishing.**
1.02	**11% of Tortugas fishermen are Charter fishermen holding a SPL, but DO NOT rely on selling fish as a part of their primary income (mates do sell 10% of their catch).**
•	**4.7% of Tortugas fishermen earn 100% of their income from fishing in the TERSA.**
•	**On average, Tortugas fishermen earn 44.69% of their income from fishing in the TERSA.**

	FAMILY MEMBERS SUPPORTED		
1 (MYSELF)	19.3	80.1	74.8
2	28.9	18.2	23.9
3	22.9	0.9	1.2
4 OR MORE	28.9	0.9	0.0
	PRIMARY HAULING PORT		
KEY WEST/STOCK ISLAND	74.4	N/A	N/A
BIG PINE KEY	4.4	N/A	N/A
MARATHON	3.3	N/A	N/A
TAVERNIER	2.2	N/A	N/A
NAPLES/FT. MYERS	15.6	N/A	N/A
FISH HOUSE USAGE (% YES)	41.1	N/A	N/A

[i](Milon et al. 1996).
*Charter boat fishermen were not reported separately in Milon et al. 1997. They were included in part-time commercial fishermen.

8.5 Management Alternatives

The biological impacts of each of the management alternatives are presented in Section 11.7 (Environmental Consequences). The socioeconomic impacts of the alternatives are presented in Sections 8.6 (Socioeconomic Impact Analysis [SIA]), 11.8 (Socioeconomic Consequences), and 9.0 (Initial Regulatory Flexibility Analysis [IRFA]).

8.5.1 Marine Reserves Area

Proposed Alternatives:

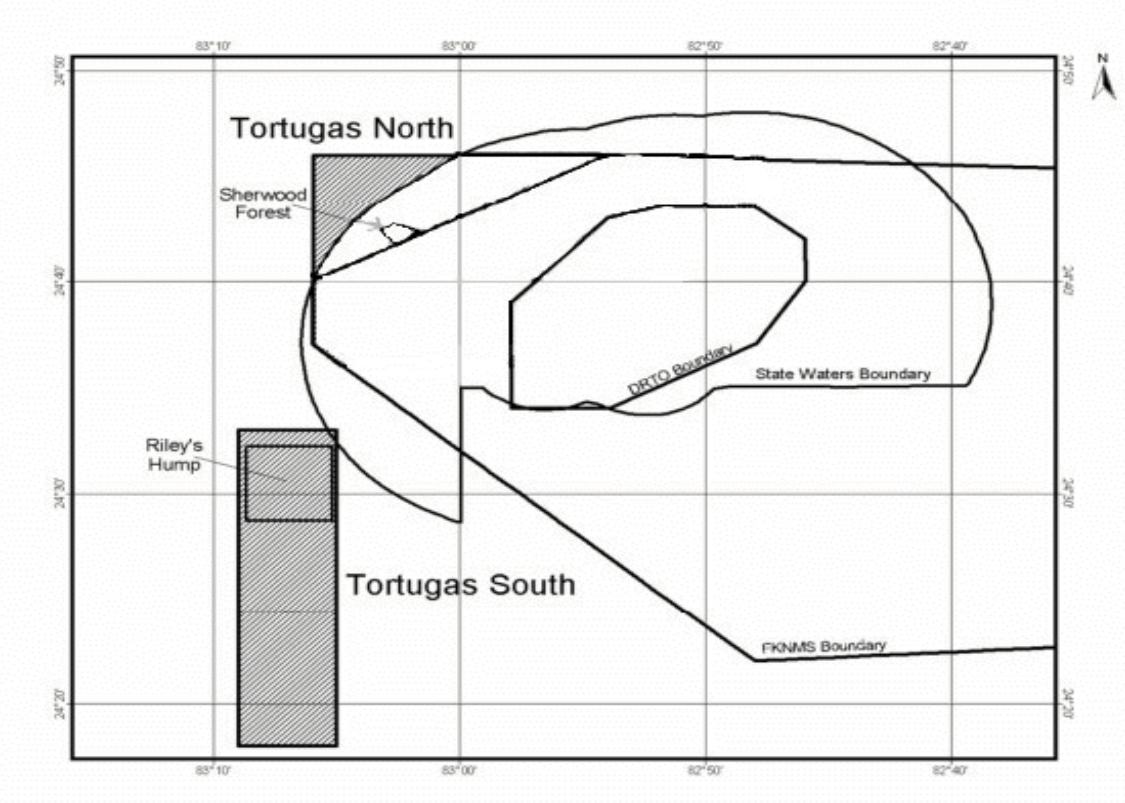
Alternative 1: Establish a marine reserve in the portion of the proposed Tortugas North ecological reserve (Figure 2) that resides in the EEZ.

Discussion: As proposed by the FKNMS, Tortugas North (Figure 1) is approximately 126 square nautical miles (126 nm²) and would include areas within the fisheries jurisdiction of the Dry Tortugas National Park (DRTO), the FKNMS, the state of Florida, and the Council. The area in the EEZ is approximately 13 square nautical miles (13 nm²) and is bounded by latitude 24° 46' on the north and longitude 83° 06' on the west, and is contiguous with state jurisdiction on the east and south. Tortugas North includes portions of Tortugas Bank and adjacent shallow and deepwater habitat areas. Sherwood Forest is an important deepwater coral habitat area just inside state waters. It is conceivable that other, as yet, undocumented coral and livebottom habitat areas exist within the EEZ portion of Tortugas North.

Alternative 2: Establish a marine reserve in the EEZ with the same boundaries as the proposed Tortugas South (Figure 2) ecological reserve.

Discussion: As proposed by the FKNMS, Tortugas South (Figure 1) is approximately 60 square nautical miles (60 nm²) and would include the Riley's Hump mutton snapper aggregation site established by the Council in 1994 (Amendment 5 to the Reef Fish FMP). The mutton snapper aggregation site is approximately 11 square nautical miles (11 nm²) and closed to all fishing each May and June. This option would provide protection to diverse habitat areas adjacent to Riley's Hump, including deepwater habitat areas that may further benefit mutton snapper (*Lutjanus analis*), tilefish, snowy grouper (*Epinephelus niveatus*), and golden crab (*Chaceon fenneri*).

Figure 2. Proposed marine reserve areas in the EEZ.



<u>Alternatives Considered and Not Selected</u>:

<u>Alternative 3</u>: Establish a marine reserve in the EEZ at the Riley's Hump mutton snapper spawning aggregation site.

<u>Discussion</u>: Riley's Hump (Figure 2) is approximately 11 square nautical miles (11nm^2). It is bounded by the following coordinates:

NW 24° 32.2' N, 83° 8.7' W
NE 24° 32.2' N, 83° 5.2' W
SW 24° 29.7' N, 83° 8.7' W
SE 24° 28.7' N, 83° 5.2' W

This option, while providing annual protection to mutton snapper (*Lutjanus analis*), does not provide any protection to other habitat in the vicinity of Riley's Hump, including deep-water habitat areas south of Riley's Hump which may include spawning sites for other managed species. The area to the south of Riley's Hump was identified by commercial fishermen in the Tortugas 2000 WG as unique and potentially important habitat for red and goldeye snapper, tilefish, golden crab, and snowy grouper. The mandate for the WG was to design

a marine reserve that included the various and diverse representative habitats that are present in the Tortugas area. The WG unanimously agreed that this area to the south of Riley's Hump, also known as "The Steps," should be included in the marine reserve design.

Alternative 4: Status quo. No action.

Discussion: This option would not provide any additional protection to EFH or to any managed species. By establishing the marine reserves, fishing pressure may be reduced in these areas. This may provide greater protection to species by increasing spawning stock biomass and recruitment supply, and preserving genetic diversity and ecosystem balance. This option could result in reduced net economic benefits in the long-term. Habitat damage and increased fisheries exploitation in this area could result in negative impacts to eco-tourism, the diving industry, and to other fisheries, resulting in reduced economic benefits from those sectors.

8.5.2 Marine Reserves Duration

Proposed Alternative:

Alternative 5: Establish the marine reserves for a period of at least 10 years, to be evaluated at the same intervals the state of Florida evaluates the FKNMS (i.e., every 5 years starting in 2002, 2007, etc.). During these periods, the future status of the marine reserves will be considered by the Council and the FKNMS.

Alternatives Considered and Not Selected:

Alternative 6a: Permanent establishment of the marine reserves.

Discussion: This alternative would permanently protect contiguous habitat areas and preserve portions of the marine ecosystem. This precautionary approach may benefit numerous commercial and recreational fisheries throughout the Florida Keys and southwest Florida, improve scientific understanding of coral reef communities, provide insight on the effect of fishing on EFH, and increase economic returns for non-consumptive businesses.

Alternative 6b: Establish the marine reserves for a period of 5 or 10 years, to be annually evaluated. Upon expiration of this period, the future status of the marine reserves will be considered by the Council and the FKNMS.

Discussion: Benefits from the establishment of the marine reserves may take several years to become apparent. Reproductive success and larval production will increase over time as species abundance is allowed to recover without fishing pressure. However, evaluation after only 5 years may not indicate immediate results for some species and may persuade individuals to abandon the effort without allowing sufficient time for the benefits of the marine reserves to accrue. If an evaluation period is specified, 10 years would be more appropriate.

8.5.3 Marine Reserves Allowable Activities[1]

Proposed Alternatives:

Alternative 7: Prohibit fishing for any species in the marine reserves.

Discussion: This alternative would prohibit all fishing, as well as prohibit the removal of any organism (including, but not limited to, those organisms listed in the Coastal Migratory Pelagics FMP, Coral and Coral Reefs FMP, Highly Migratory Species FMP, Red Drum FMP, Reef Fish FMP, Shrimp FMP, Spiny Lobster FMP, and Stone Crab FMP) within the marine reserves. Currently, all fishing is prohibited on Riley's Hump during the months of May and June.

In establishing the seasonal closure of Riley's Hump as a mutton snapper spawning aggregation site through Reef Fish Amendment 5 (1994), the enforcement officials attending Council meetings, i.e., U.S. Coast Guard and NMFS, concluded because of its remote location and size that it could not be enforced unless all fishing and anchoring of fishing vessels was prohibited. That would allow enforcement to be carried out by aerial surveillance. The National Oceanic and Atmospheric Administration (NOAA) General Counsel concurred with that position. The enforcement officials reached the same conclusion in regard to establishing the Tortugas marine reserves, pointing out that if vessels were allowed to be anchored in the areas they could not determine whether they were fishing or spearfishing. Similarly if trolling was allowed they could not determine whether they were fishing on the surface or near the bottom. A Council member who commercially fished the area pointed out that to catch the bottom dwelling reef fish by trolling he needed only to shift to use of wire line.

Vessels in continuous transit across the reserve with no fishing gear deployed are not considered to be fishing, even though there might be fishing gear and fish aboard the vessel. Continuous transit across the reserve is defined as non-stop progression through the closed area enroute to the next destination. Gear "stowed appropriately" for the following vessels are defined as:

> **Longliners - Long lines may be left on the drum with all gangion lines and hooks disconnected and stowed below deck. Hooks shall not be baited. All buoys shall be disconnected from the gear however, buoys can remain on deck.**
>
> **Trawlers - All nets will remain on deck, with doors secured and disconnected from the trawl gear.**

[1]The Council has also requested the FKNMS to prohibit anchoring by any vessel and prohibit non-consumptive diving within the reserves.

Gillnets - Gillnets shall be left on the drum. However additional nets not attached to the drum, will be stowed below deck.

Rod and Reel - Rods shall be out of the holders and stowed on or below deck. Terminal gear will be disconnected and stowed separately from the rod and reel. Terminal gear is defined as hook, leader, sinker, flasher or bait. Sinkers will be disconnected from down riggers and stowed separately.

Alternative 10: Prohibit all fishing vessels from anchoring in the marine reserves, except in emergencies.

Discussion: Anchoring has been demonstrated to negatively impact important coral resources, thus degrading EFH. Prohibiting anchoring of fishing vessels would protect fragile coral formations on Riley's Hump which has been documented to support spawning aggregations of mutton snapper and potentially other marine species. In case of an emergency, the vessel would notify the U.S. Coast Guard and/or FKNMS enforcement of the reason for anchoring. Restricting anchoring of non-fishing vessels or diving is beyond the Council's jurisdiction, but the Council is requesting FKNMS to prohibit anchoring and diving, including nonuse diving, in the proposed marine reserves.

Alternatives Considered and Not Selected:

Alternative 8: Prohibit all gear except trolling within the marine reserves.

Discussion: A marine reserve is usually associated with EFH protection, species-specific protection, or ecological protection. Proposed prohibitions in the marine reserves include any bottom fishing (hook-and-line, traps, bottom longlines, trawls, pots), spearfishing, hand harvest, and netting. All other harvesting methods are also prohibited. Trolling is less likely than bottom fishing to directly affect the coral reef ecosystem; however, trolling has been known to harvest gag grouper, yellowtail, and other snappers. The removal of these species could alter the balance of the coral reef ecosystem and, therefore, have an indirect, harmful effect on EFH and other fish species. The use of planers should be prohibited since these have the potential to impact EFH such as high-relief coral formations as they are pulled through the water column. Permitting any fishing activity may encourage poaching and hinder enforcement.

Alternative 9: Prohibit all fishing within the marine reserves except catch and release.

Discussion: Catch and release fishing is documented in several Council FMPs as having associated fishing-related (discard) mortality and, therefore, would be contrary to the goals and objectives of the marine reserves. Bohnsack (2000) summarizes information pertaining to catch-and-release mortality and survival estimates. Based on available scientific studies,

catch-and-release fishing would be incompatible with the objectives of a ecological or marine reserve as it compromises and could potentially dissipate the benefits produced by a prohibition on consumptive activities. Protracted over time, catch-and-release fishing would selectively impact some species more than others, alter behavior, and change species composition and size distributions within certain species. The two greatest risks are that release mortality would diminish biodiversity by depleting the most vulnerable species and that it would jeopardize fishery benefits by depleting the largest species and size classes (Boehlert 1996; Bohnsack and Ault 1996). Furthermore, allowing fishing within the reserves increases the effort and costs of enforcement since the enforcement agents would have to interview each vessel in the area to determine if vessels are releasing their catch. Permitting any fishing activity may also encourage poaching.

8.6 Socioeconomic Impact Analysis.

8.6.1 Recreational Sector

While the relevant impacts of alternatives pertain only to those involving recreational activities in the EEZ portions of the Tortugas ecological reserves, the following discussions start with the impacts of entire ecological reserves. Again it may be recalled that the entire Tortugas South ecological reserve is in the EEZ; on the other hand, the Tortugas North ecological reserve includes waters in the EEZ, state, and FKNMS.

The interpretation of the estimates provided in this analysis is critical to understanding the "true" impact of the various alternatives proposed for the marine reserves. The estimates from the GIS analysis for the boundary alternatives are simply the sum of each measurement within the boundaries for the given alternative. The estimates therefore represent the maximum total potential loss from displacement of the consumptive recreational activities. This analysis ignores possible mitigating factors and the possibility of net benefits that might be derived if the proposed marine reserves has replenishment effects. Although it is not possible to quantify either the extent of the mitigating factors or the potential benefits from replenishment, these will be discussed as well as other potential benefits of the proposed marine reserves after the maximum potential losses from displacement of the current consumptive recreational uses have been presented and discussed.

There are two types of potential losses identified and quantified in this analysis: non-market economic values and market economic values. There are two types of non-market economic values. The first is consumer's surplus, which is the amount of economic value a consumer receives by consuming a good or service over and above what he or she pays for the good or service. It is a net benefit to the consumer and in the context of recreation use of natural resources, where the natural resources go unpriced in markets, this value is often referred to as the net user value of the natural resource. The second type of non-market economic value is one received by producers or owners of the businesses providing goods or services to the users of the natural resources. This is commonly referred to as producer's surplus. The

concept is similar to consumer's surplus in that the businesses do not pay a price for the use of natural resources when providing goods or services to users of the resources. However, this concept is a little more complicated because, in "welfare economics," not all producer's surplus is considered a proper indicator in the improvement of welfare. Only that portion of producer's surplus called "economic rent" is appropriate for inclusion. Economic rent is the amount of profit a business receives over and above a normal return on investment (i.e., the amount of return on investment that could be earned by switching to some alternative activity). Again, because businesses that depend on natural resources in the Tortugas do not have to pay for the use of them, there exists the possibility of earning above normal rates of return on investment or "economic rent." This like consumer's surplus would be additional economic value attributable to the natural resources (i.e., another user value).

Economic rents are different from consumer's surplus in that supply and demand conditions are often likely to lead to dissipation of the economic rents. This is generally true for most open access situations. As new firms enter the industry because of the lure of higher than normal returns on investment, the net effect is to eliminate most if not all of the economic rent. However, given the remoteness of the TERSA, it is likely that all economic rents would not be eliminated. Accounting profits are used as a proxy for economic rents in this analysis. The absolute levels of accounting profits are not a good proxy for economic rents, however, they are used as an index for assessing the relative impacts across the different boundary alternatives.

The estimates for consumer's surplus were derived by combining estimates of person-days from all the operators in the TERSA with estimates of consumer's surplus per person-day from Leeworthy and Bowker (1997). The estimates were derived separately by season (Leeworthy and Wiley 1999).

Revenues from the charter boat operations that provided service to the consumptive recreational users provide the basis for the analysis of market economic values. Total output/sales, income, and employment impacts on the Monroe County economy are then derived from these estimates. These impacts include the ripple or multiplier impacts. Total output/sales is equal to business revenue times the total output multiplier of 1.12 from English et al. (1996). Income is then derived by taking the total output/sales impact and dividing by the total output-to-income ratio (2.63) from English et al. And, total employment was derived by dividing the total income impact by the total income-to-employment ratio ($23,160) from English et al.

Alternatives 1,2 & 7

These alternatives would displace over 26% of the total person-days of diving for lobsters, about 26% of the spearfishing, and about 3% of the fishing. Across all three consumptive recreational activities a little over 7% of the person-days would be displaced (Table 10). All the diving for lobsters and spearfishing activity displaced would be from within the FKNMS boundaries. For fishing, 40% of the displaced activity would be from within the FKNMS boundaries. Because of the way in which consumer's surpluses are calculated, they

generally mirror the patterns in displaced use. Minor differences would be due to the distributions across activities by season. Only in the case of diving for lobsters are the impacts on person-days and profits equal. For spearfishing, the impacts on profits is lower than the impact on person-days (18.7% versus 25.91%), while for fishing the impact is greater on profits than on person-days (10% versus 3%). The GIS generated maps (Figures 11-14) illustrate why diving for lobsters and spearfishing would be relatively more impacted than fishing. The reason is that diving for lobsters and spearfishing is concentrated on Tortugas Bank, while relatively little recreational fishing currently takes place on the Tortugas Bank.

Nine of the twelve charter boat operations operating within the TERSA would be potentially impacted by these alternatives. Direct business revenue would include potential losses of 26.6% for diving for lobsters, 20.0% for spearfishing, and 6.3% for fishing. Across all three consumptive recreational activities, 11.7% of revenue would be potentially impacted (Table 10).

Table 10. Impacts of Proposed Tortugas North and South Ecological Reserves.

	DIVING FOR LOBSTER [2]	FISHING [2]	SPEARFISHING [2]	TOTAL [2]
WITHIN FKNMS				
Person-Days	461 (31.97%)	200 (1.64%)	485 (30.91%)	1,146 (7.53%)
Revenue	$ 31,732 (31.96%)	$ 24,691 (4.26%)	$ 66,816 (22.89%)	$ 123,239 (12.70%)
Cost	$ 21,862 (31.98%)	$ 14,496 (3.07%)	$ 36,656 (24.52%)	$ 73,014 (10.59%)
Profit	$ 9,870 (31.93%)	$ 10,195 (9.48%)	$ 30,160 (21.18%)	$ 50,225 (17.89%)
Number of Firms	2 (100.00%)	8 (80.00%)	3 (100.00%)	9 (75.00%)[1]
Consumer Surplus	$ 41,976 (31.99%)	$ 16,439 (1.65%)	$ 44,550 (30.93%)	$ 102,965 (8.09%)
OUTSIDE FKNMS				
Person-Days	- (0.00%)	297 (7.13%)	- (0.00%)	297 (6.25%)
Revenue	$ - (0.00%)	$ 28,815 (10.77%)	$ - (0.00%)	$ 28,815 (8.75%)
Cost	$ - (0.00%)	$ 23,254 (10.68%)	$ - (0.00%)	$ 23,254 (9.14%)
Profit	$ - (0.00%)	$ 5,561 (11.17%)	$ - (0.00%)	$ 5,561 (7.43%)
Number of Firms	- (0.00%)	2 (50.00%)	- (0.00%)	2 (40.00%)[1]
Consumer Surplus	$ - (0.00%)	$ 24,064 (7.09%)	$ - (0.00%)	$ 24,064 (6.11%)
TOTAL				
Person-Days	461 (26.65%)	497 (3.03%)	485 (25.91%)	1,443 (7.22%)
Revenue	$ 31,732 (26.63%)	$ 53,506 (6.32%)	$ 66,816 (20.02%)	$ 152,054 (11.70%)
Cost	$ 21,862 (26.64%)	$ 37,750 (5.48%)	$ 36,656 (21.26%)	$ 96,268 (10.20%)
Profit	$ 9,870 (26.61%)	$ 15,756 (10.02%)	$ 30,160 (18.70%)	$ 55,786 (15.69%)
Number of Firms	2 (100.00%)	8 (80.00%)	3 (100.00%)	9 (75.00%)[1]
Consumer Surplus	$ 41,976 (26.66%)	$ 40,503 (3.03%)	$ 44,550 (25.92%)	$ 127,029 (7.63%)

[1] Number of firms does not add up to the total because individual firms may engage in more than one activity.
[2] Percent of Total Study Area by activity and total in parentheses.

Through the ripple or multiplier effects, 11.7% of output/sales, income, and employment associated with all the consumptive recreational activities in the TERSA could potentially be lost (Table 10). Although these impacts could be significant on the nine firms operating in the TERSA, they would not likely be noticed in the Monroe County economy because the impact would amount to only a fraction of a percent of the total economy supported by recreating visitors to the Florida Keys (Table 15).

Table 11. Maximum Potential Market Economic Losses from the Proposed North & South Ecological Reserves.

	TERSA	NORTH & SOUTH ECOLOGICAL RESERVES
WITHIN FKNMS		
Revenue[1]	$ 1,065,456	$ 123,239 (11.57%)
Output/Sales[2,5]	$ 1,193,311	$ 138,028 (11.57%)
Income[3,5]	$ 453,730	$ 52,482 (11.57%)
Employment[4,5]	20	2 (11.57%)
OUTSIDE FKNMS		
Revenue[1]	$ 348,284	$ 28,815 (8.27%)
Output/Sales[2,5]	$ 390,078	$ 32,273 (8.27%)
Income[3,5]	$ 148,319	$ 12,271 (8.27%)
Employment[4,5]	6	1 (8.27%)
TOTAL		
Revenue[1]	$ 1,413,740	$ 152,054 (10.76%)
Output/Sales[2,5]	$ 1,583,389	$ 170,300 (10.76%)
Income[3,5]	$ 602,049	$ 64,753 (10.76%)
Employment[4,5]	26	3 (10.76%)

[1]Total Revenue from Tables 4-6.
[2]Output is derived by multiplying Revenue by a multiplier of 1.12.
[3]Income is calculated by dividing total output by the total output to total income ratio for Monroe County (2.63).
[4]Employment is calculated by dividing total income by the total income to jobs ratio for Monroe County (23,160).
[5]The multiplier, total output to total income ratio, and total income to jobs ratio are taken from English et al. 1996.

Since the alternatives considered in this generic amendment pertain only to the EEZ, the foregoing estimated impacts displayed in Table 11 are overestimates of the impacts of the proposed alternatives. Specifically only the EEZ portion of the estimated impacts outside FKNMS boundaries is appropriate. Tables 12 and 13 below show a breakdown of the total impacts outside FKNMS boundaries into state and federal waters.

Table 12. Consumptive Recreation in Boundary Expansion Areas [1]

	Diving for Lobsters[2]		Fishing[2]		Spearfishing[2]		Total[2]	
North Expansion - EEZ								
Person-Days	-	(0.00%)	-	(0.00%)	-	(0.00%)	-	(0.00%)
Revenue	$ -	(0.00%)	$ -	(0.00%)	$ -	(0.00%)	$ -	(0.00%)
Profit	$ -	(0.00%)	$ -	(0.00%)	$ -	(0.00%)	$ -	(0.00%)
Consumer Surplus	$ -	(0.00%)	$ -	(0.00%)	$ -	(0.00%)	$ -	(0.00%)
North Expansion - State Waters								
Person-Days	-	(0.00%)	1	(0.00%)	-	(0.00%)	1	(0.00%)
Revenue	$ -	(0.00%)	$ 243	(0.04%)	$ -	(0.00%)	$ 243	(0.03%)
Profit	$ -	(0.00%)	$ 204	(0.17%)	$ -	(0.00%)	$ 204	(0.12%)
Consumer Surplus	$ -	(0.00%)	$ 43	(0.00%)	$ -	(0.00%)	$ 43	(0.00%)
North Expansion - Total								
Person-Days	-	(0.00%)	1	(0.00%)	-	(0.00%)	1	(0.00%)
Revenue	$ -	(0.00%)	$ 243	(0.03%)	$ -	(0.00%)	$ 243	(0.02%)
Profit	$ -	(0.00%)	$ 204	(0.13%)	$ -	(0.00%)	$ 204	(0.06%)
Consumer Surplus	$ -	(0.00%)	$ 43	(0.00%)	$ -	(0.00%)	$ 43	(0.00%)
South Expansion - EEZ								
Person-Days	-	(0.00%)	296	(17.11%)	-	(0.00%)	296	(1.48%)
Revenue	$ -	(0.00%)	$ 28,571	(23.98%)	$ -	(0.00%)	$ 28,571	(2.20%)
Profit	$ -	(0.00%)	$ 5,357	(14.44%)	$ -	(0.00%)	$ 5,357	(1.51%)
Consumer Surplus	$ -	(0.00%)	$ 23,527	(14.94%)	$ -	(0.00%)	$ 23,527	(1.44%)

1. No diving for lobsters or spearfishing currently takes place in the boundary expansion areas.

2. Boundary expansion area totals as a percent of total Tortugas Ecological Reserve Study Area totals in parentheses.

Table 13. Maximum Potential Market Economic Losses - Recreation			
		Boundary Expansion	
North Expansion - EEZ			
Revenue[1]		$ -	(0.00%)
Output/Sales[2,5]		$ -	(0.00%)
Income[3,5]		$ -	(0.00%)
Employment[4,5]		0	(0.00%)
North Expansion - State Waters			
Revenue[1]		$ 243	(0.05%)
Output/Sales[2,5]		$ 273	(0.05%)
Income[3,5]		$ 104	(0.05%)
Employment[4,5]		0	(0.05%)
North Expansion - Total			
Revenue[1]		$ 243	(0.02%)
Output/Sales[2,5]		$ 273	(0.02%)
Income[3,5]		$ 104	(0.02%)
Employment[4,5]		0	(0.02%)
South Expansion - EEZ			
Revenue[1]		$ 28,571	(3.58%)
Output/Sales[2,5]		$ 32,000	(3.58%)
Income[3,5]		$ 12,167	(3.58%)
Employment[4,5]		1	(3.58%)
1. Total Revenue from Tables A.1 and A.2.			
2. Output is derived by multiplying Revenue by a multiplier of 1.12.			
3. Income is calculated by dividing total output by the total output to total income ratio for Monroe County (2.63).			
4. Employment is calculated by dividing total income by the total income to jobs ratio for Monroe County (23,160).			
5. The multiplier, total output to total income ratio, and total income to jobs ratio are taken from English, et. al. 1996			

The EEZ portions of Table 14 summarize the maximum potential impacts of Proposed Alternatives 1, 2, and 7. Note that the first two alternatives define the areas proposed as ecological reserves while the third alternative provides for the prohibition of all fishing activities in the proposed reserves. Basically, Alternative 1 (in combination with Alternative 7) has no impacts on fishing activities in the EEZ. The impacts of Alternative 2 (in combination with Alternative 7) appear to be relatively small in magnitude. The adoption of the Tortugas Ecological Reserve in the EEZ would potentially reduce market economic values by $28,571 in revenues, $32,000 in output/sales, and $12,167 in income. Losses in non-market values would amount to $23,570 in consumer surplus and $5,357 in producer surplus (profit). Only one full-time job equivalent would be lost.

Table 14. Maximum Potential Losses to Recreational Activities (outside FKNMS) from Displacement: North & South Ecological Reserves.

	TORTUGAS NORTH			TORTUGAS SOUTH		TOTAL	
MEASURE	TOTAL	EEZ	STATE	EEZ	TOTAL	EEZ	STATE
MARKET							
Revenue	$ 243	$ -	$ 243	$ 28,571	$ 28,814	$ 28,571	$ 243
Output/Sales	$ 273	$ -	$ 273	$ 32,000	$ 32,273	$ 32,000	$ 273
Income	$ 104	$ -	$ 104	$ 12,167	$ 12,271	$ 12,167	$ 104
Employment	-	-	-	1	1	1	-
NON-MARKET							
Consumer's Surplus	$ 43	$ -	$ 43	$ 23,527	$ 23,570	$ 23,527	$ 43
Producer's Surplus (profit)	$ 204	$ -	$ 204	$ 5,357	$ 5,561	$ 5,357	$ 204

Mitigating Factors – Are the Potential Losses Likely?

In the GIS-based analysis, impacts are constantly referred to as "potential losses." The reason is that there are several factors that could mitigate these potential losses and further there is a possibility that there might not be any losses at all. It is quite possible that there might be actual benefits to even the current displaced users. These factors are discussed only in qualitative terms because it is not possible to quantify them. Two possible mitigating factors are discussed below and how this might differ for each of the alternatives.

Substitution

If displaced users are simply able to relocate their activities, they may be able to fully or partially mitigate their losses. This of course depends on the availability of substitute sites and further depends on the substitute site qualities. Several scenarios are possible. Even when total activity remains constant (i.e., person-days remain the same as they simply go to other sites), if the quality of the site is lower there could be some loss in consumer's surplus.

If it costs more to get to the substitute sites, there could still be increases in costs and thus lower profits. If there is not a completely adequate supply of substitute sites, then there could be losses in total activity and in all the non-market and market economic measures referenced in our above analysis of displaced use. The possibilities for substitution vary by alternative.

Mitigation by substituting to alternative sites has a high probability for Alternatives 1 and 2, because there will still be substantial area available for all consumptive recreational activities (over half of Tortugas Bank). Given the equal distribution of use for diving for lobsters and spearfishing on the Tortugas Bank, it is not likely that increased costs of relocation would occur or that there would be losses from users forced to go to sites of lower quality. Crowding effects, by pushing all the use currently spread over the whole Tortugas

Bank onto half the bank, would also be unlikely given the small absolute amounts of activity. For fishing, only 3% of the activity would be displaced, so for this activity it is expected there would be no crowding effects and recreational fishermen would not likely suffer any losses.

Replenishment Effects

Marine reserves may have beneficial effects beyond the direct ecological protection for the sites themselves. That is, both the size and number of fish, lobster, and other invertebrates both inside and outside the reserves may increase (i.e., the replenishment effect). Davis (1998) summarizes what is currently known about marine reserves:

> *"...we found 31 studies that tested whether protected areas had an effect on the size, reproductive output, diversity, and recruitment of fish in adjacent areas. Fisheries targeted species were two to 25 times more abundant in no-take areas than in surrounding areas for fish, crustaceans, and mollusks on coral and temperate reefs in Australia, New Zealand, the Philippines, Japan, Kenya, South Africa, the Mediterranean Sea, Venezuela, Chile, and the United States (California, Florida and Rhode Island). Mean sizes of fished species protected in no-take zones were 12 to 200 percent larger than those in surrounding areas for all fishes studied and in 75 to 78 percent of the invertebrates. Eighty-six percent of the studies that tested fishery yields found that catches within three kilometers of the marine protected areas were 46 to 50 percent higher than before no-take zones were created. It is clear that fishers all over the world believe no-take zones increase yields because they fish as close to the boundaries as possible."*

The long-term benefits from the reserve could offset any losses from displacement and may also result in long-term benefits and no costs (net benefits) to recreational users that are displaced by the proposed marine reserves. Again, this conclusion may vary by alternative.

Alternatives 1 and 2 include several known spawning areas for several species of fish and invertebrates. The connection with the other jurisdictions (FKNMS, Florida, and DRTO) increases the likelihood of replenishment effects. Due to the oceanography of the area, the marine reserves may serve as both a sink and a source not only for the marine reserve area itself, but also the entire Florida reef tract (Schmidt et al. 1999). Thus, there is a high likelihood that there will be long-term benefits to all consumptive recreational users in the TERSA.

Benefits of the Proposed Marine Reserves to Recreational Users

Recreational Users on Entire Florida Keys Reef Tract

The possibility that consumptive recreational users could possibly benefit if there were long-term offsite impacts was discussed above. But given the work by Ault et al. (1998), Bohnsack and Ault (1996), Bohnsack and McClellan (1998), and Lee et al. (1994, 1999), there is also the possibility that a protected area in the Tortugas could yield beneficial stock effects to a wide variety of species all along the entire Florida Keys reef tract and to pelagic

Table 15. Comparison of the Economic Contribution of Visitors to the Florida Keys (Monroe County).

	Monroe County	North & South Ecological Reserves
Output/Sales	$ 1,548,762,097	0.011%
Income	$ 573,566,049	0.011%
Employment	18,892	0.016%

[1]For year June 1997-May 1998. Represents total impact of spending by recreating visitors (non-residents of Monroe County) on economy of Monroe County (Leeworthy and Vanasse 1999).

species such as sailfish that are primarily offshore species. Even small increases in recreational tourist activities along the entire Florida Keys reef tract could more than offset the total displacements from the most extreme alternative analyzed here. Table 15 shows the total impacts for Alternatives 1 and 2 (in combination Alternative 7) relative to the total Florida Keys recreational visitor economic contribution. They are only fractions of a percent of the total recreational visitor economic contribution. One-tenth of one percent increase in the total recreational visitor contribution along the entire Florida Keys reef tract would more than offset the maximum potential losses from Alternatives 1, 2 and 7 (Table 15).

Non-consumptive Users (Divers) in Tortugas

Currently there are four operators that bring divers to the TERSA for non-consumptive diving. There were 1,048 person-days of non-consumptive diving which account for 4.98% of the total recreational activity in the TERSA (excluding the DRTO). Of the total non-consumptive diving, 83.3% is currently done within the FKNMS boundaries. Table 16 summarizes the information for non-consumptive divers. It is expected that this group would be benefitted by the marine reserves. As the site improves in quality, it would be expected that the demand for this site will increase and person-days, consumer's surplus, business revenues, and profits will all increase. This would be expected to vary by alternative (allowable activities) with the more protective alternatives having greater benefits. It may be noted, however, that there are currently no non-consumptive activities in the EEZ portions of the Tortugas ecological reserves, and thus the impacts of the proposed alternatives on non-consumptive diving may be deemed nil.

Table 16. Non-consumptive diving in the TERSA.

	TERSA	NORTH & SOUTH ECOLOGICAL RESERVES
WITHIN FKNMS		
Person-Days	873	279 (31.96%)
Revenue	$ 95,123	$ 30,439 (32.00%)
Cost	$ 58,157	$ 18,610 (32.00%)
Profit	$ 36,966	$ 11,829 (32.00%)
Number of Firms	2	2
Consumer Surplus	$ 77,198	$ 24,710 (32.01%)
OUTSIDE FKNMS		
Person-Days	175	- (0.00%)
Revenue	$ 19,025	$ - (0.00%)
Cost	$ 11,631	$ - (0.00%)
Profit	$ 7,393	$ - (0.00%)
Number of Firms	2	- (0.00%)
Consumer Surplus	$ 15,475	$ - (0.00%)
TOTAL		
Person-Days	1,048	279 (26.62%)
Revenue	$ 114,148	$ 30,439 (26.67%)
Cost	$ 69,788	$ 18,610 (26.67%)
Profit	$ 44,359	$ 11,829 (26.67%)
Number of Firms	4	2 (50.00%)
Consumer Surplus	$ 92,673	$ 24,710 (26.66%)

Alternative 4: No Action

The no action alternative simply means that the proposed marine reserves and corresponding no-take regulations would not take place. The no action alternative has a simple interpretation in that any costs of imposing the no-take regulations, for any given alternative with no-take regulations, would be the benefits of the no action alternative. That is, by not adopting the no-take regulations, the costs are avoided. Similarly, any benefits from imposing the no-take regulations, for any given alternative with no-take regulations, would be the costs of the no action alternative. That is, by not adopting the no-take regulations, the costs are the benefits lost by not adopting the no-take regulations. Said another way, the opportunities lost. The impacts of the no action alternative can only be understood by comparing it to one of the proposed alternatives. Thus the impacts of the no action alternative can be obtained by reading the impacts from any of the proposed alternatives in

reverse. For example, Table 14 shows that by adopting the no action alternative the recreational fishery would not be forgoing consumer surplus of $23,527 and producer surplus of $5,357. On the other hand, any long-term benefits accruing to the proposed ecological reserves, such as the discussed replenishment effects, would be forgone.

8.6.2 Commercial Sector

As with the case of the analysis for the recreational fishery, the following discussions of impacts for the commercial fishery start with the impacts of entire ecological reserves. The discussions then proceed to determining the impacts of the alternatives on the affected commercial fishery in the EEZ. Again it may be recalled that the entire Tortugas South ecological reserve is in the EEZ; on the other hand, the Tortugas North ecological reserve includes waters in the EEZ, state, and FKNMS.

No commercial fishing is currently allowed in the DRTO so these grid cells are true zeroes in the analysis. Before breaking out the impact, the status of each grid cell (i.e., inside or outside of the boundary) had to be determined. Two methods were considered to carry out this task: the "centroid method" and the "intersection method." The centroid method characterizes a grid cell as within a boundary if the centroid (i.e., center point) of the cell is within the boundary. The intersection method characterizes a grid cell as within a boundary if any part of the cell is intersected by the boundary. The centroid method was selected because it was more consistent with how the data was collected (i.e., 1 square nautical mile grid cells was the finest resolution).

The interpretation of the estimates provided in this analysis is critical to understanding the true impact of the alternatives proposed for the marine reserves. The estimates from the GIS analysis for the alternatives are simply the sum of each measurement within the boundaries for a given alternative. The estimates therefore represent the maximum total potential loss from displacement of the commercial fishing activities. This analysis ignores possible mitigating factors and the possibility of net benefits that might be derived if the proposed ecological reserve has replenishment effect. Although it is not possible to quantify either the extent of the mitigating factors or the potential benefits from replenishment, these will be discussed as well as other potential benefits of the proposed marine reserves after the maximum potential losses from displacement of the current commercial fisheries have been presented and discussed.

The analysis is driven by the catch summed across grid cells within the alternatives. The set of relationships, measures, and methods described in Leeworthy and Wiley (2000a) are then used to translate catch into estimates of market and non-market economic values potentially impacted. These estimates are broken-down by area both inside and outside FKNMS boundaries and are done by species. Table 17 shows the results for catch for the alternatives. Catch for the total TERSA is also presented to allow assessment of the proportion of the TERSA fishery potentially impacted by the alternatives.

Alternatives 1, 2 & 7

The entire ecological reserves (not just the EEZ portion) could potentially impact 14% of the catch of king mackerel, 11.58% of the lobster catch, 20.30% of the reef fish catch, and 8.16% of the shrimp catch in the TERSA. This would lead to a reduction of about $864,000 in harvest revenue or 12.26 % of the TERSA harvest revenue. This reduction in revenue would result in a reduction of 12.16% of total output, income and employment generated by the TERSA fishery. The impacts are split almost evenly between the areas inside and outside FKNMS boundaries. Although these impacts might seem significant to those firms that might potentially be impacted, the overall impact on the local economies would be so small they would not be noticed. Harvest revenue potentially impacted was only 1.16% of all harvest revenue of catch landed in Monroe County. In addition, this lost revenue would translate (accounting for the multiplier affects) into only fractions of a percent of the total Monroe county economy; 0.0596% of total output, 0.0779 % of total income, and 0.0785% of total employment.

Table 17 summarizes the economic impacts of the Tortugas North and South ecological reserves. The numbers in this table differ slightly from those found in Leeworthy and Wiley (2000a) because of the average ex-vessel price per pound used for shrimp of $2.75 instead of the original $2.40. The original price was for Monroe County only while the new price was generated as a weighted average of the prices in Monroe ($2.40) and Lee ($3.12) counties.

For all species/species groups, it is estimated that these alternatives could result in a potential loss of about $880,000 in consumer's surplus. This was 11.7% of the consumer's surplus generated by the entire TERSA. Whereas the market economic values were almost evenly split inside and outside the FKNMS, 53.76% of the consumer's surplus potentially impacted is from inside the FKNMS boundaries. This is due to the distributions of lobster and reef fish catch where a higher proportion of the potentially impacted catch come from inside FKNMS boundaries, whereas the distributions of shrimp and king mackerel come largely from outside the FKNMS boundaries.

Although producer's surplus or economic rents are estimated to be zero, about 11.5% of the return to labor and capital of the TERSA fishery is potentially impacted by these alternatives. The distribution inside versus outside the FKNMS boundaries follows that of the market economic values with 48% from catch inside the FKNMS.

Table 17. Maximum Potential Losses to the Commercial Sector from Displacement: North & South Ecological Reserves.

AREA/MEASURE	TOTAL TERSA	N & S ECOLOGICAL RESERVES
TOTAL TERSA		
Market[1]		
Harvest Revenue	$ 7,135,417	$ 864,477
Total Output	$ 15,054,495	$ 1,827,177
Total Income	$ 9,333,787	$ 1,162,850
Total Employment	407	50
Non-market		
Consumer Surplus[2]	$ 7,537,841	$ 882,478
Producer Surplus[3]	$ 0	$ 0
Return to Labor and Capital[4]	$ 1,980,004	$ 226,625
INSIDE FKNMS		
Market[1]		
Harvest Revenue	$ 3,540,659	$ 434,730
Total Output	$ 7,317,294	$ 953,098
Total Income	$ 4,536,722	$ 590,920
Total Employment	198	26
Non-market		
Consumer Surplus[2]	$ 3,890,993	$ 421,499
Producer Surplus[3]	$ 0	$ 0
Return to Labor and Capital[4]	$ 1,042,931	$ 107,652
OUTSIDE FKNMS		
Market[1]		
Harvest Revenue	$ 3,581,589	$ 449,602
Total Output	$ 7,711,461	$ 958,845
Total Income	$ 4,781,105	$ 594,484
Total Employment	209	26
Non-market		
Consumer Surplus[2]	$ 3,646,848	$ 460,979
Producer Surplus[3]	$ 0	$ 0
Return to Labor and Capital[4]	$ 932,305	$ 118,974

[1]Market economic measures include impacts on Monroe county and Collier/Lee counties.
[2]Maximum values from each species were used when range estimates were generated from multiple demand equations.
[3]Producer surplus or economic rents were assumed to be zero for two reasons. First, all fisheries with the exception of spiny lobster are open access fisheries and therefore economic rents would be zero (i.e., firms are earning only normal rates of return on investment). Second, even using total return to labor & capital which overstates return on investment, it does not yield rates of return on investment above normal rates of return.
[4]Return to labor & capital is not a non-market value but would include rent if it existed.

The impacts portrayed above are overestimates of the impacts of adopting Alternatives 1 and 2 in combination with Alternative 7, primarily because these estimates include impacts outside the EEZ but within the Tortugas North. The impacts of the entire Tortugas South ecological reserves are appropriate since the entire area is located in the EEZ. The relevant estimates for the purpose of this generic amendment are those for the EEZ portion of the estimated impacts outside FKNMS.

Table 18 shows the amount of the various species caught in state and federal waters of the proposed Tortugas North and South ecological reserves that are outside the FKNMS boundaries. The northern area of the reserves outside FKNMS includes both state and federal waters. Pound landings from the EEZ are the ones that would be affected by Alternatives 1 and 2 (in combination with Alternative 1). These alternatives are expected to potentially displace about 8.45 percent of king mackerel catch, 4.74 percent of lobster catch, 6.21 percent of reef fish catch, and 6.30 percent of shrimp catch in the TERSA. These percentages would be much lower when related to the entire catches in FMRI areas 2.0 and 2.9, or for that matter catches of relevant species throughout the Gulf.

Table 18. Maximum Potential Loss in Commercial Catch from Displacement: Ecological Reserves Outside FKNMS Boundaries

Species	North Expansion			South Expansion	Total		
	Total	EEZ	State	EEZ	Total	EEZ	State
Lobster	9,699	2,307	7,392	42,139	51,838	44,446	7,392
Reef Fish	8,252	1,800	6,452	33,895	42,147	35,695	6,452
King mackerel	1,646	353	1,293	7,785	9,431	8,138	1,293
Shrimp	18,293	12,926	5,367	32,142	50,435	45,068	5,367
Total	37,890	17,386	20,504	115,961	153,851	133,347	20,504

1. Numbers are in pounds.

Table 19 below translates the pounds that would be forgone under Alternatives 1 and 2 (in combination with Alternative 7) into economic values. As in the immediately preceding table, the values shown under the "EEZ" columns are the relevant impacts. The Tortugas North and South ecological reserves proposed in this generic amendment would then potentially reduce harvest revenues by $389,653, output by $831,868, income by $515,701, employment by 22 jobs, consumer surplus by $398,426 and return to labor and capital by $102,999. Producer surplus is considered to be nil.

Table 19. Maximum Potential Losses to Commercial Sector from Displacement: Ecological Reserves Outside FKNMS Boundaries

Measure	North Expansion			South Expansion	Total		
	Total	EEZ	State	EEZ	Total	EEZ	State
Market							
Harvest Revenue	109,119	49,164	59,953	340,489	449,608	389,653	59,953
Output/Sales	237,145	110,158	127,077	721,710	958,855	831,868	127,077
Income	147,031	68,240	78,787	447,461	594,492	515,701	78,787
Employment	7	3	4	19	26	22	4
Non-Market							
Consumer's Surplus	109,937	48,514	61,423	349,912	459,859	398,426	61,423
Producer's Surplus	0	0	0	0	0	0	0
Return to Labor & Cap	27,558	11,582	15,976	91,417	118,975	102,999	15,976

1. Market economic measures include impacts on Monroe and Collier/Lee counties.
2. Maximum values from each species were used when range of estimates was generated from multiple demand equations.
3. Producer's surplus or economic rents were assumed to be zero for two reasons. First, all fisheries, except spiny lobsters, are open access fisheries and therefore economic rents would be zero, i.e., firms are earning only normal rates of return on investment. Second, even using total return to labor and capital, which overstates return on investment, does not yield rates of return on investment above normal rates of return.
4. Return to labor and capital is not a non-market value but would include rent if it existed.

Alternative 4: No Action

The no action alternative simply means that the proposed marine reserves and corresponding no-take regulations would not take place. The no action alternative has a simple interpretation in that any costs of imposing the no-take regulations, for any given alternative with no-take regulations, would be the benefits of the no action alternative. That is, by not adopting the no- take regulations, the costs are avoided. Similarly, any benefits from imposing the no-take regulations, for any given alternative with no-take regulations, would be the costs of the no action alternative. That is, by not adopting the no-take regulations, the costs are the benefits lost by not adopting the no-take regulations. Said another way, the opportunities are lost. The impacts of the no action alternative can only be understood by comparing it to one of the proposed alternatives. Thus the impacts of the no action alternative can be obtained by reading the impacts from any of the proposed alternatives in reverse. As per Table 19 for example, if the no action alternative is adopted, the commercial fishery would not be faced with a reduction of $389,653 in revenues, $398,426 in consumer

surplus, and $102,999 in return to labor and capital. On the other hand, maintaining the status quo would imply forgoing any benefits, such as the replenishment effects discussed below, that may accrue due to the adoption of the proposed ecological reserves.

Profiles of Fishermen Potentially Impacted

In a previous section describing the fishery in the TERSA, a profile of TERSA fishermen was given with a comparison with other commercial fishermen in Monroe County. Here, the profiles of those potentially impacted by the alternatives are compared. This comparison does not differentiate among those fishing in the EEZ, state waters, and FKNMS. Hence, any implications regarding impacts of the ecological reserves proposed in this generic amendment are deemed overestimates.

The profiles are summarized in Table 20. Statistical tests were performed comparing the sample distributions for the groups that fished within the alternatives as compared with TERSA fishermen as a whole. Except for the number of fishing operations potentially impacted, the only significant differences for all alternatives were in membership in organizations and fish house usage.

In terms of memberships in organizations, the fishermen potentially impacted by all alternatives had significantly lower participation rates in the Conch Coalition, the Organized Fishermen of Florida (OFF), and in the Monroe County Commercial Fishermen, Inc. (MCCF), but had a significantly higher participation rates in environmental organizations and the Chambers of Commerce. Fish house usage was significantly lower for those fishermen potentially impacted by all alternatives.

Sixty-four (64) operations or 71% of the total operations could be potentially impacted by alternatives 1 and 2, which includes 27 of the 28 lobster operations (96%), 15 of 18 (83%) of the shrimp operations, all 16 of the king mackerel operations, and 40 (95%) of the reef fish fishing operations (multi-species fisheries).

Table 20. Profile of TERSA Fishermen Potentially Impacted by the Proposed Ecological Reserves.

	TERSA (%)	Tortugas North & South Ecological Reserves
	Age	
18-30	13.3	15.6
31-40	18.9	18.8
41-50	36.7	34.4
51-60	20.0	21.9
Over 60	11.1	9.4
	Years of Fishing in Monroe County	
Less than one year	1.1	1.6
1-5	6.7	7.8
6-10	12.4	12.5
11-20	16.9	17.2
21 or more years	62.9	60.9
	Years of Fishing in TERSA	
1-5 years	10.1	10.9
6-10	25.8	20.3
11-20	16.9	17.2
21 or more years	47.2	51.6
	Race/Ethnicity	
Anglo-American	76.7	78.1
Hispanic	21.1	20.3
African-American	2.2	1.6
	Membership in Organizations	
Conch Coalition	7.0	16.9
OFF	12.0	19.0
MCCF	38.0	24.2
Environmental	2.0	6.9

	Occupation	
Full-time Commercial Fishing	87.8	85.9
Part-time Commercial Fishing	1.1	1.6
Charter Boat (sell some catch)	11.1	12.5
	Income	
Percent Income from Fishing	89.1	87.3
Percent Income Fishing in TERSA	44.7	46.8
	Family Members Supported	
1 (Myself)	19.3	15.5
2	28.9	29.3
3	22.9	27.6
4 or more	289	27.6
	Primary Hauling Port	
Key West/Stock Island	74.4	75.0
Big Pine Key	4.4	4.7
Marathon	3.3	0.0
Tavernier	2.2	3.1
Naples/Ft. Myers	15.6	17.2
Fish House Usage (% Yes)	**41.1**	**35.9**
Number in Sample	90.0	64.0
Lobster Operation	28.0	27.0
Shrimp Operations	18.0	15.0
King Mackerel Operations	16.0	16.0
Reef Fish Operations	42.0	40.0

Other Potential Costs and Mitigating Factors – Are the Potential Losses Likely?

In the GIS-based analysis, impacts are constantly referred to as "potential losses." They are also referred to as the "maximum potential losses." There is the possibility that there could

be an additional cost not discussed but which cannot be quantified, that is, crowding and the resulting conflicts among users forced to compete in a smaller area. There are also several factors that could mitigate all the potential losses and further there is a possibility that there might not be any losses at all. It is quite possible that there might be actual net benefits to even the current displaced users. The issue of crowding costs and the mitigating factors and potential for beneficial outcomes are discussed below, in qualitative terms because it is not possible to quantify them. Two mitigating factors are discussed and how likely they might mitigate the potential losses from displacement and further how this might differ for each of the alternatives.

Crowding: As previously demonstrated, the alternatives will result in a certain amount of displacement. Displacement of commercial fishing activity is a certainty under all alternatives, except the no action alternative. If this displacement results in the activity being transferred to other sites, there is a potential for crowding effects. Crowding effects could raise the costs of fishing, both private costs to each fishing operation and social costs in resolving conflicts.

Crowding conflicts were one of the issues mentioned when the State of Florida created the lobster trap certificate program which was designed to reduce the number of lobster traps. If fishing stocks outside the protected area are already fished to their limits (i.e., limits of sustainable harvests), then displacement could also lead to adverse stock effects and a lower level of catch from all commercial fisheries. Crowding effects would represent a potential costs not accounted for in the GIS-based analysis and the potential for the existence of crowding effects would vary by alternative. Whether crowding effects are experienced will depend on the status of the fisheries outside the proposed areas, the extent of displacement, the current knowledge and fishing patterns of the displaced fishermen, and other potential regulations. The trap reduction program is an example where crowding effects could be mitigated by making room for the displaced traps.

Relocation: If displaced commercial fishermen are simply able to relocate their fishing effort and they are able to partially or completely replace their lost catch by fishing elsewhere, then there might be less or no impact. However, the possibility exists that displacement, even if it does not result in lower overall catch, may result in higher costs. This would result in lower profits to fishing operations. Whether fishermen are able to relocate to other fishing sites and replace lost catch or avoid cost increases would depend, like with the issue of crowding, on the status of the fisheries outside the proposed areas, the extent of the displacement, the current knowledge and fishing patterns of the displaced fishermen, and other potential regulations.

Replenishment: Ecological reserves or marine reserves may have beneficial effects beyond the direct ecological protection from the sites themselves. That is, both the size and number of fish, lobster, and other invertebrates both inside and outside the reserves may increase i.e., the *replenishment effect*. The quote from Davis 1998 summarizes what is currently known about marine reserves:

". . . we found 31 studies that tested whether protected areas had an effect on the size, reproductive output, diversity, and recruitment of fish in adjacent areas. Fisheries targeted species were two to 25 times more abundant in no-take areas than in surrounding areas for fish, crustaceans, and mollusks on coral and temperate reefs in Australia, New Zealand, the Philippines, Japan, Kenya, South Africa, the Mediterranean Sea, Venezuela, Chile, and the United States (California, Florida and Rhode Island). Mean sizes of fished species protected in no-take zones were 12 to 200 percent larger than those in surrounding areas for all fishes studied and in 75 to 78 percent of the invertebrates.

Eighty-six percent of the studies that tested fishery yields found that catches within three kilometers of the marine protected areas were 46 to 50 percent higher than before no-take zones were created. It is clear that fishers all over the world believe no-take zones increase yields because they fish as close to the boundaries as possible."

The long-term benefits from the reserve could offset any losses from displacement and may also result in long-term benefits and no costs (net benefits) to commercial fishermen that would be displaced by a proposed reserve. Again, this conclusion may vary by alternative.

Alternatives 1, 2 & 7

Crowding and Relocation

In the succeeding discussion of crowding, relocation and replenishment, the potential impacts of the proposed ecological reserves may be considered overestimates unless otherwise stated as to be relevant only to the EEZ portion of the proposed ecological reserves. It is worth noting, however, that the issues related to crowding, relocation, and replenishment would have to consider the effects of the entire proposed ecological reserves (not just the EEZ portion) since these areas would be closed to fishing. For example, any displaced fishing activity in the EEZ portion of the entire ecological reserves cannot be relocated to other areas in the ecological reserves.

For the lobster fishery, there is some potential for crowding costs. It is estimated that these alternatives would displace 4,346 traps. A 10% reduction in traps in the TERSA would provide space for 3,690 traps. However, if the remaining 656 traps are relocated to zones 1-3 in the Keys, there would be more than adequate space given the 10% reduction in traps that took place in Monroe County between 1997-98 and 1998-99 (475,094 to 428,411; FMRI 1998). Lobster fishermen in the TERSA catch only 68% of their lobsters from the TERSA. In addition, only about 12% of TERSA caught lobsters is affected by North and South Tortugas ecological reserves, with less than 5% being in the EEZ portion of the ecological reserves. It appears then that lobster fishermen are knowledgeable about fishing in other areas of the Keys where they might move their displaced traps. Thus, it can be concluded that the proposed ecological reserves would not result in any crowding costs for lobsters, and it is expected that lobster fishermen will be able to replace catch from other areas. Hence,

for lobsters, the potential catch reduction identified in Table 18 and consequent economic values shown in Table 19 may be partially or fully offset.

Crowding is not an issue for king mackerel because they are a coastal migratory pelagic species and catching them elsewhere is highly likely without interfering with other fishermen. In addition, commercial king mackerel fishermen in the Keys are now catching their quota before the normal end of the season, so that it is likely that fishing effort expended in the proposed ecological reserves would be redirected to other areas. There is therefore a very high likelihood that the king mackerel catch reduction shown in Table 18 and consequent reduction in economic values summarized in Table 19 would be partially or fully offset.

Potential affected shrimp fishermen currently catch only 10% of their total shrimp catch from the TERSA. Displacement of shrimp catch due to the fishing closure in the proposed ecological reserves will only be about 8% of their TERSA catch and less than 1% of their total shrimp catch. In addition, only about 6% of shrimp caught in the TERSA came from the EEZ portion of the ecological reserves, and thus would be substantially less than 1% of the fishermen's total shrimp catch. It would seem highly likely that there will be no crowding costs from displacement and given the small amounts of catch impacted, it is likely that shrimp fishermen will be able to replace partially or fully their lost catch from other sites. However, in public testimony before the Council, some fishermen indicated that shrimp effort relocation would not be feasible. For shrimp then, the potential economic losses identified in Table 19 may not be fully offset by fishing in other areas.

Reef fish fishermen comprise the largest group of TERSA fishermen. The entire proposed ecological reserves (not just the EEZ portion) would impact 40 of the sampled 42 fishermen. Reef fishermen are knowledgeable of other fishing locations outside the TERSA. In 1997, they caught 52% of their reef fish from areas in the Keys outside the TERSA. However, stocks of reef fish in the TERSA and throughout the Keys appear to be overfished. The proposed ecological reserves would displace 20% of the reef fish catch in the TERSA. The EEZ portion of the ecological reserves would displace about 6% of reef fish caught in the TERSA. Given the status of reef fish stocks, it is expected that the losses identified in Tables 18 and 19 are likely to occur in the short-term until the benefits of replenishment could offset these losses in the longer-term.

Replenishment

It is expected that there will be no replenishment benefits to king mackerel or shrimp. For lobsters and reef fish, replenishment benefits are expected. Davis (1998) provided an estimate that invertebrates and reef fish at other marine reserves had shown increases in yields of 46-50% within three kilometers of the protected areas. Also, Schmidt et al. (1999) identified 5 spawning areas in the western portion of the TERSA. Three of the five spawning areas are located within the proposed ecological reserves and will be protected, thus bolstering the replenishment effect. For lobsters, it is expected that there will be long-

term net benefits under these alternatives to the commercial fishery of the TERSA. For reef fish, it is not clear whether the full 20% lost catch from displacement would be replaced from replenishment, but the costs of displacement would be mitigated and the losses expected to be less than the 20% reductions for the entire ecological reserves and 6% for the EEZ portion of the reserves that are the basis for the losses calculated and presented in Table 19.

8.6.3 Other Potential Benefits[2]

In both the recreational industry and the commercial fishery, the potential benefits from the replenishment effect of a marine reserve were discussed. Also discussed were the potential benefits to nonconsumptive recreational users. Here, several of the most important benefits of a marine reserve are discussed: nonuse economic values, scientific values, and education values.

Nonuse Economic Values

Nonuse or passive use economic values encompass what economists refer to as option value, existence value, and other nonuse values. Kopp and Smith (1993) includes a detailed discussion on this subject. All nonuse economic values are based on the fact that people are willing to pay some dollar amount for a good or service they currently do not use or consume directly. In the case of a marine reserve, they are not current visitors (users), but derive some benefit from the knowledge that the reserve exists in a certain state and are willing to pay some dollar amount to ensure that actions are taken to keep the reserve in that state.

Option value is a bit different from other nonuse economic values in that option value is a willingness to pay for the possibility of some future use. The concept of option value was first introduced by Weisbrod (1964). As argued by Weisbrod, an individual uncertain as to whether or not he will visit some unique site at some future point in time would be willing to pay a sum in excess of his consumer's surplus to assure that the site would be available in the future should he wish to visit it. Option value then is characterized by uncertainty of both future supply and future demand. Some have questioned whether option value is a legitimate economic value (Freeman 1993). However, the U.S. Environmental Protection Agency (EPA) still lists option value as a legitimate value to be included in intrinsic benefits when conducting benefit-cost analysis of proposed regulations mandated under the terms of Executive Order 12291.

Other nonuse values have traditionally been labeled according to motive (e.g., existence value or bequeath value). The key distinctions between option value and other nonuse values is that the other nonuse values do not relate to any future use and uncertainty is not a factor. Existence value is an individual's willingness to pay a dollar amount to simply know that a resource will be protected in a given state. Bequeath value is an individual's

[2]The following information on non-use studies and assumptions is extracted from the FKNMS Supplemental Environmental Impact Statement.

willingness to pay a dollar amount to ensure the resource will be protected in a given state so one's heirs may have the opportunity to enjoy them. The motive themselves are unimportant as to the value's legitimacy, since, in economics, people's motives for their willingness to pay for any good or service is not questioned. Motives with respect to nonuse values are used simply to differentiate them from use values. Randall and Stoll (1983) argued that when estimating nonuse economic values, nonuse economic values cannot be separated from use values for users of the resource. Methods available for estimating nonuse economic values are only capable of revealing "total value" which cannot be broken down into separate components of use and nonuse. Pure nonuse economic values can only be estimated for nonusers.

The terminology of "passive use" economic values has become more accepted when referring to nonuse economic values. This change in terminology grew out of the debate over the whether nonuse economic values could actually be measured. People must have some knowledge of the resource they are being asked to place a dollar value whether it is through a newspaper, magazine, television show, etc. People must first learn about the resource and it's current state and then must make a decision about what they would be willing to pay to ensure that the resource will be protected in that state. It is of key importance that the individuals are making this decision under their budget constraints. That is, willingness to pay is constrained by a person's income and wealth and the person is forced to make a budget allocation between spending for protection of the resource or on something else.

To date there are no known studies that have estimated nonuse or passive use economic values for coral reefs or marine reserves. However, Spurgeon (1992) has offered two sets of identifiable factors which will dictate the magnitude of nonuse or passive use economic values. First, nonuse economic values will be positively related to the quality, condition, and uniqueness of the ecosystem on a national or global scale. Second, the size of population, standard of education, and environmental perception of people in the country owning or having jurisdiction over the ecosystem will be positively related to nonuse or passive use economic values. Thus, nonuse or passive use economic values are determined by both supply and demand conditions. The existence of many similar sites would reduce the value. Although Spurgeon (1992) limits his scope to the people in the country owning or having jurisdiction over the ecosystem, people from all over the world may have nonuse or passive use economic values for ecosystem protection in other countries. Debt for nature protection swaps being conducted by The Nature Conservancy in South America are just one example. Legitimacy of including the values of people from other countries is more a judicial concern than an economic one. In some judicial proceedings people from other countries might not have legal standing over issues of resource protection and their economic values may be eliminated from inclusion in the proceedings.

<u>What is known about nonuse economic values</u>

A literature search found 19 studies in which nonuse economic values were estimated. Desvouges et al. (1992) contained summaries of 18 of the 19 studies. The remaining study

was by Carson et al. (1992) on the Exxon Valdez Oil Spill. Sixteen (16) of the 18 studies found in Desvouges et al. (1992) reported values (not adjusted for inflation) of $10 or more per household per year for a broad variety of natural resource protection efforts. Of the two (2) studies that reported values less than $10/household/year, one reported $3.80/household/year for adding one park in Australia and $5.20/household per year for a second park (these estimates were from a national sample of Australians). The other study that estimated nonuse economic values less than $10/household/year was a study of Wisconsin resident's willingness to pay for protecting bald eagles and striped shiners in the State of Wisconsin. For the bald eagle, nonuse economic values had an estimated range of $4.92 to $28.38/household/year, while for striped shiners the values ranged from $1.00 to $5.66/household/year. Total value ranged from $6.50 to $75.31/household/year.

Only two (2) of the 18 studies summarized in Desvouges et al. (1992) used national samples of U.S. households, the others were limited to state or regional populations. The Exxon Valdez Oil Spill Study (Carson et al. 1992) used a national sample of U.S. households. An important caveat is that the sample included only English speaking households and eliminated Alaskan residents. Alaskan residents were eliminated to limit the sample to primarily nonusers of Prince William Sound (site of the oil spill) and non English speaking households were eliminated because the researchers were not able to convert their questionnaires to other languages. The impact was that the sample represented only 90% of U.S. households.

Carson et al. (1992) reported a median willingness to pay of $31 per household. The payment was a lump sum payment through income taxes and covered a ten year period. The funds would go into a trust fund to pay for equipment and other costs necessary to prevent a future accident like the Exxon Valdez in Prince William Sound. After 10 years, double hull tankers would be fully implemented and the need for the protection program would expire. Mean willingness to pay was higher and more variable to model specification than the median willingness to pay, so the authors argued that the median value was a conservative estimate. Applying the $31/household to only 90% of the U.S. population of households was also considered conservative since non English speaking people probably have positive nonuse economic values as do Alaskans.

Estimation of Nonuse Economic Values

In the FKNMS analysis of impacts of the Tortugas 2000 ecological reserve, an attempt was made to estimate nonuse economic values. This estimation crucially hinged on the assumption that one percent of U.S. households (about 1.13 million households) would have some positive nonuse economic values for an ecological reserve in the Tortugas. Economic values per household of $3, $5, and $10 were subsequently applied on the subject households to generate the total nonuse economic values. At a 3% discount rate, this estimation resulted in an asset value of marine reserves ranging from $113 million to $376 million. While the concept of nonuse economic values is rather well established in economics literature, the just described estimation technique may not be totally appropriate for the current purpose. At this stage, it may only be appropriate to state that nonuse

economic values are bound to result from the proposed Tortugas ecological reserves, but the magnitude may not be as what FKNMS estimated. It may also be stated that the presence of nonuse economic values offers the potential to outweigh any of the negative economic effects of the alternatives considered in this generic amendment.

Factors Supporting Positive Nonuse Economic Value

Three studies were reviewed based on national surveys of U.S. households that evaluated adults perceptions and concerns about the environment. Each of the surveys demonstrated that U.S. citizens have a high level of concern about the environment and believe the environment is threatened and requires action. In addition, one of the studies focused specifically on ocean related issues (SeaWeb 1996) and found strong support for marine protected areas. Also, the Roper survey (Roper 1990) indicated that in 1990 8% of U.S. households made financial contributions to environmental organizations.

Table 21. Environmental Opinion Study, Inc. National sample of 804 households conducted 18-26 May 1991.

Identification with Environmental Label	(%)
Strong Environmentalist	**31**
Weak Environmentalist	**29**
Lean Towards Environmentalism	**30**
Neutral	**6**
Anti-Environmentalist	**4**

The U.S. population is certainly a high income and highly educated population and, as the results above predictably show, the U.S. population has a high environmental concern. However, since the characteristics of the people valuing the reserve would be constant (U.S. households) across different proposed marine reserve alternatives, to differentiate among alternatives would require that some measurements that would serve as indicators of the relative quality, condition, and uniqueness of the proposed reserves be compared across alternatives. Unfortunately, the information to conduct this comparison is not available at this time.

Table 22. SeaWeb 1996. National Sample of 900 U.S. Households 10-15 May, 1996.

Condition of the ocean	49% very important	38% somewhat important
Destruction of the ocean on quality of life		
Today	**52% very serious**	35% somewhat serious
10 years from now	**63% very serious**	23% somewhat serious
Oceans threatened by human activity	**82% agree**	
The federal government needs to do more to help protect the oceans	**85% agree to strongly agree**	
Destruction of ocean plants/ animals	**56% very serious problem**	
Overfishing by commercial fishermen	45% very serious problem	
Deterioration of coral reefs	43% very serious problem	
Protect sanctuaries where fishing, boating, etc, prohibited	**62% strongly agree**	
Support efforts to set up marine sanctuaries	24% say they are almost certain to take this action	
Marine sanctuaries where no human activity is permitted	19% say they are almost certain to take this action	

Table 23. Roper 1989 and 1990 National Surveys

Things the Nation Should Make a Major Effort on Now	1989 (%)	1990 (%)
Trying to solve the problem of crime and drugs	78	88
Taking steps to contain the cost of health care	70	80
Trying to improve the quality of the environment	**56**	**78**
Trying to improve the quality of public school education	N/A	77
Contribute money to environmental groups	7	8

Scientific and Educational Values

Marine reserves provide a multitude of benefits. Scientific and educational values were categorized by Sobel (1996) into those things a reserve provides that increase knowledge and understanding of marine systems:

Scientific

- Provides long-term monitoring sites.
- Provides focus for study.
- Provides continuity of knowledge in undisturbed site.
- Provides opportunity to restore or maintain natural behaviors.
- Reduces risks to long-term experiments.
- Provides controlled natural areas for assessing anthropogenic impacts, including fishing and other impacts.

Educational

- Provides sites for enhanced primary and adult education.
- Provides sites for high-level graduate education.

8.7 Private and Public Cost

The preparation, implementation, enforcement, and monitoring of this or any federal action involves the expenditure of public and private resources that can be expressed as costs associated with the regulations. Costs associated with the actions contained in this generic amendment include:

Council costs of document preparation, meetings, public hearings, and information dissemination	$45,000
NMFS administrative costs of document preparation, meetings, and reviews	20,000
Law enforcement costs	none
Public burden associated with permits and data collection	none
NMFS costs associated with permits and data collection	none
TOTAL	65,000

The Council and NMFS costs of document preparation are based on staff time, travel, printing, and any other relevant items where funds would be expended directly for this specific action. There are no additional law enforcement and data collection costs at the federal level with this generic amendment. Monitoring and enforcement related to fishing activities in the proposed ecological reserves would be part of routine activities. It should be noted, though, that given certain enforcement budget and activities, the implementation of this generic amendment would entail reallocation of resources. There is no additional requirement relative to permitting or data collection, so that the cost for these activities would be zero. It is deemed that the identified costs comprise the major cost items for the preparation and implementation of this amendment.

8.8 Determination of a Significant Regulatory Action

Pursuant to E.O. 12866, a regulation is considered a "significant regulatory action" if it is likely to result in a rule that may: (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or

tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of the recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

The estimated maximum impacts of the actions proposed in this generic amendment, i.e., relative to the EEZ portion of the proposed ecological reserves, are $32,000 in output/sales for the recreational sector and $831,868 in output/sales for the commercial sector. The combined effects are therefore well below the $100 million a year threshold. Relative to 1997-1998 average catches from FMRI areas 2.0 and 2.9 and assuming no relocation of fishing activities, the proposed ecological reserves for the EEZ would reduce king mackerel by 6%, lobster by 5%, reef fish by 3%, and shrimp by less than 1%. These percentage reductions would be even much smaller when related to gulfwide landings of these species. In this regard, any resulting price increase would appear to be very minimal. The extent of impacts on the productivity of affected for-hire and commercial vessels cannot be quantified, but since the potential reductions in catch of various species are relatively small, any such adverse effects on the productivity may be deemed relatively small. With the prohibition of most fishing activities in the proposed ecological reserves, some reduction in employment may be expected. This has been estimated to be about 1 and 22 full-time equivalent jobs, respectively, for the recreational and commercial sectors. No health or safety concern has been identified from adopting the proposed actions. While fishing vessels are prohibited from anchoring in the proposed ecological reserves, emergency situations requiring vessels to anchor are allowed. With the adoption of the proposed ecological reserves in the EEZ, some consistency in regulations among the Council/NMFS, FKNMS, and state of Florida would be achieved. The proposed actions have no identified effects on entitlements, grants, user fees, or loan programs. The creation of an ecological reserve in the Gulf EEZ is a not a novel approach in terms of the Council actually adopting this type of management system. In 1999, the Council proposed two marine reserve areas in the Gulf to protect gag spawning aggregations. The Secretary of Commerce has approved this proposal and implemented the closures this year. In addition, the Council's action on this matter is based partly on the problems and issues discussed in great length by FKNMS which has experience in creating an ecological reserve and has therefore established an administrative record pertinent to this issue. In this case, the proposed actions creating an ecological reserve is determined to not raise a novel legal and policy issue.

It is, therefore, determined that the proposed actions would not constitute a major regulatory action as stipulated under E.O. 12866.

9.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to establish a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.

With certain exceptions, the RFA requires agencies to conduct an Initial Regulatory Flexibility Analysis (IRFA) for each proposed rule. The IRFA is designed to assess the impacts various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those impacts. An IRFA is conducted to primarily determine whether the proposed action would have a "significant economic impact on a substantial number of small entities." In addition to analyses conducted for the Regulatory Impact Review (RIR), the IRFA provides a description of the reasons why action by the agency is being considered; a succinct statement of the objectives of, and legal basis for, the proposed rule; a description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; a description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirements of the report or record; and, an identification, to the extent practicable, of all relevant Federal rules, which may duplicate, overlap, or conflict with the proposed rule.

Description of the reasons why action by the agency is being considered: The need and purpose of the actions are set forth in Section 6 of this document. This particular section is included herein by reference.

Statement of the objectives of, and legal basis for, the proposed rule: The specific objectives of this action are enumerated in Sub-section 8.2 of this document. This sub-section is included herein by reference. The Magnuson-Stevens Fishery Conservation and Management Act, as amended, provides the legal basis for the rule.

Description and estimate of the number of small entities to which the proposed rule will apply: There are about 12 for-hire vessels and 164 commercial vessels that would be directly affected by the proposed rule. Some description of these affected entities can be found in Sub-section 8.4 of this document and is included herein by reference. Additional descriptions are noted below in the discussion of the substantial number of small entities criterion.

Description of the projected reporting, record-keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be

subject to the requirement and the type of professional skills necessary for the preparation of the report or records: The proposed alternatives in this generic amendment neither impose additional reporting and record-keeping requirements nor alter any existing reporting and record-keeping requirements.

Identification of all relevant Federal rules which may duplicate, overlap or conflict with the proposed rule: No duplicative, overlapping, or conflicting Federal rules have been identified. In fact the actions in this amendment would complement the actions proposed by the FKNMS in the nearby areas. Commercial fishing is already prohibited in the DRTO, and thus such prohibition will be complemented by the no-fishing rule in the ecological reserves. Non-consumptive diving is allowed in both the DRTO and ecological reserves. There is a possibility that (recreational) catch and release fishing may be allowed in the DRTO and thus conflicts with the proposed no-fishing rule in North Tortugas ecological reserve, which borders the DRTO. It should be noted, however, that the EEZ portion of the North Tortugas ecological reserve is relatively far from the DRTO and the Tortugas South ecological reserve is nowhere near the DRTO. At any rate, any discrepancy in regulations may have to be addressed by FKNMS and DRTO officials.

Substantial Number of Small Entities Criterion

There are two general classes of small entities that would be directly affected by the proposed rule, namely, for-hire vessel and commercial vessel operations. Due to the location of the proposed ecological reserves, only for-hire vessels in Florida are likely to be affected by the proposed rule. Holland et al. (1999) estimated that in 1998 there were about 1,258 charterboats in Florida, with 412 boats in the Atlantic coast, 230 boats in the Keys, 432 in the Peninsula Gulf, and 183 in the Panhandle Gulf. They also estimated 111 headboats in Florida, with 42 boats in the Atlantic coast, 16 boats in the Keys, 35 boats in the Peninsula Gulf, and 18 in the Panhandle Gulf. Excluding boats in the Atlantic coast, there would be around 915 charter and head boats in Florida (inclusive of the Keys). The federal charter/headboat permitting system lists (as of August 2000) 1,048 charter/headboats in Florida, with 851 boats having both reef fish and coastal migratory pelagic permits, 84 boats having only reef fish permits, and 113 boats having only coastal migratory pelagic permits. From these two sources of information, it appears that the universe of for-hire vessels in the Gulf side of Florida (inclusive of the Keys) ranges from 900 to slightly over 1,000.

While the above number comprises the universe of for-hire vessels in Florida, it is expected that by the nature of their operation relative to the location of the proposed ecological reserves only a subset of this number is potentially exposed to the impacts of the proposed actions in this generic amendment. Leeworthy and Wiley (2000a) estimated that about 12 for-hire vessels actually operate in the TERSA for a variety of activities, including diving for lobster, non-consumptive diving, fishing, and spearfishing. All these 12 operations would be potentially affected by the proposed rule. These vessels are located in Key West, Marco Island, and Naples. As earlier shown in Table 5, total combined annual revenues

generated by these 12 vessel from their operations inside and outside the proposed ecological reserves amounted to about $1.4 million, or an average of $117,000 per vessel. These vessels clearly fall within the general definition of "small businesses," since their individual annual gross receipts are not in excess of $5 million.

Commercial fishing vessels in Florida are much more numerous than for-hire vessels. The RIR analysis determined that vessels fishing for reef fish, king mackerel, lobster, and shrimp are the ones that would be affected by the proposed rule. The federal permitting system on commercial vessels lists around 1,000 vessels with reef fish permits and 1,900 vessels with king and/or Spanish mackerel permits as based in Florida. Some of the vessels with mackerel permits are located in the east coast of Florida, and some vessels have both reef fish and mackerel permits. Also, there are around 700 vessels/boats in Florida fishing for spiny lobster (Vondruska 1998) and about 1,700 shrimp boats based in Florida (Travis, pers. comm. 2000).

While these vessels/boats may comprise the universe of commercial vessels/boats in Florida fishing for the subject species, only a subset thereof is exposed to the impacts of the proposed rule. Leeworthy and Wiley (2000a) determined that, in their scrutiny of Florida Saltwater Product License holders, a population of 105 to 110 commercial fishing operations representing 164 vessels and 270 crew (inclusive of captains) actually recorded catches from the TERSA. Noting that the TERSA is a much wider area than the proposed ecological reserves, about 164 vessels may be considered to comprise the universe of commercial fishing operations that is potentially affected by the proposed rule. As earlier shown in Table 7, these vessels generated an aggregate of approximately $7 million in gross revenues, or about $44,000 per vessel. Clearly these vessel operations fall within the definition of "small businesses," since their individual annual gross receipts are well below $3 million.

The number of for-hire vessels (12) potentially affected by the proposed rule is about 7 percent of for-hire vessels based in Key West (107), Marco Island (21), Naples (35). Based on sampled observations, Leeworthy and Wiley (2000a) determined that number of commercial fishing operations in the TERSA that may be affected by the proposed ecological reserves would be about100 percent for king mackerel, 96 percent for spiny lobster, 95 percent for reef fish, and 83 percent for shrimp. Based on this information, it is concluded that at least for the commercial sector, a substantial number of small entities would be impacted by the proposed rule.

Significant Economic Impact Criterion

The outcome of "significant economic impact" can be ascertained by examining two issues: disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All the commercial entities potentially affected by the proposed rule are considered small entities so that the issue of disproportionality does not arise in the present case. It may be noted, however, that the short-term adverse effects of the proposed rule would fall more on the commercial fishing operations than on the for-hire operations, in terms of both the number of entities affected and amount of economic values involved. The affected for-hire vessels would stand to forgo aggregate gross revenues amounting to $28,571 from the EEZ portion of the ecological reserves, or $152,054 from the entire ecological reserves. On the other hand, the revenue losses to the commercial fishing operations would amount to $389,653 from the EEZ portion of the ecological reserves, or $864,477 from the entire ecological reserves. Among the commercial fishing operations, the revenue reductions from the EEZ portion of the ecological reserves would be $184,450 for spiny lobster, $123,937 for shrimp, $73,531 for reef fish, and $7,731 for king mackerel. The corresponding revenue losses from the entire ecological reserves would be $450,851 for spiny lobster, $240,282 for reef fish, $160,528 for shrimp, and $12,814 for king mackerel. Thus, spiny lobster fishing operations would incur the highest revenue losses among all fishing operations affected by the proposed ecological reserves. One other point to consider here is that these losses are maximum losses when displaced fishing activities cannot be transferred to areas outside the proposed ecological reserves.

Profitability: Do the regulations significantly reduce profit for a substantial number of small entities?

For the for-hire vessels, profits mean total revenues minus total costs, as these information were available from the specialized survey (Leeworthy and Wiley 2000a). The affected for-hire vessels would lose profits amounting to $5,357 from the EEZ, or $55,785 from the entire ecological reserves. Relative to total profits from the TERSA of $355,662, the proposed ecological reserves would mean profit reductions of about 1.5 percent from the EEZ, or 15.7 percent from the entire ecological reserves. Profit reduction then for an average for-hire vessel would be relatively small when only EEZ operations are considered but would be relatively significant when operations in the entire ecological reserves are taken into account.

Leeworthy and Wiley (2000a) did not report profits from commercial vessels, partly due to the difficulty of collecting information on fixed costs and amount of investment on the vessels. For the purpose of estimating non-market values, these authors derived the vessels' return to labor and capital using the Kearney/Centaur (1988) cost and earnings study. For the present purpose of assessing the impacts of the proposed rule on vessel profitability, different sources are used to develop estimates of profits in the commercial harvest operations. Table 24 below shows the profit estimates for the four affected species and for various areas of concern. Profits are derived by multiplying species-specific revenues by corresponding profit ratios.

Table 24. Revenues and profits for commercial fishing operations, by species and areas.

Species/ Species Group	Profit/Revenue Ratio	TERSA		Entire Ecological Reserves		EEZ Reserves	
		Revenue	Profit	Revenue	Profit	Revenue	Profit
Lobster	0.292[1]	3,892,501	1,137,000	450,851	131,694	184,450	53,878
Shrimp	0.073[2]	1,967,625	144,030	160,528	11,751	123,937	9,072
Reef Fish	0.233[3]	1,183,763	276,172	240,282	56,058	73,531	17,155
K. Mackerel	0.244[4]	91,529	22,370	12,814	3,132	7,731	1,889
Total		7,135,418	1,579,571	864,475	202,634	389,649	81,994

[1]Milon et al. (1999)
[2]Ward et al. (1995)
[3]Waters et al. (1999)
[4]Vondruska (1998)

Relative to TERSA profits, the combined commercial vessel profits from the EEZ portion and the entire ecological reserves would be reduced by approximately 5 percent and 13 percent, respectively. Profit losses from operations in the EEZ portion of the ecological reserves would range from about 5 percent for king mackerel to 8 percent for shrimp. The corresponding profit losses from the entire ecological reserves would range from about 8 percent for lobster to 20 percent for reef fish. Profit reductions particularly for reef fish and shrimp operations may be more severe than those for king mackerel and spiny lobster, since as discussed earlier the potential for shifting reef fish and shrimp fishing effort to other areas is very low.

Considering the potential adverse effects on both the commercial and for-hire vessel operations, as described above, it is determined that the proposed rule will have a significant economic impact on a substantial number of small business entities.

Description of significant alternatives to the proposed rule and discussion of how the alternatives attempt to minimize economic impacts on small entities: There are 3 sets of alternatives considered in this amendment. The first relates to the area considered for marine reserves, the second relates to the duration of the marine reserves designation, and the third provides for allowable activities within the marine reserves. Regarding the area for marine reserves, two other alternatives were considered, namely, the status quo and a smaller area covering Riley's hump. These two other alternatives would definitely provide lesser adverse impacts on small entities, but they would not offer the type of protection to EFH or some of the managed species afforded by the larger area covered for marine reserve designation. The status quo option, in particular, provides a higher risk that habitat damage and fisheries exploitation in the specified areas could result in long-term adverse impacts to eco-tourism, the diving industry, and other fisheries. With respect to the duration of the marine reserves,

two other alternatives were considered, one for a permanent duration and the other for a period of 5 or 10 years. For the latter, the 10-year duration does not differ in terms of effects on small entities from the Proposed Alternative, which also provides for a 10-year duration. There is also a good likelihood that the 5-year duration would provide similar effects on small entities as the 10-year duration. If the effects are materially negative without any potential for being eventually compensated for by the positive effects of marine reserves, the 5-year duration would be long enough to impose a lasting impairment on the operations of the affected small entities. If, on the other hand, the negative effects are not materially negative, a 5-year accumulation of gradual impacts may be tolerable, but a 10-year accumulation of such impacts could likely bring some business operations to bankruptcy, particularly if displaced fishing effort cannot be effectively relocated to other areas. Along this line also, the option to permanently establish marine reserves would do worse, since it would totally eliminate the opportunity for small entities to resume their operations. Between a 5-year, 10-year, and permanent duration, the 10-year duration probably provides enough time to determine whether marine reserves have started to achieve the desired necessary protection to EFH and relevant managed species. Regarding the restriction on activities in the marine reserves, two other alternatives were considered, namely, prohibition of all gear except trolling within the marine reserves, and prohibition of all fishing within the marine reserves except catch and release. These two other alternatives are likely to have the same impacts on small entities as the Proposed Alternatives, except that they would likely tend to increase enforcement costs.

10.0 IMPACTS ON FISHING COMMUNITIES

National Standard 8 of the Magnuson-Stevens Fishery Conservation and Management Act provides that conservation and management measures take into account the importance of fishery resources to fishing communities in order to provide for the sustained participation of such communities and to the extent practicable, minimize adverse economic impacts on such communities. The National Standard Guidelines defines fishing community as "a community that is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities." An important part of this definition is that the social or economic group forming this community resides in a specific location. In view of this, the first task to consider is the identification of specific locations of possible fishing communities, and then determine the extent of adverse impacts on these communities due to the proposed rule.

Leeworthy and Wiley (2000b) conducted a community impact analysis of the proposed ecological reserves. In addition, the Gulf Council attempted to identify potential fishing communities around the Gulf as part of its generic SFA amendment. Considering that both these documents rely on census data to provide some characterization of potential fishing communities, the identified areas are similar. The succeeding discussion is mainly based on the Leeworthy and Wiley (2000b) study.

It may noted at this juncture that the basic conclusion of the Leeworthy and Wiley (2000b) study is that the proposed ecological reserves would not have a significant adverse impact on affected communities. In view of the fact that the ecological reserves proposed in this generic amendment pertain only to the EEZ portion of the entire ecological reserves, a similar conclusion of no significant adverse impacts on affected communities may be made. At any rate, the succeeding discussion provides certain characteristics of the affected communities and the economic impacts on those communities.

Tables 25 below shows the number of for-hire fishing operations affected by the proposed ecological reserves. The operators are spread across four communities by location of business and across five communities by place of residence of charterboat operators. Considering the fact that there are only few affected for-hire businesses coupled by the fact that they are spread out among several communities, the adverse impacts on each community from the proposed ecological reserves would be relatively insignificant. In the particular case of the EEZ portion of the ecological reserves, it was earlier estimated that the potential loss to the for-hire sector would amount to about $28,000 in revenues, $12,000 in income and 1 job. Spreading these relatively small figures across several communities would result in very minimal economic impacts on the affected communities.

Table 25. Number of Recreational Charter Boat Fishing Operators Affected by the Proposed Ecological Reserves

Community	Operators by Location of Business	Operators by Residence of Operator
Key West	4	3
Naples	2	2
Fort Myers	1	0
Marco Island	1	0
Bradenton	0	1
Englewood	0	1
Big Pine Key	0	1

Table 26 shows the number of commercial fishing operations that would be affected by the proposed ecological reserves. The commercial fishing operations are concentrated in only three communities by location of where the fish is landed and dispersed across 13 communities by residence of the fishermen. A further look at three communities, namely, Key West City, Stock Island CDP, and Fort Myers CDP, can shed some insights into the impacts of the proposed ecological reserves on fishing communities.

Table 26. Number of Commercial Fishing Operations Affected by the Proposed Ecological Reserves

Community	Operations by Place of Fish Landed	Operations by Residence of Fishermen
Key West City	0	20
Stock Island CDP	52	20
Ft. Myers Beach CDP	8	8
Big Coppitt Key CDP	0	3
Big Pine Key CDP	0	3
Ft. Lauderdale City	0	1
Key Largo CDP	0	1
Lynn Haven City	0	1
Naples City	3	3
Panama City, City	0	1
Plantation Keys CDP	0	1
Tavernier CDP	0	1

Table 27 shows the relative profiles of the three communities in comparison with Monroe County (home of Key West and Stock Island CDP), Lee County (home of Ft. Myers Beach CDP), and the entire State of Florida. Data from the 1990 Census was used because it is the most current data that can be obtained at the community level. Results from the 2000 Census for communities is not currently available.

Table 27. Selected Characteristics of Florida Communities Affected by the Proposed Ecological Reserves

Community/ County	Population (1990 Census)	Sex Ratio M/F	% Married Family Household	% of High School Graduate (25 & over)	Civilian Unemployment Rate (%)	1989 Per Capita Income ($)	Employment % Agriculture and Forestry
Key West	24,832	1.14	43.4	79.9	3.31	15,547	2.17
Stock Island CDP	3,613	1.11	42.9	56.8	4.05	9,872	7.9
Ft. Myers B. CDP	9,284	0.96	60.7	79.8	6.81	19,445	3.32
Monroe County	78,024	1.11	61.8	79.7	3.31	18,869	3.89
Lee County	335,113	0.93	71.6	76.9	4.45	15,623	1.98
Florida	12,937,926	0.94	68.9	74.4	5.8	14,698	1.74

Key West had a 1990 population of 24,832. A relatively high proportion of its residents age 25 and over had at least a High Scholl education. Although 1989 per capita income was slightly higher than that for the entire State of Florida, it was slightly lower than that for the rest of Monroe County. Only 2.17 percent of Key West's employment is listed as being in agriculture, forestry and fishing. Since there is no agriculture or forestry in Key West, it can be fairly assumed that the employment in this category is all fishing. All 20 of the commercial fishing operations that fish in the proposed ecological reserves and live in Key West land their catch in Stock Island CDP.

Ft. Myers Beach CDP had a 1990 population of 9,284. A relatively high proportion of its residents age 25 and over have at least a high school education and had a significantly higher 1989 per capita income as compared with any of the areas listed in Table 27. Only 3.32 percent of Ft. Myers Beach CDP employment was in agriculture, forestry or fishing in 1990. Currently, there are five wholesale fishing businesses and five retail seafood businesses listed in Ft. Myers Beach CDP. Eight of the 63 fishing operations impacted by the proposed ecological reserves land their catch in Ft. Myers Beach CDP.

Stock Island, located in Monroe County just north of Key West, is the smallest community, has a significantly lower per capita income than the other communities, has a higher civilian rate of unemployment, has the lowest percent of high school graduates, and is more dependent on the fisheries than any of the other communities impacted. Of the 63 affected commercial fishing operations, 52 land their fish on Stock Island. Stock Island contains six wholesale seafood operations, one seafood packer and two seafood retail outlets. Stock Island comes closest to meeting the 20 percent criterion to be considered a fishing community with 7.9 percent of its employment listed in agriculture, forestry and fishing. Since there is no agriculture or forestry on Stock Island, it is fair to assume that all of this employment is related to fishing.

The foregoing information demonstrates that none of the affected communities may be considered "fishing communities." At any rate, some analysis of impacts is presented below. For the current purpose, analysis is restricted to two communities; 1) Stock Island CDP in Monroe County, Florida and 2) Ft. Myers Beach CDP in Lee County, Florida. These two communities have the highest concentrations of fishing landings that are impacted.

Stock Island CDP

Based on data collected through a survey, the proposed ecological reserves would affect 63 commercial fishing operations, 52 of which land their catch in Stock Island CDP. These 52 commercial fishing operations include 65 fishing vessels which are manned by captain and crew of approximately 180. There are 27 operations fishing for lobsters with a total captain and crew of 75, 9 operations fishing for shrimp with a total captain and crew of 25, 14 operations fishing for king mackerel with a total captain and crew of 38, and 33 operations fishing for reef fish with a total captain and crew of 83. The total number of fishing operations and captain and crew is less than the addition across operations by species of catch because fishing operations and captain and crew fish multiple species.

The above numbers on fishing operations and number of captain and crew affected overstate the potential impact in that these fishing operations and captain and crew fish in areas other than the proposed ecological reserves. The 52 fishing operations that fish in the proposed ecological reserves caught 9.1% of their total lobster catch, 15.1% of their total reef fish, 2.5% of their total king mackerel, and 3.0% of their total shrimp within the proposed ecological reserves. Overall, 8.73% of their total ex vessel value of catch from all areas would be lost, assuming they are not able to replace this catch from fishing in other areas. These fishing operations derive 86.6% of their total incomes from fishing, thus about 7.5% of their incomes might be potentially lost.

The above estimates represent the maximum potential loss under the assumption that lost catch from displacement of fishing effort from the closed area cannot be replaced by reallocating fishing effort to other locations. This assumption does not necessarily hold true for some of the fisheries. King Mackerel is a pelagic species and highly mobile. In addition, the commercial quota for king mackerel in the South/West area of the Eastern Zone has been reached every year. It is then highly likely that king mackerel catches from the closed areas could be replaced by catches in other areas. For lobsters, the State of Florida's trap reduction program reduces the number of total traps in the fishery more than enough to accommodate the relocation of traps to other areas. In addition, given that there is no relationship between the number of traps and total lobster catch, it is expected that there will be no losses in lobster catch.

For reef fish and shrimp, the maximum potential losses could occur, especially in the short-run, i.e., before the long-term gains of stock replenishment could be realized. Many reef fish species are currently considered to be overfished or reaching an overfished status throughout the region. Simply relocating fishing effort is unlikely to result in replacement of lost catch.

For shrimp, some fishermen have said that they cannot replace lost catch by simply reallocating effort to other locations. So for both reef fish and shrimp, the short-run maximum potential losses are highly likely to occur.

The net affect for reef fish and shrimp losses would mean that the 52 commercial fishing operations that land their catch in Stock Island lose about 3.5% of their fishing revenues and approximately 3 % of their total incomes due to being displaced from the closed area. It should be noted, however, that these losses pertain to those from the no-fishing rule for the entire ecological reserves, and only a portion thereof come from the EEZ.

Ft. Myers Beach CDP

Of the 63 commercial fishing operations that would be impacted by the proposed ecological reserves, only 8 landed their catch in Ft. Myers Beach CDP. All the owners of these operations also lived in Ft. Myers Beach CDP. These 8 commercial fishing operations include 8 fishing vessels which are manned by captain and crew of 22. There are 5 operations fishing for shrimp with a total captain and crew of 15 and 3 operations fishing for reef fish with a total captain and crew of 7.

The 8 fishing operations that fish in the proposed ecological reserves caught 4.0% of their total shrimp catch and 1.0% of their total reef fish from within the reserves. Overall, 1.2% of their total ex vessel value of catch from all areas would be lost, assuming they are not able to replace this catch from fishing in other areas. These fishing operations derive 100% of their total incomes from fishing, thus about 1.2% of their incomes might be potentially lost.

The above estimates represent the maximum potential loss under the assumption that lost catch from displacement of fishing effort from the closed area cannot be replaced by reallocating fishing effort to other locations. This assumption is not always supported once we consider other offsetting or mitigating factors. For reef fish and shrimp, the maximum potential losses could occur, especially in the short-run, i.e., before the long-term gains of stock replenishment could be realized. Reef fish are currently considered to be overfished throughout the region. Simply relocating fishing effort is unlikely to result in replacement of lost catch. For shrimp, some fishermen have said that they cannot replace lost catch by simply reallocating effort to other locations. So for both reef fish and shrimp we can assume that in the short-run, the maximum potential losses are highly likely to occur.

The net affect for reef fish and shrimp losses would mean that the 8 commercial fishing operations that land their catch in Ft. Myers Beach CDP would lose about 1.2% of their fishing revenues and approximately 1.2% of their total incomes due to being displaced from the closed area. Again, it should be noted that these losses are from the entire ecological reserves, and only a portion thereof comes from the EEZ.

11.0 FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

11.1 Summary

This integrated Final Supplemental Environmental Impact Statement (FSEIS) includes information needed to evaluate potential impacts to the environment resulting from management alternatives of establishing a marine reserve included in this amendment. A notice of intent to prepare a Draft Supplemental Environmental Impact Statement (DSEIS) and request for comments was published in the Federal Register on March 29, 2000. The DSEIS was filed with the Environmental Protection Agency (EPA) on June 30, 2000. A Notice of Availability for the DSEIS and request for comments was published in the Federal Register on July 7, 2000.

This FSEIS supplements previously completed FEISs in Council FMPs. Specifically, this FSEIS supplements: the EIS included in the Coastal Migratory Pelagics FMP (July 1981) and the Supplemental Environmental Impact Statement (SEIS) included with Amendment 1 (April 1985) to the FMP; the EIS included in the Coral and Coral Reefs FMP (April 1982) and the SEIS included in Amendment 2 (September 1994) to the FMP; the EIS included in the Red Drum FMP (December 1986); the EIS included in the Reef Fish FMP (August 1981); the EIS included in the Shrimp FMP (February 1981) and the SEIS included in Amendment 9 (February 1997) to the FMP; the EIS included in the Spiny Lobster FMP (March 1982); and the EIS included in the Stone Crab FMP (April 1979). Please refer to Sections 3.0, 4.0, 5.0, 6.0, and 7.0 for further background information on this action.

As the implementation of these marine reserves is a collaborative effort with the FKNMS as noted in Sections 3.0 and 5.0, further related information can be found in the FKNMS DSEIS/Draft Supplemental Management Plan for the Tortugas Ecological Reserve.

11.2 Table of Contents

11.3 Purpose and Need for Action

Please refer to Sections 5.0 (p.5) and 6.0 (p.6) for information on the purpose and need for action on this issue.

11.4 Management Alternatives

Please refer to Section 8.3 (p.12) for information on the management alternatives for this issue.

11.5 Affected Environment

The Tortugas region refers to a roughly 480 square nautical mile (480 nm^2) area of open ocean containing several carbonate banks, one of which is emergent with 7 small, sandy islands (Figure 3). The Tortugas region is remote – located approximately 70 miles west of Key West and over 140 miles from mainland Florida. Due to its remote location away from population centers, its coral reef, hardbottom, and seagrass communities are bathed by the clearest and cleanest waters in the Florida Keys archipelago. The area's rich biodiversity is fueled by the confluence of strong ocean currents emanating from the Gulf of Mexico and Caribbean Sea. The deeper water portions of the Tortugas are afforded some protection by the FKNMS while the shallower areas and the associated islands are afforded some protection by the DRTO, which is not part of the FKNMS. The DRTO was established in 1992 by the NPS.

The following sections describe the physical, ecological, and human use characteristics of the Tortugas region. Descriptions include information on the FKNMS and DRTO as they are an inseparable part of the overall ecosystem and because they include some of the most well-studied areas of the Tortugas.

11.5.1 Geology

The Tortugas are comprised of a series of carbonate banks situated on the southwest Florida continental margin (Figure 4). The banks define a roughly circular pattern and were described as an atoll by Vaughan (1914). The shallow rim of the atoll is discontinuous and consists of Holocene (<10,000 years old) corals and several sandy islands including Loggerhead Key, Bush Key, and Garden Key. These banks occupy a transitional zone between the south and east facing rimmed margin (to the east) and the west facing ramp margin (to the north) of the Florida Carbonate Platform.

The Holocene reefs which comprise the Dry Tortugas are approximately 14 meters (46 feet) thick, are composed of massive head corals such as *Montastrea sp.*, and are situated upon an antecedent high of the Key Largo Limestone, an oxygen isotope substage 5e (~125 ka) reef also composed of massive head corals (Shinn et al. 1977). The reefs surrounding the area represent windward reef margins in regards to their orientation relative to the dominant

wind and wave energies (Hine and Mullins 1983). Tidal energy is also important in the area with exchange occurring between the southwest Florida Shelf (Gulf of Mexico waters) to the north, and the Florida Straits to the south (Shinn et al. 1989).

Two additional significant carbonate banks are situated in close proximity to the Dry Tortugas. These include Tortugas Bank and Riley's Hump. Tortugas Bank crests at approximately 20 meters, and is located directly west of the Dry Tortugas reefs (Figures 3 and 4).

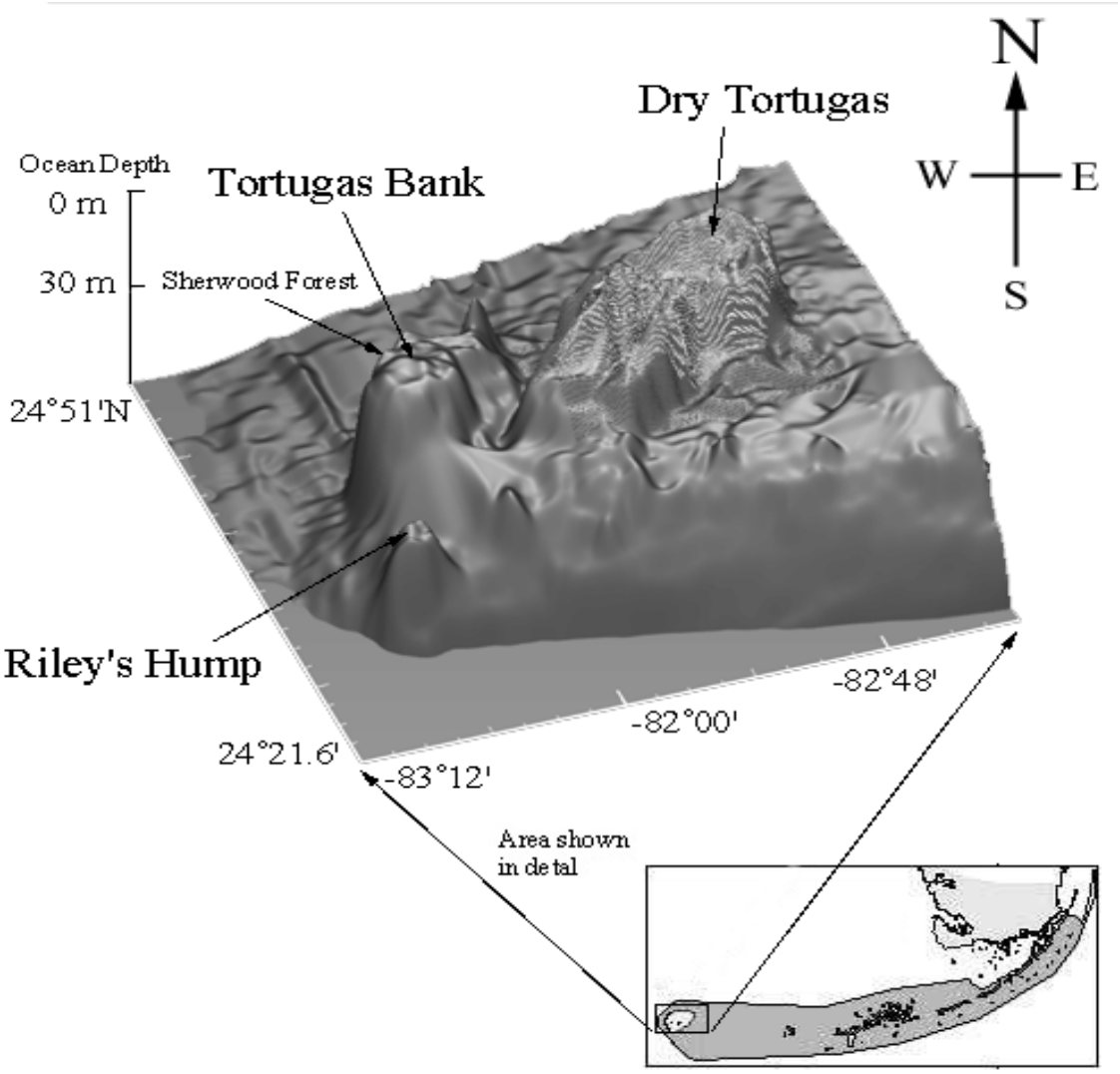


Figure 3. Map showing an exaggerated, three-dimensional rendering of the ocean floor with the location of the Dry Tortugas, Tortugas Bank, and Riley's Hump (courtesy of Dr. Ault, University of Miami).

A northeast-southwest trending channel, ~34 meters deep and 5 km wide, separates Tortugas Bank from the Dry Tortugas reefs. Tortugas Bank has a 30 meter escarpment on the west side and a 15 meter face on the east side. Sediment aprons drape the flanks of the bank and small patch reefs occur on the top of the bank. Recent geological investigations by the University of South Florida Department of Marine Science illustrate that Tortugas Bank consists of reef framework formed during multiple sea-level fluctuations. Uranium-series

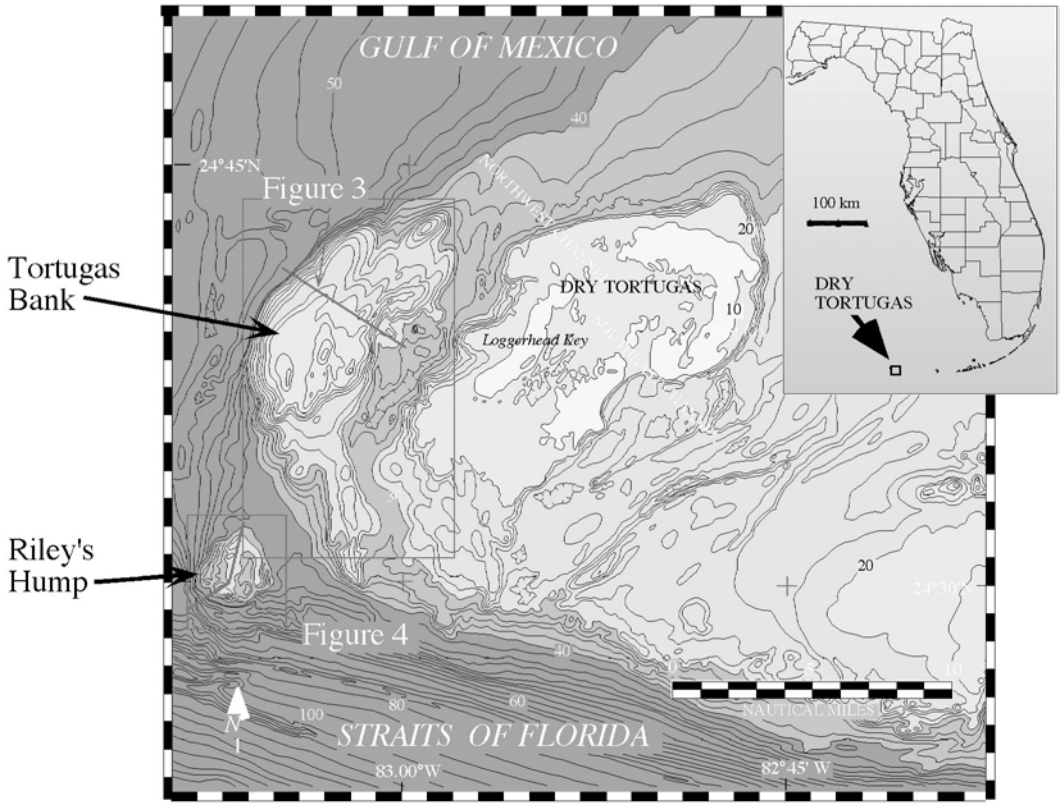


Figure 4. Map showing the location of the Dry Tortugas, Tortugas Bank, and Riley's Hump. Contours are in meters below sea level.

and radiocarbon dates of core material are pending. Seismic data and core data initially suggest that the bank consists dominantly of Stage 5a reef framework sediments, overlying highly altered Stage 5e reef sediments. This would indicate that Tortugas Bank is contemporary with the outlier reefs seaward of the Keys reef tract (Lidz et al. 1991; Ludwig et al. 1996). Riley's Hump is a carbonate bank cresting at ~30 meters directly south-southwest of Tortugas Bank (Figures 3 and 4). The southern face of the bank exhibits a 20 meter escarpment situated at the shelf/slope break. Thick sedimentary deposits fill a trough separating Riley's Hump from Tortugas Bank to the north. Based on the position of Riley's Hump, it is estimated that it may be equivalent in age to the Florida Middle Ground, possibly stage 3.

11.5.2 Physical Oceanography and Recruitment Pathways

Available information clearly illustrates that the Tortugas region is unique in its location and the extent to which oceanographic processes impact the area. More importantly, the Tortugas may play a dynamic role in supporting marine ecosystems throughout south Florida and the Florida Keys (Figure 5). Larvae that are spawned from adult populations in the Tortugas may be spread throughout the Keys and south and southwest Florida by a system of currents and eddies that provide the retention and current pathways necessary for successful settlements of both local and foreign-spawned recruits, with larval stages ranging in duration from hours for some coral species to one year for spiny lobster. Additionally, the
upwellings and convergences of the current systems provide the necessary food supplies in concentrated frontal regions to support larval growth stages.

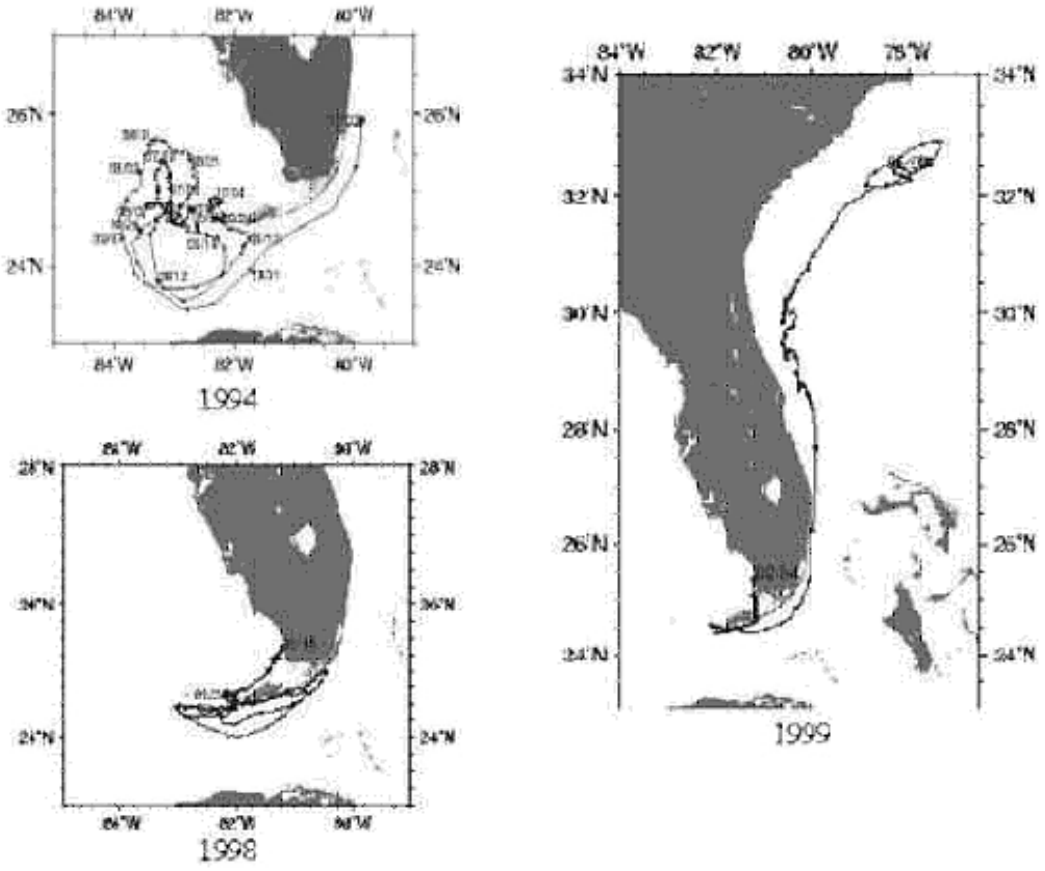


Figure 5. Satellite-tracked drifters showing connectivity of the Tortugas area with rest of the Gulf of Mexico/South Atlantic region (courtesy of Dr. Lee).

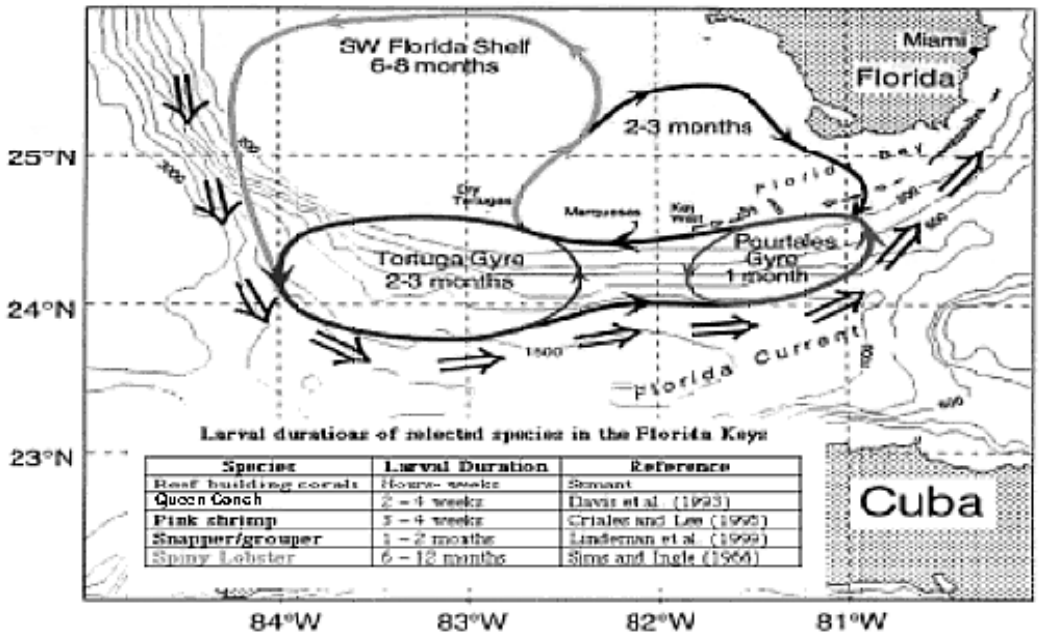


Figure 6. Schematic of possible recruitment pathways for fish and lobster larvae spawned locally in the Dry Tortugas and Florida Keys.

The Tortugas are located at the transition between the Gulf of Mexico and the Atlantic. As such, they are strongly impacted by two major current systems, the Loop Current in the eastern Gulf of Mexico and the Florida Current in the Straits of Florida, as well as by the system of eddies that form and travel along the boundary of these currents. Of particular importance to ecosystems of the Tortugas and Florida Keys is the formation of a large counter-clockwise rotating gyre (large eddy) that forms just south of the Tortugas where the Loop Current turns abruptly into the Straits of Florida (Figure 6). This gyre can persist for several months before it is forced downstream along the Keys, decreasing in size and increasing in forward speed until its demise in the middle Keys. This gyre serves as a retention mechanism for local recruits, and as a pathway to inshore habitats for foreign recruits. The gyre may also supply a source of food through plankton production and concentration.

The Tortugas are also located adjacent to two coastal current systems, including the wind–driven currents of both the Florida Keys coastal zone and the west Florida shelf. Persistent westward winds over the Keys create a downwelling system that drives a westward coastal countercurrent along the lower Keys to the Tortugas. The countercurrent provides a return route to the Tortugas and its gyre–dominated circulation, and onshore surface Ekman transport (a process whereby wind–driven upwelling bottom water is transported ~45˚ to the left of the actual wind direction in the northern hemisphere) provides a mechanism for larval entry into coastal habitats. Circulation on the west Florida shelf is

strongly influenced by wind forcing, but there also appears to be a significant southward mean flow, possibly due to the Loop Current. The effect of these currents on the Tortugas is to provide a larval return mechanism to the Florida Bay nursery grounds during periods of southeast winds, as well as a transport mechanism for low-salinity shelf waters from the north when the mean southward flow is strong.

The combination of downstream transport in the Florida Current, onshore Ekman transport along the downwelling coast, upstream flow in the coastal countercurrent, and recirculation in the Tortugas gyre forms a recirculating recruitment pathway stretching from the Dry Tortugas to the middle Keys which enhances larval retention and recruitment into the Keys coastal waters of larvae spawned locally or foreign larvae from remote upstream areas of the Gulf of Mexico and Caribbean Sea. Convergences between the Florida Current front and coastal gyres provide a mechanism to concentrate foreign and local larvae, as well as their planktonic food supply. Onshore Ekman transport and horizontal mixing from frontal instabilities enhance export from the oceanic waters into the coastal zone. A wind- and gyre-driven coastal countercurrent provides a return leg to aid larval retention in local waters. Seasonal cycles of the winds, countercurrent and Florida Current favor recruitment to the coastal waters during the fall when the countercurrent can extend the length of the Keys from the Dry Tortugas to Key Largo, onshore Ekman transport is maximum and downstream flow in the Florida Current is minimum. The mix and variability of the different processes forming the recruitment conveyor provide ample opportunity for local recruitment of species

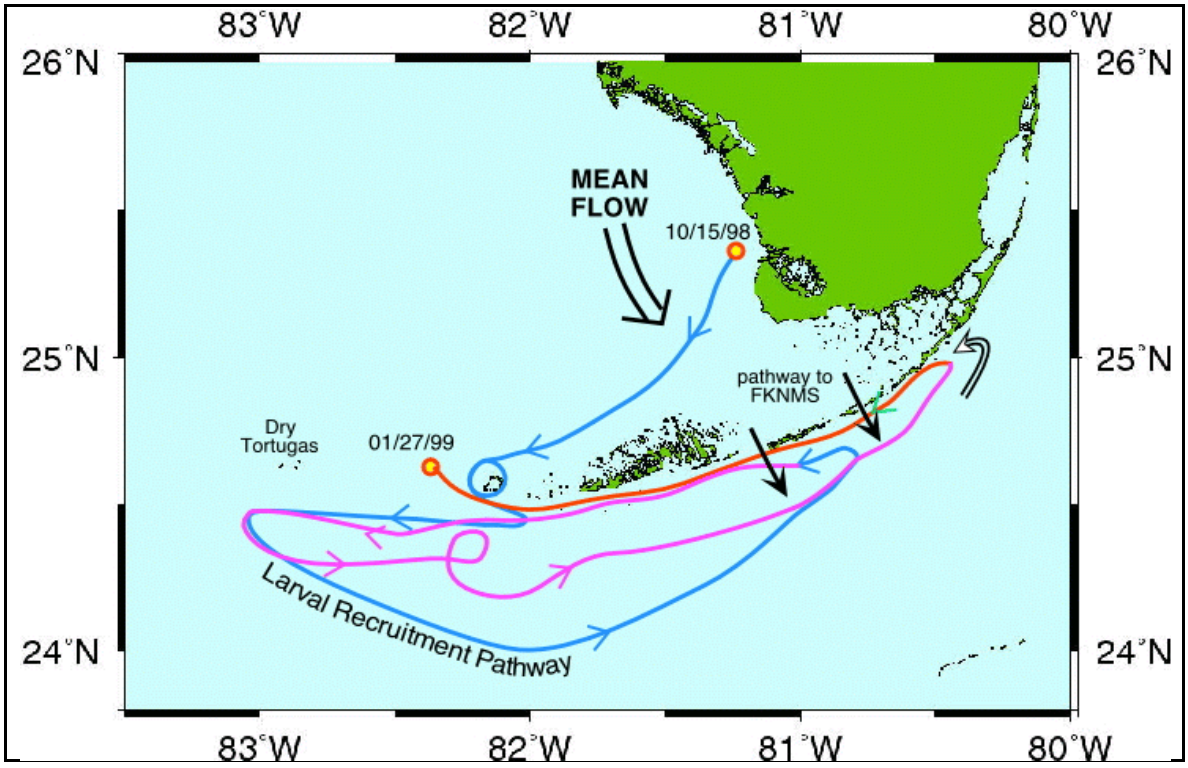


Figure 7. Satellite drifter track of #23113 demonstrating complexity of currents in the Florida Keys and the existence of recruitment pathways for fish and invertebrate larvae (courtesy of Dr. Lee).

with larval stages ranging from days to several months (Figure 6). For species with longer larval stages, such as spiny lobster (*Panulirus argus),* which has a 6 to 12 month larval period, a local recruitment pathway exists that utilizes retention in the Tortugas gyre and southwest Florida shelf and return via the Loop Current and the Keys conveyor system. Return from the southwest Florida shelf could also occur through western Florida Bay and the Keys coastal countercurrent, due to a net southeastward flow recently observed connecting the Gulf of Mexico to Atlantic through the Keys (Figure 7).

11.5.3 Benthic Habitats

The following is a description of both the benthic (seafloor) habitats found within the DRTO and the deeper water habitats found in FKNMS waters to the west of the DRTO boundary.

Dry Tortugas National Park

Dry Tortugas was discovered by Ponce de Leon in 1513. Natural history expeditions to the area in the nineteenth century included Louis and Alexander Agassiz, and Louis Pourtales. The greatest contribution in documenting marine benthic resources during this era is a map of submerged habitats published by Alexander Agassiz (1882). In 1904, the Carnegie Institution established a marine laboratory on Loggerhead Key, Dry Tortugas (Mayer 1902). Under Alfred G. Mayer's direction, the Tortugas laboratory was a leading research facility studying the biology, geology, and the environmental conditions of the Dry Tortugas and adjacent areas (Davenport 1926; Colin 1980). The Carnegie Institution, Washington, D.C., has published a complete set of the publications resulting from the research at the Tortugas Laboratory. Seminal coral reef work includes studies from Vaughan (1911, 1914, 1915, 1916), Mayer (1914, 1918), and Wells (1932). Subsequent publications on Tortugas coral reefs include Shinn et al. (1977), Thompson and Schmidt (1977), Davis (1979, 1982), Halley (1979), Dustan (1985), Jaap et al. (1989), and Jaap and Sargent (1993). Schmidt and Pikula (1997) contains an annotated bibliography of scientific studies conducted within DRTO.

Current research at Dry Tortugas benefits from the historical data base, relative isolation, and from the fact that the Dry Tortugas has been a National Park with a history of protecting natural resources. Within DRTO, commercial fishing is prohibited and recreational fishing is limited to hook-and-line fishing for finfish. Lobster, conch, and other benthic resources are totally protected within the park boundaries.

The physiography-bathymetry of the Dry Tortugas is complex and dynamic. The DRTO is an elliptical area with a northeast to southwest axis. The approximate dimensions are 11 nautical miles NE to SW and 5.5 to 6 nautical miles SE to NW (Figure 10). Depth outside the ellipse is 18 m (60 ft) or greater. The park boundaries are designated by buoys (listed on the charts as buoys A, C, E, H, I, J, K, L, N, O). The park includes approximately 1,002 miles (25,900 hectares), less than one percent of which is terrestrial (Davis 1982). This ellipsoid area has three major components: a crescent-shaped shoal on the east that includes East and Middle Keys; a shoal that extends from Iowa Rock in a southwestern trend for

approximately 4 nautical miles and includes Bush, Garden, and Long Keys; and a western shoal including Loggerhead Key and extending northeast to southwest approximately 5.4 nautical miles. A relatively deep basin (12 to 20 m; 40 to 67 ft) occupies the central portion of the ellipse. Three channels to the outside-deeper waters (Southeast, Southwest, and Northwest) converge in the basin. Smaller shoal-water banks (emergent or semi-emergent at low tides) and reefs are found throughout the basin (including Hospital Key, Middle Ground, White Shoal, and Texas Rock).

A recent collaborative effort by the FMRI and NOAA provides a recent estimate (Table 28) of benthic habitats in the Dry Tortugas and adjacent areas outside the park boundaries.

Algal Communities

Algal communities are the most ephemeral of the benthic communities. Davis (1982) reported that the distribution of brown algae was restricted to rocks or rubble in areas of high

Habitat	Acres	Hectares	Percent
Patch Reefs	1,760	710	2.07
Bank Reefs	21,610	8,730	25.39
Total Reef	23,410	9,460	27.52
Hard bottom	40	20	0.06
Seagrass	10,960	4,430	12.88
Unmapped	50,710	20,490	59.60
Total	85,080	34,380	

Table 28. Marine habitats, Dry Tortugas (FMRI and NOAA, in press).

wave energy, such as the reef flats. The conspicuous genera include: *Laurencia, Dictyota, Sargassum, Cladophora,* and *Padina*. In deeper areas there are often abundant algae that are attached to the hard substrate or sedimentary deposits. Common genera include: *Halimeda, Avrainvillea, Penicillus, Udotea*. Crustose coralline algae (*Rhodophyceae*) form thin-branched or unbranched crusts typically attached to the limestone. These algae proliferate in shallow areas with high wave energy (Humm 1984).

The benthic algae and seagrasses function as primary producers contributing biomass and oxygen to the system. The algae are consumed by invertebrate and vertebrate herbivores ranging from microscopic crustaceans to large sea turtles. Some organisms, such as the damselfish, lay their eggs in the algae. The life cycles of the algae are very rapid compared to sponges, corals and fish. The marine algae at DRTO include at least 377 species (Taylor 1928). Taylor found 50 species of algae within a few yards off the northwest beach of Loggerhead Key. Work to describe the marine algae at Dry Tortugas continues: Ballantine and Aponte (1995) and Ballantine (1996) described eight new species near Pulaski Shoal (northeastern DRTO). In addition to biomass and oxygen, algae such as *Halimeda* contribute significant amounts of carbonate sediments to the system.

Submerged Aquatic Vegetation (SAV)

SAV (seagrass) beds are one of the most common benthic habitats in the DRTO and are found in water as deep as 30 meters (100 ft) whenever there is sufficient light and unconsolidated sediment to support their root systems. Five species of SAV have been recorded from the DRTO: turtle grass, *Thalassia testudinum*, manatee grass, *Syringodium filiforme*, shoal grass, *Halodule wrightii*, paddle grass, *Halophila decipiens*, and star grass, *Halophila engelmannii*. Two other species of SAV occur in south Florida, but have not been reported for the DRTO: *Halophila johnsonii* and *Ruppia maritima*.

SAV are valued for their role as nursery grounds, foraging habitat, shelter, sediment stabilization, energy attenuation, and primary production (Zieman 1982). As primary producers, energy fixed by SAV predominantly reaches higher trophic levels through the detritus pathway - seagrass blades die and are colonized by bacteria and fungi before being consumed by other organisms. Few organisms graze directly on living seagrass blades, but of those that do, some are quite conspicuous. Green sea turtles (*Chelonia mydas*) feed almost exclusively on seagrass, and the Dry Tortugas is an important refuge for this endangered species. In 1998, 165 green turtle nesting attempts (and 78 actual nests) were recorded in DRTO (Reardon 1998). Many other valued animals are dependent on SAV beds during part of their life cycle, including pink shrimp (*Penaeus duorarum*), spiny lobster (*Panulirus argus*) and queen conch (*Strombus gigas*). Many predatory fishes of the reef also forage in SAV beds and many herbivorous fishes that find shelter on coral reefs during the day feed in SAV beds at night. Vast schools of snappers and grunts migrate off of daytime resting areas around reefs to feed at night in the SAV beds (Robblee and Zieman 1984).

The distribution of SAV beds is determined by exposure to air, penetration of light in the water column, availability of nutrients, suitable sandy or muddy sediments, and levels of disturbance (Zieman 1982). DRTO lies at the western end of a nearly continuous shallow-water SAV bed that covers over 14,000 square kilometers (Fourqurean et al. in press). As water quality in the park is sufficient to support SAV growth on the bottom, the primary factor limiting the distribution of SAV within DRTO is the presence of suitable unconsolidated substratum. The maximum depth for *T. testudinum* is 18 meters (59 ft) and a mean depth of 3 meters (10 ft) from 898 randomly-sampled sites in south Florida (Fourqurean et al. in press). These findings indicate that deeper waters in DRTO are generally clear enough to support growth of SAV beds.

In shallow water, *Thalassia testudinum* forms dense meadows. As depth increases, other species can coexist with *T. testudinum*. For example, as one swims down the slope of the bank north of Loggerhead Key, a dense *Thalassia* bed grades into a mixed *Thalassia-Syringodium* bed, then *Thalassia* drops out, and *Halodule* becomes common with the *Syringodium*. Deeper still, *Syringodium* drops out, and *Halophila engelmannii* and *Halophila decipiens* occur interspersed with *Halodule*. At 23 meters (75 ft), the dominant seagrass is *Halophila decipiens*. The SAV beds of DRTO are relatively diverse compared to other beds in south Florida. It is not uncommon to find three or four species growing in

close association; 5 species have been found in the same 0.25 square meter (m^2) area.

Sponges (*Porifera*)

The sponge fauna at DRTO was studied by deLaubenfels during the Carnegie Laboratory period. He described 76 species including five dredged from 1,047 meters. Schmahl (1984) reported 85 sponge species within DRTO. Sponges create over 1,000 ecological space (niches) and are thus an important asset to the area. The numbers of species and the broad range of habitat that sponges occupy gives testament to their importance. Sponges are a source of shelter, habitat, and food for many marine organisms. They also play an important role in filtering a large volume of seawater. In the context of reefs and carbonate rock, sponges can be an important structural buttress holding the reef together. Carbonate producing sponges provide structure and demosponges provide an interstitial fabric which holds the materials together. The boring sponges are destructive to the reef, however, because they excavate coral limestone skeletons. Over time the weakened skeletons may break loose from the reef platform.

Coral Habitats

The term coral reef is a broad category used to define many habitats where massive corals are conspicuous. In other cases, the existing community is a mixture of smaller corals, octocorals, and sponges, but the underlying foundation was built in the recent past by massive corals.

The major reef types at DRTO include bank reefs, patch reefs, and thickets of staghorn coral. The once abundant elkhorn coral (*Acropora palmata*) assemblages (44 hectares by Agassiz's estimate in 1882) have virtually disappeared from the area (Davis 1982; Jaap and Sargent 1993). Since Davis published his map, some of the staghorn (*Acropora cervicornis, A. prolifera*) coral populations have declined due to hypothermal stress (Roberts et al. 1982) and a virulent disease (Peters et al. 1983).

Reefs are constructed principally by the massive scleractinian coral species. Most of the corals that are found associated with reefs in the western Atlantic and Caribbean occur at DRTO (Jaap et al. 1989). The following list identifies the stony corals (Milleporina, Scleractinia) reported from DRTO:

- Phyllum Cnidaria
  - Class Hydrozoa (Owen 1843)
    - Order Milleporina (Hickson 1901)
      - Family Milleporidae (Fleming 1828)
        - *Millepora alcicornis* (Linne 1758)
        - *Millepora complanata* (Lamarck 1816)
  - Class Anthozoa (Ehrenberg 1834)
    - Order Scleractinia (Bourne 1900)
      - Family Astrocoeniidae (Koby 1890)
        - *Stephanocenia michelinii* (Milne, Edwards, and Haime 1848)
      - Family Pocillopridae (Gray 1842)
        - *Madracis decactis* (Lyman 1859)
        - *Madracis pharensis* (Heller 1868)
        - *Madracis mirabilis* (sensu Wells 1973)
        - *Madracis formosa* (Wells 1973)
      - Family Acroporidae (Verrill 1902)
        - *Acropora cervicornis* (Lamarck 1816)
        - *Acropora palmata* (Lamarck 1816)
        - *Acropora prolifera* (Lamarck 1816)
      - Family Agariciidae (Gray 1847)
        - *Agaricia agaricites* (Linne 1758)
          - Forma *agaricites* (Linne 1758)
          - Forma *purpurea* (LeSeuer 1821)
          - Forma *humilis* (Verrill 1901)
          - Forma *carinata* (Wells 1973)
        - *Agaricia lamarck*i (Milne, Edwards, and Haime 1851)
        - *Agaricia fragilis* (Dana 1846)
        - *Leptoseris cucullata* (Ellis and Solander 1786)
      - Family Siderastreidae (Vaughan and Wells 1943)
        - *Siderastrea radians* (Pallas 1766)
        - *Siderastrea siderea* (Ellis and Solander 1786)
      - Family Poritidae (Gray 1842)
        - *Porites astreoides* (Lamarck 1816)
        - *Porites branneri* (Rathbun 1887)
        - *Porites porites* (Pallas 1766)
          - Forma *porites* (Pallas 1766)
          - Forma *clavaria* (Lamarck 1816)
          - Forma *furcata* (Lamarck 1816)
          - Forma *divaricata* (LeSueur 1821)
      - Family Faviidae (Gregory 1900)
        - *Favia fragum* (Esper 1795)
        - *Favia gravida* (Verrill 1868)
        - *Diploria labyrithiformis* (Linne 1758)
        - *Diploria clivosa* (Ellis and Solander 1786)
        - *Diploria strigosa* (Dana 1846)
        - *Manicina areolata* (Linne 1758)
          - Forma *areolata* (Linne 1758)
          - Forma *mayori* (Wells 1936)
        - *Colpophyllia natans* (Houttuyn 1772)
        - *Cladocora arbuscula* (LeSueur 1821)
        - *Montastraea annularis* (Ellis and Solander 1786)
          - Forma *annularis* (Ellis and Solander 1786)
          - Forma *faveolata* (Ellis and Solander 1786)
          - Forma *franksi* (Gregory 1895)
        - *Montastraea cavernosa* (Linne 1767)
        - *Solenastrea hyades* (Dana 1846)
        - *Solenastrea bournoni* (Milne, Edwards, and Haime 1849)

Family *Rhizangiidae* (DÆOrbigny 1851)
- *Astrangia soliteria* (LeSueur 1817)
- *Astrangia poculata* (Milne, Edwards, and Haime 1848)
- *Phyllangia americana* (Milne and Edwards 1850)

Family Oculinidae (Gray 1847)
- *Oculina diffusa* (Lamarck 1816)
- *Oculina robusta* (Pourtales 1871)

Family Meandrinidae
- *Meandrina meandrites* (Linne 1758)
  - Forma *meandrites* (Linne 1758)
  - Forma *danai* (Milne, Edwards, and Haime 1848)
- *Dichocoenia stokesii* (Milne, Edwards, and Haime 1848)
- *Dendrogyra cylindrus* (Ehrenberg 1834)

Family Mussidae (Ortmann 1890)
- *Mussa angulosa* (Pallas 1766)
- *Scolymia lacera* (Pallas 1766)
- *Scolymia cubensis* (Milne, Edwards, and Haime 1849)
- *Isophyllia sinuosa* (Ellis and Solander 1786)
- *Isophyllastrea rigida* (Dana 1846)
- *Mycetophyllia lamarckiana* (Milne, Edwards, and Haime 1849)
- *Mycetophyllia danaana* (Milne, Edwards ,and Haime 1849)
- *Mycetophyllia ferox* (Wells 1973)
- *Mycetophyllia aliciae* (Wells 1973)

Family Caryophylliidae
- *Eusmilia fastigiata* (Pallas 1766)

The bank reef habitat occurs in an arc along the northeastern to southern margins of DRTO. This habitat includes spur and groove structures and large isolated formations with up to three meters of relief. Bird Key Reef in the southern portion of the park is a good example of this reef type. The reef is estimated to be 5,883 years old (Shinn et al. 1977). Three species of coral (*Montastraea annularis*, *M. cavernosa*, and *Siderastrea siderea*) were the principal frame work builders on this reef. Coral diversity, cover, and habitat complexity increased with depth. Coral cover (as determined by linear measurement) was greatest in depths between 9 and 13 meters. Octocorals exhibited their greatest species richness in depths less than 8 meters. During 1975-1976, 33 species of stony corals were inventoried at Bird Key Reef.

The topographic complexity of the reef structure provides excellent refuge for both sessile and mobile organisms. Sponges, octocorals, and stony corals are conspicuous on the structures. The grooves between the structures contain sediments which are important as refuges for polycheates and crustaceans that are hidden in the sediments during the daylight hours, but are found in the waters above the reef at night.

Patch reefs are isolated accumulations of massive corals that are often surrounded by seagrass and sediments. At DRTO, patch reefs lie inside the bank reef formations in the northeast to southeast, to the south and east of Loggerhead Key, and to the west of Garden Key. The highest concentration of patch reefs is a large area southwest of Loggerhead Key (i.e., Loggerhead Reef). These formations are isolated or in loose clusters. Well developed patch reefs have massive colonies of *Montastraea annularis* that are several meters in diameter. A good example of this type of formation is the area due west of Loggerhead Key, commonly referred to as "Little Africa." Isolated patch reefs off the edge of Loggerhead Key, in 15 meter depths, have a circular to irregular outline and come to within 8 meters of

the surface. The surrounding area is SAV, rubble, and sediments. The massive corals are typically eroded around the bases with small to moderate openings that lead to the interior of the reef. These galleries provide refuge for invertebrates such as lobsters and crabs and dead areas on the massive corals are often occupied by algae (*Halimeda* and *Dictyota*), sponges, octocorals, and other stony corals (*Porites porites, Mycetophyllia* spp).

Staghorn reefs are constructed by two species of staghorn corals (*Acropora cervicornis* and *Acropora prolifera*) that are able to rapidly monopolize a large area. Their success is partially the result of broken fragments surviving and growing into new colonies. These species have the highest growth rate of any scleractinian corals in Florida. Vaughan (1916) reported 4 centimeters per year, Shinn (1966) reported a rate of 10.9 centimeters per year, and Jaap (1974) reported a growth rate of 11.5 centimeters per year. The large thickets of staghorn coral up to two meters high have virtually no other coral species associated with them. In the period prior to January 1977, staghorn reefs were the most commonly occurring reef in DRTO. In an area west of Loggerhead Key, huge fields of staghorn coral were typical (Davis 1977). Davis (1982) estimated staghorn reefs comprised 478 hectares of the seafloor (55.3% of all reef habitat). The staghorn reef community is very susceptible to perturbation from meteorological phenomena, however, and the passage of a winter cold front in January of 1977 eliminated up to 95% of the extant staghorn reefs (Walker 1981; Davis 1982; Porter et al. 1982; Roberts et al. 1982). The *M/V Mavro Vetranic* ship grounding near Pulaski Shoal (Tilmant et al. 1989) exposed a deep cross section of reef strata composed of alternating layers of staghorn corals and star and brain corals showing that staghorn coral reefs have been dynamic, both proliferating and waning in time and space.

In 1989, Jaap et al. installed permanent monitoring sites east and west of Loggerhead Key. These areas had extensive staghorn coral thickets in 1975-77. As reported above, these thickets were severely impacted by hypothermic stress during the January 1977 cold front passage. These areas were sampled by a quadrat census from 1989-1991 and recorded that recovery of staghorn corals was not occurring west of Loggerhead Key. There was evidence of recruitment and growth at White Shoal (east of Loggerhead Key), particularly on the north end. Jaap et al. have subsequently returned to these sites (between 1991 and 1997) and examined them qualitatively. The area west of Loggerhead Key is still characterized as staghorn coral rubble covered with *Dictyota, Lobophora,* and *Halimeda* algae. The White Shoal area has extensive thickets of *Acropora cervicornis* that occupy the northeastern portions of the bank. Other areas within the park have moderately large staghorn coral reefs.

The extant elkhorn (*Acropora palmata*) assemblage at DRTO is located in front of Garden Key. It is a remnant population that survived Hurricane Georges (October 1998) and occupies approximately 800 square meters (m^2). This formerly abundant coral now is at risk of local extinction.

Octocoral dominated hardbottom was the habitat type which Davis (1982) identified as major bottom type. He reported 3,965 hectares of octocoral covered hardbottom within DRTO (4.08% of the seafloor). The most conspicuous characteristics of the octocoral

hardbottom are the abundant sea whips, sea plumes, sea fans, and the rather flat topography. Octocoral species density at a monitoring station at Pulaski Shoal was 15.50±3.50 and 92.60±31.74 colonies per square meter (m^2). The area is like a jungle, with the bottom virtually obscured by the octocoral canopy. The octocoral hardbottom areas have a rich diversity in species. The following is a list of species that are reported from DRTO:

Phylum Cnidaria
- Subclass Octocorallia (Haeckel 1866)
  - Order Alcyonacea (Lamouroux 1816)
    - Family Briareidae (Gray 1840)
      - *Briareum asbestinium* (Pallas 1766)
    - Family Anthothelidae
      - *Iciligorgia schrammi* (Duchassaing 1870)
      - *Erythropodium caribaeorum* (Duchassaing and Michelotti 1860)
    - Family Plexauridae (Gray 1859)
      - *Plexaura homomalla* (Esper 1792)
      - *Plexaura flexuosa* (Lamouroux 1821)
      - *Eunicea succinea* (Pallas 1766)
      - *Eunicea calyculata* (Ellis and Solander 1786)
      - *Eunicea laxispica* (Lamarck 1815)
      - *Eunicea mammosa* (Lamouroux 1816)
      - *Eunicea fusca* (Duchassaing and Michelotti 1860)
      - *Eunicea lanciniata* (Duchassaing and Michelotti 1860)
      - *Eunicea tourneforti* (Milne, Edwards, and Haime 1857)
      - *Eunicea knighti* (Bayer 1961)
      - *Plexaurella dichotoma* (Esper 1791)
      - *Plexaurella grisea* (Kunze 1916)
      - *Plexaurella fusifera* (Kunze 1916)
      - *Muricea elongata* (Lamouroux 1821)
      - *Muricea laxa* (Verrill 1864)
      - *Muricea atlantica* (K kenthal 1919)
      - *Pseudoplexaura porosa* (Houttuyn 1772)
      - *Pseudoplexaura flagellosa* (Houttuyn 1772)
      - *Pseudoplexaura crucis* (Bayer 1961)
    - Family Gorgoniidae (Lamouroux 1812)
      - *Pseudopterogorgia acerosa* (Pallas 1766)
      - *Pseudopterogorgia americana* (Gmelin 1791)
      - *Pseudopterogorgia bipinnata* (Verril 1864)
      - *Gorgonia ventalina* (Linne 1758)
      - *Pterogorgia anceps* (Pallas 1766)
      - *Pterogorgia citrin*a (Esper 1792)
      - *Pterogorgia guadalupensis* (Duchassaing and Michelin 1846)

Sedimentary Habitats

The largest component of the DRTO sea floor is composed of sediments (silt, sand, gravel). Davis (1982) estimated that sediments were contributing 10,892 hectares (47.80%) of the benthic habitat in DRTO. If SAV are included (because SAV grow in sediments), the sediment benthic contribution in DRTO is 78%. Research on DRTO sedimentary habitats is very limited. Sedimentary habitats provide niches for virtually every marine phyla and thus the biodiversity of these habitats is relatively high. Because organisms are living (for the most part) under the surface of the sediments, there is a misconception that this area is barren of life (Cahoon et al. 1990; Snelgrove 1999). Bacteria, diatoms, protozoa, molluscs, crustaceans, echinoderms, polycheates, gobies, and blennies are examples of higher order taxonomic categories that are found in the sediments. The sediments also function as a forage area for larger predators (Cox et al. 1996) and serve as a pool of geo-chemical material (calcium carbonate).

Florida Keys National Marine Sanctuary

To the west of the DRTO in the area proposed for the ecological reserve are several deep water coral banks. In contrast to the DRTO, these deep reefs have not been well studied or mapped. Water depths surrounding the banks are 20 to 24 meters (66 to 78 ft), the shallowest portions of these banks being 11 to 15 meters (36 to 48 ft) deep. Diving observations reveal a complex karst-like limestone with abundant attached reef organisms (sponges, corals, octocorals).

Tortugas Bank is approximately 7 nautical miles west of Loggerhead Key; 8 Fathom Rock is located north of Tortugas Bank and approximately 5.5 nautical miles west-northwest of Loggerhead Key; and Little Bank is north of 8 Fathom Rock and approximately 6.6 nautical miles northwest of Loggerhead Key. The central, western, northern, and southern portions of Tortugas Bank are characterized by low-relief hard-bottom with patches of sand and rubble at 7-23 meter depths. The substratum is dominated by brown algae and gorgonians.

The southern terminus of the bank is characterized by deep sandy plains with patches of hard-bottom at 25-27 meter depths. Corals found on the banks appear light starved. As depth increases, corals respond by maximizing their surface area, building pancake-like structures rather than the normal mounds or hemispheres.

On the northwest flank of Tortugas Bank is an area of low-relief but high coral cover. The area was dubbed "Sherwood Forest" because of the bizarre mushroom-shaped coral heads that are an adaptation to the low light conditions. There seem to be indications that the mushroom-shape is the result of a composite of two coral species (Ginsburg personal communication). The coral reef is so well-developed it forms a veneer over the true bottom approximately 3 feet below the coral reef. This veneer is riddled with holes and caves providing ideal habitat for a high diversity of fish. Soft corals, gorgonian-forests, sponges, and black corals are also present. Coral abundance exceeds 30% cover in many areas (compared to an average of 14% for the rest of the Florida Keys). In other areas such as Black Coral Rock, large relief structures protrude like mountains upward from the seafloor.

The black corals (*Antipathes spp.*) which are uncommon in Florida Keys reefs, are attached along wall faces. Black corals are a branching type of coral that has a yellow to red outer tissue layer with a solid black matrix skeleton. The skeleton has value in the manufacture of jewelry and in many areas collection pressure has made black corals rare. They favor deep reef environments with moderate to strong currents. Black corals are listed as totally protected under the Convention on International Trade in Endangered Species. Moderate to strong currents are common on Tortugas Bank and may be one of the reasons that black corals are moderately abundant in the area. Reef corals are abundant on the deep banks and are a principal faunal and major contractual component of the reef structures. The most common corals are the *Montastraea* complex with other common genera being *Siderastrea*, *Colpophyllia*, and *Agaricia*. The Codacean algae *Halimeda* is common and occupies the areas between the corals.

Riley's Hump

Riley's Hump is located approximately 10 nautical miles southwest of DRTO just outside State waters. This deep reef terrace (22-27 meter depths) is dominated by algae interspersed with coral. It is not known for spectacular coral formations, but for its richness of fish and other marine life. A small population of sargassum fish, or red-tailed triggerfish (*Xanthichthys ringens*), is among the unique species found in the area. Large pelagic fish (tunas, jacks, and sharks) are common in the area as well as dolphins. Evidence suggests that this low profile reef is an aggregation or spawning site for snapper-grouper species, including gray, cubera, mutton, dog, red and yellowtail snapper, black grouper, and ocean triggerfish. Currently, the Council closes Riley's Hump two months of the year to protect mutton snapper during their spawning period. The deeper water habitats to the south of Riley's Hump contain important habitat for red and goldeye snapper, tilefish, golden crab, and snowy grouper.

11.5.4 Fish Communities and Fisheries

This section summarizes the major findings of a report entitled, "Site characterization for the Tortugas region: Fisheries and essential habitats" (Schmidt et al. 1999). The report synthesized the pertinent literature and data to determine the extent and current status of key resources in the Tortugas region relevant to the condition of the broader fish communities and fisheries of the Florida Keys. The report was commissioned by the NPS and the FKNMS as background information for designing and evaluating the proposed (FKNMS) ecological reserve.

Status of Fishes and Fisheries

Compared to the rest of the Florida Keys, the Tortugas region appears to have more and larger individuals of many key species (i.e., groupers, snappers, hogfish, grunts, lobsters, etc.). However, throughout the Florida Keys, including the Tortugas, there appears to be a serious serial overfishing problem.

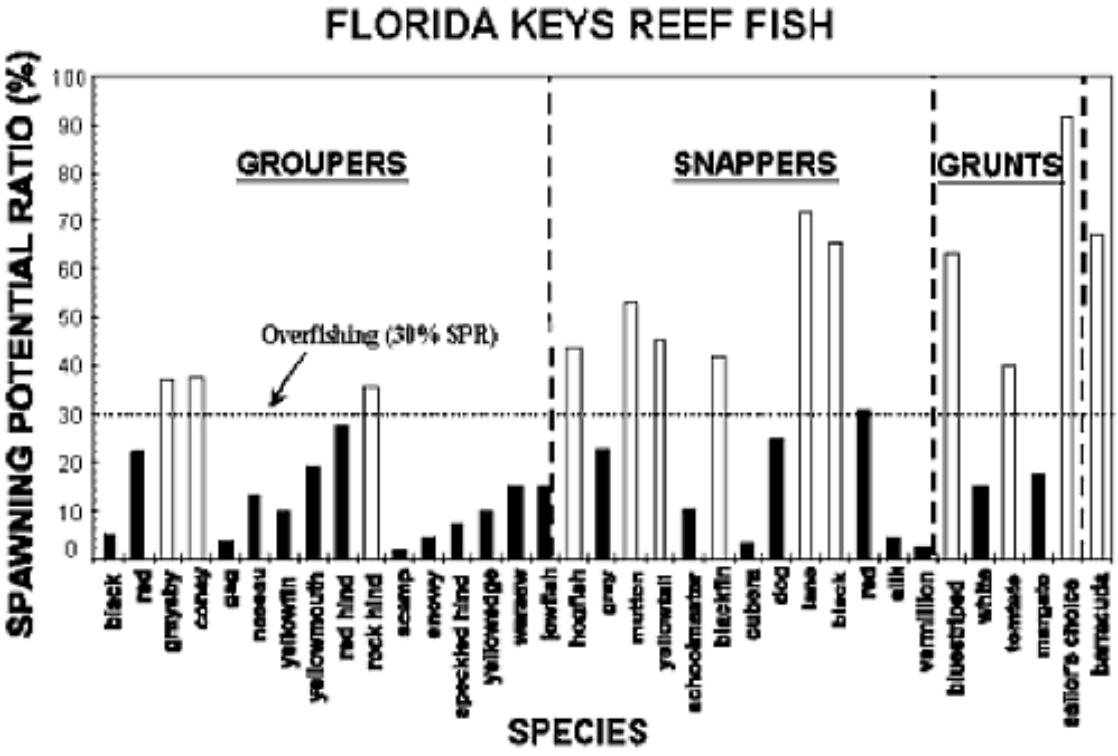


Figure 8. Status of the snapper-grouper complex in the Florida Keys (Ault et al. 1998).

Using two statistically independent data sources on reef fish -- fishery-independent diver observations and fishery-dependent charter fishing catches -- Ault et al. (1998) documented that 13 of 16 groupers (*Epinephilinae*), 7 of 13 snappers (*Lutjanidae*), one wrasse (*Labridae*), and 2 of 5 grunts (*Haemulidae*) are below the 30% SPR overfishing minimum (Figure 8). Some stocks appear to have been chronically overfished since the late 1970s. The Florida Keys reef fishery exhibits classic "serial overfishing" in which the largest, most desirable, and vulnerable species are depleted by fishing.

Black grouper was studied as an example of the effects of overfishing on the fisheries resources of the Tortugas region and the Florida Keys. The net conclusion of these analyses relevant to fishermen is that the average size of black grouper caught in 1999 is 40% its historical level (i.e., average of 22.5 pounds circa 1930 versus 9 pounds today). In terms of the stability and resiliency of the black grouper population, the spawning stock biomass is now estimated to be at 5% of what it once was. The current rate of fishing mortality on the black grouper stock is now greater than 4 times the level that would be expected to produce maximum sustainable yield. This situation is similar for a broad segment of the economically and ecologically important reef fish stocks in the Florida Keys.

Fish Biogeography, Trophic Role, and Species Diversity

The geographic description of fishes varies over time. Each fish species is partly a product of regional oceanography, coastal geomorphology, habitat availability, and natural disturbance. The Tortugas is a region of convergence for a wide variety of tropical, subtropical, and temperate fish species.

The demersal fishes of the Tortugas region can be classified into four basic types based on habitat descriptions and species distribution as discussed by Longhurst and Pauly (1987). The four categories are (1) sciaenid assemblages (drums, croakers, groupers); (2) lutjanid assemblages (snappers); (3) active, large-eyed species adapted to clear water/high illumination (e.g., grunts, mojarra); and (4) highly evolved genera specific to reefs (e.g., triggerfishes, boxfishes, pufferfishes). The sciaenid assemblages occur in the warm temperate turbid waters to tropical areas in the western Atlantic. Although the tropical sciaenid assemblages have not been reported in Florida, the subtropical sciaenid assemblage do occur in the Florida/Tortugas area and is represented by families/species from the northern Gulf of Mexico to Cape Hatteras (Longhurst and Pauly 1987) including *Sciaenidae* (drums/croakers), *Serranidae* (groupers), *Clupeidae* (herrings), *Mullidae* (goatfishes), and *Gerreidae* (mojarra). The lutjanid assemblage inhabit rock, coral, and coral sand habitats from Florida to Brazil and includes species from the families *Lutjanidae* (snapper), *Serranidae* (grouper), *Balistidae* (triggerfishes), and *Haemulidae* (grunts). These species are found primarily offshore from the Tortugas region northward to west central Florida. In addition to the species specific to reefs (e.g., triggerfishes, trunkfishes), the Florida Keys/Tortugas Region is considered a faunal transitional zone based on the presence of one or more demersal assemblages (Schomer and Drew 1982). Starck (1968) described assemblages of fish as either insular (reef-associated species from abiotically stable environments) or continental as represented by species found over muddy bottoms or turbid waters. The merging of temperate and tropical species is also apparent in other taxa (e.g., invertebrates, benthic algae) as reported in Chiappone and Sluka (1996). This unique convergence of abiotic and biotic factors provides for diverse and variable fish communities relative to the more tropical (Caribbean) and more temperate (e.g., northern Gulf of Mexico) environments in the western Atlantic.

Tortugas reef fish constitute a highly diverse fauna of over 400 fish species according to a long-term study by Longley and Hildebrand (1941) packed into a relatively small spatial scale represented by the Tortugas region. Many of these species are rare and some are endemic to the region such as the red-tailed triggerfish (*Xanthichthys ringens*). Trophic classifications for reef fish indicating the general type of prey items they consume include herbivores (feed on algae), planktivores (feed on plankton in the water column), benthic invertivores (feed on invertebrates on the bottom), benthic carnivores (feed on invertebrates and fish on the bottom), pelagic carnivores (feed on invertebrates and fish in the water column), coralivores (feed on coral), omnivores (feed on everything), and detritus feeders (feed on dead or decaying matter). Generally, most reef fish are herbivorous bottom feeders and feed primarily during the night.

Reproduction, Larval Transport, and Recruitment

Recruitment is defined as the addition of newborn to a stock each year. In the tropics, recruitment can occur over a protracted portion of the year (Ault 1988; Ault and Fox 1990). Spawning aggregations are often associated with specific confluences of biological cycles, physical oceanography, and habitat. A number of spawning aggregation sites have been identified in the Tortugas region. These areas concentrate fish during the spawning season and serve as the source points for larvae which then drift advectively and then behaviorally until they become competent juveniles and settle to take on a benthic existence. A suite of different species occupy the different spawning sites at different times. For example, the snapper species: gray (*Lutjanus griseus),* cubera *(Lutjanus cyanopterus),* mutton *(Lutjanus analis),* yellowtail *(Ocyurus chrysurus),* and dog *(Lutjanus jocu),* potentially use the Riley's Hump area as a spawning site (Lindeman et al. in press). It is critical to protect the integrity of the spawning sites and spawners during the reproductive periods of the year, and to protect the habitats critical to the survivorship of the settling juveniles. All spawning aggregation sites have been identified as EFH-HAPC by some councils (SAFMC 1998).

Most tropical marine reef fishes of the Florida Keys and the Dry Tortugas Region have pelagic larvae that are dispersed by currents driven by winds, tides, and bathymetry. Recruitment of juveniles into a particular habitat or environment (e.g., the inshore coastal bays, nearshore barrier islands, or the coral reef tract) of this region is dependent upon behaviors and the nature of the water flow. Evidence for larval settlement of large numbers of important reef fish species with DRTO clearly exists (Lindeman et al. in press). New physical and biological evidence suggests gyre formations, current reversals, and larval behaviors can facilitate the partial retention of larvae of some species. Migrations across the continental shelf are often necessary to reconnect settlement areas to spawning sites. Thus the probability of successful recruitment is a function of the size of the parent stock, the number of gravid (egg-bearing) fish spawning at a particular location, and the physical environment prevalent during the period of spawning and transport.

Relatively few studies of reef fishes in the Florida Keys have examined the settlement of fish larvae near the Tortugas Region. Recent studies by Cha et al. (1994) and Limouzy-Paris et al. (1994) have examined the distribution and biodiversity of reef fish larvae from the Upper Florida Keys to Cosgrove Reef near the eastern boundary of the TERSA, the Marquesas Keys. Of the 68 families of reef fishes compiled by Starck (1968) at Alligator Reef in the Middle Keys, larvae of 43 families were collected in plankton tows from May 31 to June 5, 1989 (Limouzy-Paris et al. 1994). The nine most common fish families (most frequently occurring among stations, and in the top 10% in terms of abundance) were *Paralichthyidae* (flounders), *Scombridae* (mackerel/tunas), *Gobiidae* (gobies), *Bregmacerotidae* (codlets), *Myctophidae* (lanternfishes), *Serranidae* (seabasses), *Carangidae* (jacks), and *Bothidae* (lefteye flounders).

Migratory Species

Very little is known about the distribution and abundance of highly migratory species (HMS) in the Tortugas region or about the region's importance to these species. However, one study discovered that the Tortugas region likely serves as a spawning ground for a variety of highly migratory species (HMS) such as bluefin tuna. In an analysis of the regurgitated food of sooty terns (*Sterna fuscata*) and brown noddies (*Anous stolidus*), Potthoff and Richards (1970) found 40 juvenile bluefin tuna (*Thunnus thynnus*) and other juvenile scombrids such as blackfin tuna (*Thunnus atlanticus*), bullet mackerel (*Auxis* spp.), little tuna (*Euthynnus alletteratus*), and skipjack tuna (*Katsuwonus pelamis*). Migratory species (Table 29) in the Tortugas region are managed by a joint Coastal Migratory Pelagics FMP and directly by NMFS under the Final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks, April, 1999, and Amendment 1 to the Atlantic Billfish Management Plan, April, 1999. A FMP for dolphin and wahoo is under development.

Table 29. Migratory fish species likely to be found in the Tortugas region.

GROUP	SPECIES	SCIENTIFIC NAME
Swordfish	Swordfish	*Xiphias gladius*
Atlantic Billfishes	Sailfish	*Istiophorus platypterus*
	White marlin	*Terapturus albidus*
	Blue marlin	*Makaira nigricans*
	Longbill spearfish	*Terapturus pfluegeri*
Atlantic Tunas	Western Atlantic bluefin	*Thunnus thynnus*
	Atlantic bigeye	*Thunnus obesus*
	Atlantic yellowfin	*Thunnus albacares*
	Albacore	*Thunnus alalunga*
	Skipjack	*Katsuwonus pelamis*
	Little tunny	*Euthynnus alletteratus*
Ocean Pelagics	Wahoo	*Acanthocybium solandri*
	Dolphin	*Coryphaena hippurus*
	Bonito	*Sarda chiliensis*
Mackerels	King mackerel	*Scomberomorus cavalla*
	Spanish mackerel	*Scomberomorus maculatus*
	Cero	*Scomberomorus regalis*
Cobia	Cobia	*Rachycentron canadum*

Basking Sharks	Basking shark	*Cetorhinus maximus*
Hammerheads	Great hammerhead	*Sphyrna mokarran*
	Scalloped hammerhead	*Sphyrna lewini*
	Smooth hammerhead	*Sphyrna zygaena*
Mackerel Sharks	White shark	*Carcharadon carcharius*
Nurse Sharks	Nurse shark	*Ginglymostoma cirratum*
Requiem sharks	Bignose shark	*Carcharhinus altimus*
	Blacktip shark	*Carcharhinus limbatus*
	Bull shark	*Carcharhinus leucas*
	Caribbean Reef shark	*Carcharhinus perezi*
	Dusky shark	*Carcharhinus obscurus*
	Galapagos shark	*Carcharhinus galapagensis*
	Lemon shark	*Negaprion brevirostris*
	Narrowtooth shark	*Carcharhinus brachyurus*
	Night shark	*Carcharhinus signatus*
	Sandbar shark	*Carcharhinus plumbeus*
	Silky shark	*Carcharhinus falciformis*
	Spinner shark	*Carcharhinus brevipinna*
	Tiger shark	*Galeocerdo cuvieri*
Sand Tiger sharks	Bigeye sandtiger shark	*Odontaspis noronhai*
	Sand Tiger shark	*Odontaspis taurus*
Whale Sharks	Whale shark	*Rhinocodon typus*
Angel sharks	Atlantic angel shark	*Squatina dumerili*
Hammerhead sharks	Bonnethead shark	*Sphyrna tiburo*
Requiem sharks	Atlantic sharpnose shark	*Rhizoprionodon terraenovae*
	Blacknose shark	*Carcharhinus acronotus*
	Caribbean sharpnose shark	*Rhizoprionodon porosus*
	Finetooth shark	*Carcharhinus isodon*
	Smalltail shark	*Carcharhinus porosus*
Cow sharks	Bigeye sixgill shark	*Hexanchus vitulus*
	Sevengill shark	*Heptranchias perlo*

	Sixgill shark	*Hexanchus griseus*
Mackerel sharks	Longfin mako	*Isurus paucus*
	Porbeagle shark	*Lamna nasus*
	Shortfin mako	*Isurus oxyrinchus*
Requiem sharks	Blue shark	*Prionace glauca*
	Oceanic whitetip shark	*Carcharhinus longimanus*
Thresher sharks	Bigeye thresher shark	*Alopias superciliosus*
	Thresher shark	*Alopias vulpinus*

The marine reserves have been identified to constitute a portion of the EFH for the following HMS life stages:

Blacknose shark - juvenile, adult
Blacktip shark - juvenile, adult
Caribbean reef shark - adult
Dusky shark - juvenile
Great hammerhead shark - adult
Lemon shark - noenate, juvenile, adult
Longfin mako shark - adult
Sandbar shark - neonate, juvenile, adult
Silky shark - juvenile
Spinner shark - neonate
Tiger shark - juvenile
Bluefin tuna - spawning, eggs, larvae
Skipjack tuna - spawning, eggs, larvae
Yellowfin tuna - spawning, eggs, larvae

11.5.5 Seabirds

The islands of the Tortugas are the only breeding ground in the continental U.S. for magnificent frigate birds, sooty terns (*Sterna fuscata*), brown noddies (*Anous stolidus*), and masked boobies. These seabirds rely on the clear waters of the area to see and prey on fast moving baitfish. The foraging range of the sooty tern (Figure 9) is approximately 15 miles from Bush Key (Potterhoff and Richards 1970). This sooty tern colony is the most productive in the West Indies (Hoffman personal communication).

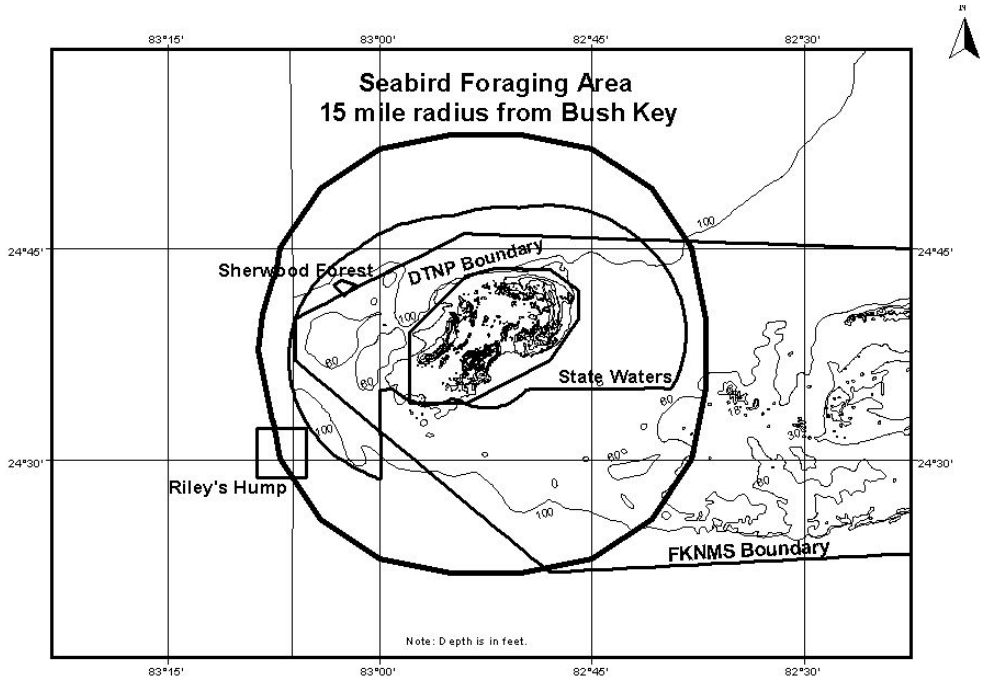


Figure 9. Foraging range of the sooty tern (*Sterna fuscata*).

11.5.6 Endangered and Threatened Species

Sea Turtles

Five species of marine turtles are found in the Tortugas: green (*Chelonia mydas*), loggerhead(*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), hawksbill (*Eretmochelys imbricata*), and leatherback (*Dermochelys coriacea*). The Tortugas is the most productive nesting area for the green and loggerhead turtles in the entire Florida Keys. All of these species were once much more abundant but are now either endangered or threatened. By the late 1800s, there was a full-scale turtle fishery in Key West where one cannery was canning 200 quarts of turtle meat a day (Lott 1996). Prior to this era of exploitation, turtles served a critical ecological role in grazing on SAV.

Jackson (1997) estimated that the green turtle population in the Caribbean basin before the industrial revolution was approximately 660 million, where now the population is in the tens of thousands. The DRTO contains the largest remaining loggerhead and green turtle rookery in the Florida Keys. The DRTO has surveyed turtle nests and nesting activities from April through October since 1995.

One green turtle eats roughly the same amount of turtlegrass as 500 large sea urchins. The turtle is able to break down the grass into basic nutrients and distribute these over a wide area for reuse by the ecosystem (Jackson 1997). Whereas once the green turtle played a major role in structuring the Florida Keys ecosystem, both sea turtles and sea urchins are now effectively ecologically extinct.

Marine Mammals

Because of the remoteness of this region, very little is known about the dolphin and whale species that visit the area. The most common dolphins found in the area are: bottlenose dolphins (*Tursiops truncatus*), spotted dolphins (*Stenella frontalis*), offshore spotted dolphins (*Stenella attenuata*), and Risso's Dolphins (*Grampus griseus*; Lott 1997). Bottlenose dolphins are undoubtedly the most common cetacean in the area. Given the deep depths in the proposed Tortugas South reserve, it is possible that some of the deeper diving whales (e.g., sperm and right) may occasionally be found there, although they were not listed in the site characterization by Schmidt et al (1999).

11.6 Human Activities

Political jurisdictions

No fewer than five resource management jurisdictions converge in Tortugas region (Figure 10; Table 30).This proposed action does not directly affect the SAFMC jurisdiction; however, the SAFMC has an interest in the effects of the reserve and has been consulted with extensively by the FKNMS throughout the process of establishing their proposed Sanctuary boundaries.

Human uses

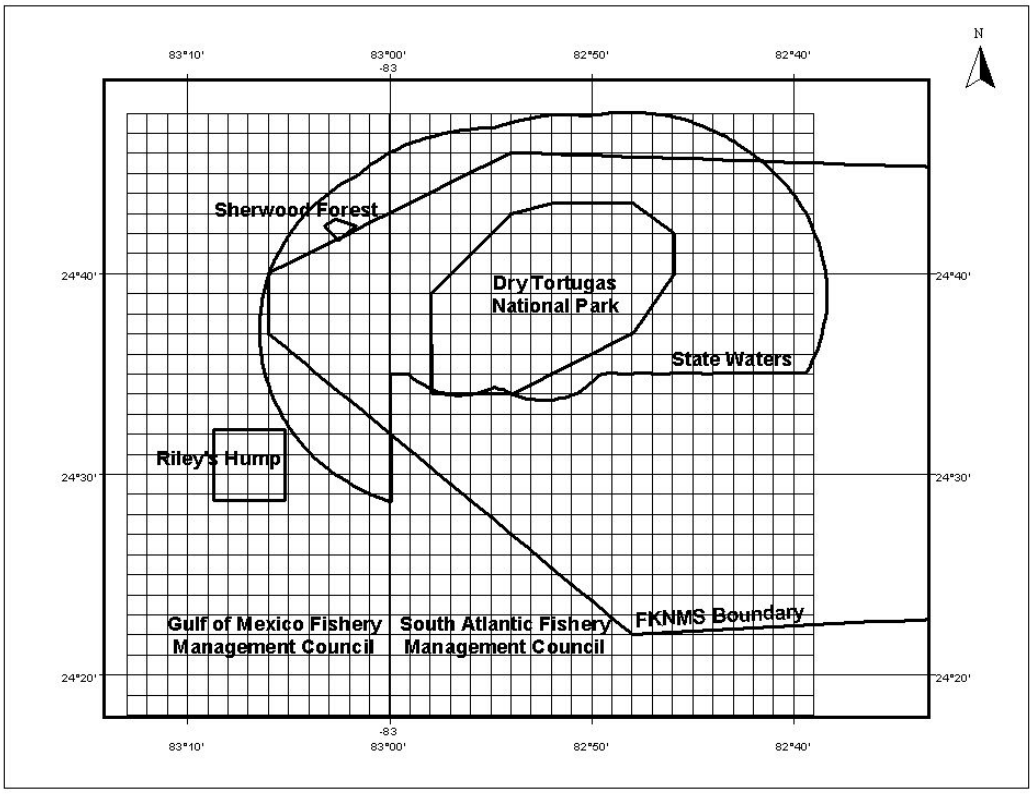
Recreational charter and commercial activities in the Tortugas region (excluding the DRTO) were characterized and mapped during 1998 so that the economic impacts of the proposed reserve could be analyzed. Private recreational activities were not mapped. The research team asked each charter operator if they ever had seen any private household boats in the

Table 30. Jurisdictions within the Tortugas region.

AGENCY/RESPONSIBILITY
Department of Commerce/National Oceanic and Atmospheric Administration
• National Marine Fisheries Service: responsible for managing for sustainable fisheries (e.g., highly migratory fish species), and recovering protected species (e.g., sea turtles). The Highly Migratory Species division regulates highly migratory fish species through a secretarial fishery management plan.
• Gulf of Mexico Fishery Management Council: responsible for managing fishery resources in the U.S. federal waters of the Gulf of Mexico through various fishery management plans.
• National Ocean Service/Florida Keys National Marine Sanctuary: responsible for managing and protecting natural and cultural resources within Sanctuary boundaries.
•

Department of the Interior/National Park Service • Dry Tortugas National Park: responsible for protecting and interpreting a pristine subtropical marine ecosystem, including an intact coral reef ecosystem.
State of Florida • Fish and Wildlife Conservation Commission: responsible for managing fish and wildlife resources within state waters. • Department of Environmental Protection: serves as co-trustee with NOAA of Sanctuary resources.

Figure 10. Tortugas Ecological Reserve Study Area (each grid cell represents one minute by one minute of latitude or approximately one square nautical mile).



Tortugas region (excluding the DRTO) and every fishing club in the region was contacted and asked if any of their members used the area. The research team found no information to support private household use. If there is private household use it is very sporadic and light outside the DRTO and, therefore, difficult, if not impossible, to quantify.

The location and intensity of recreational charter and commercial fishing activities was determined by face-to-face interviews where the interviewee was asked to draw on a gridded map (similar to the one in Figure 10) where they fish and dive and at what intensity. Intensity was recorded as person-days for recreational charter activities and pounds of fish caught for commercial fishing activities. The entire population of recreational charter operators (12) that operate outside of the DRTO was interviewed. A sample of the commercial fishing population that fishes the Tortugas region was interviewed (90). The population of commercial fishermen (105-110) was determined by holders of saltwater products licenses for FMRI Areas 2.0 and 2.9 (Appendix 15.1, Figure 1) that fall within the TERSA. The following maps are the result of this data collection effort (Figures 11-18).

Recreational Activities

Please refer to Figures 11-14 for information on recreational activities.

Commercial Fisheries

Commercial fisheries of southern Florida and the Tortugas region have been described previously by Bannerot (1990), Bohnsack et al. (1994), and Chiappone and Sulka (1996). Analyses of commercial and recreational sector fisheries operations within the FKNMS, including the Tortugas area, are described by Bohnsack et al. (1994). The Tortugas region supports productive and profitable fisheries. For example, of the over 1 million pounds of spiny lobster caught in Monroe County in 1998, 57% was reportedly caught in the Tortugas, as was over a third of the shrimp, almost half of the reef fish, and a third of the king mackerel (Murray personal communication).

The Tortugas region has been the principal fishing grounds for pink shrimp, and represents one the most valuable commercial fisheries in Florida waters. Pink shrimp appear to favor sediments composed of calcareous- and sand-bottoms in waters between 9 and 44 meters deep. The main commercial gear is double-winged trawls. Most shrimp are caught south and north of the DRTO (Figure 17). The fishery was developed in the early 1950s, and the pink shrimp fishery grew to average annual landings that varied around 10 million pounds. Areal closures have been the primary measures used for managing the pink shrimp population off south Florida and the Tortugas grounds; the Tortugas Shrimp Sanctuary north of the Marquesas Keys was established in 1981 to protect juveniles. Pink shrimp spawn year-round, and juveniles settle inshore in the low salinity environments of coastal bays, tending to get larger (and mature) as they move further from shore (Schmidt et al. 1999).

The spiny lobster fishery is extremely productive in the Tortugas region. The main fishing method is by trapping although some diving does occur. Commercial fishing for lobster in the DRTO ended in 1935 and recreational fishing (for lobster) ended in 1971. Most of the lobster is landed on the south side of the DRTO (Figure 18). However, in the winter when the winds pick up, fishermen tend to move their traps to the east or west on Tortugas Bank.

In a study of lobster spawning potential throughout the Keys, Bertelsen and Hunt (1999) found some stark differences between fished and unfished populations. Lobster sizes ranged from 17 millimeters carapace length (CL) from a back reef area in the Upper Keys to 184 millimeters CL from a back reef area in the DRTO. Egg mass sizes ranged from 1.95 million eggs found in the DRTO to 0.03 million eggs found west of Key West. The average egg mass size in the DRTO was 800,000 eggs, whereas it was 300,000 for the rest of the Keys (Bertelsen and Hunt 1999).

King mackerel is a seasonal species caught primarily in the Lower and Middle Keys. It is a multiple gear species, in that net fishermen and hook-and-line fishermen target the fish. Also, both commercial and charter fishermen target the species. In the Tortugas region the catch is limited to certain hot spots which may be an artifact of the dumping of shrimp trawl bycatch such as in the area northeast of the DRTO (Figure 16).

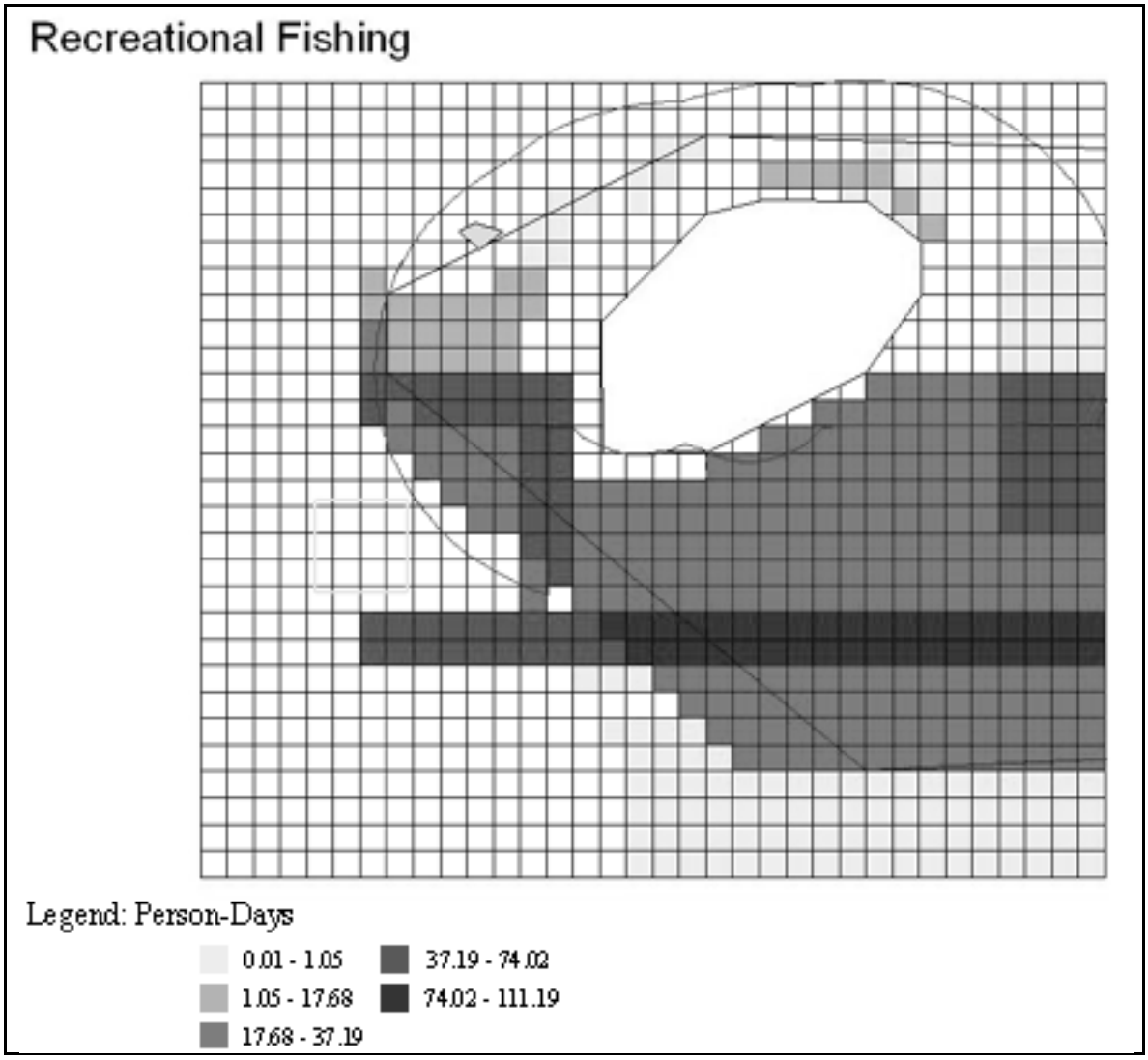


Figure 11. Recreational charter fishing activity in the Tortugas region in 1998.

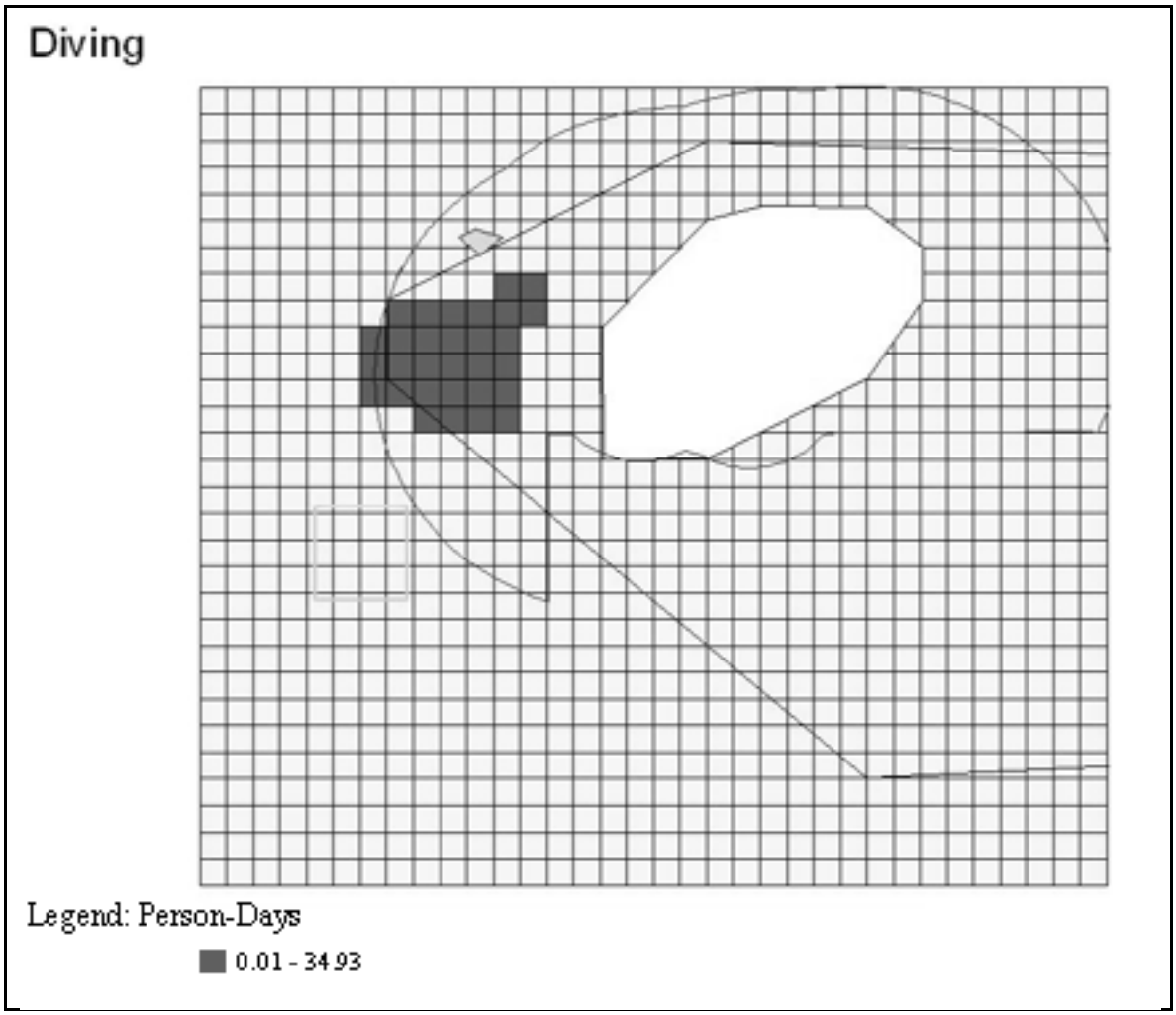


Figure 12. Recreational charter diving (non-consumptive) activity in the Tortugas region in 1998.

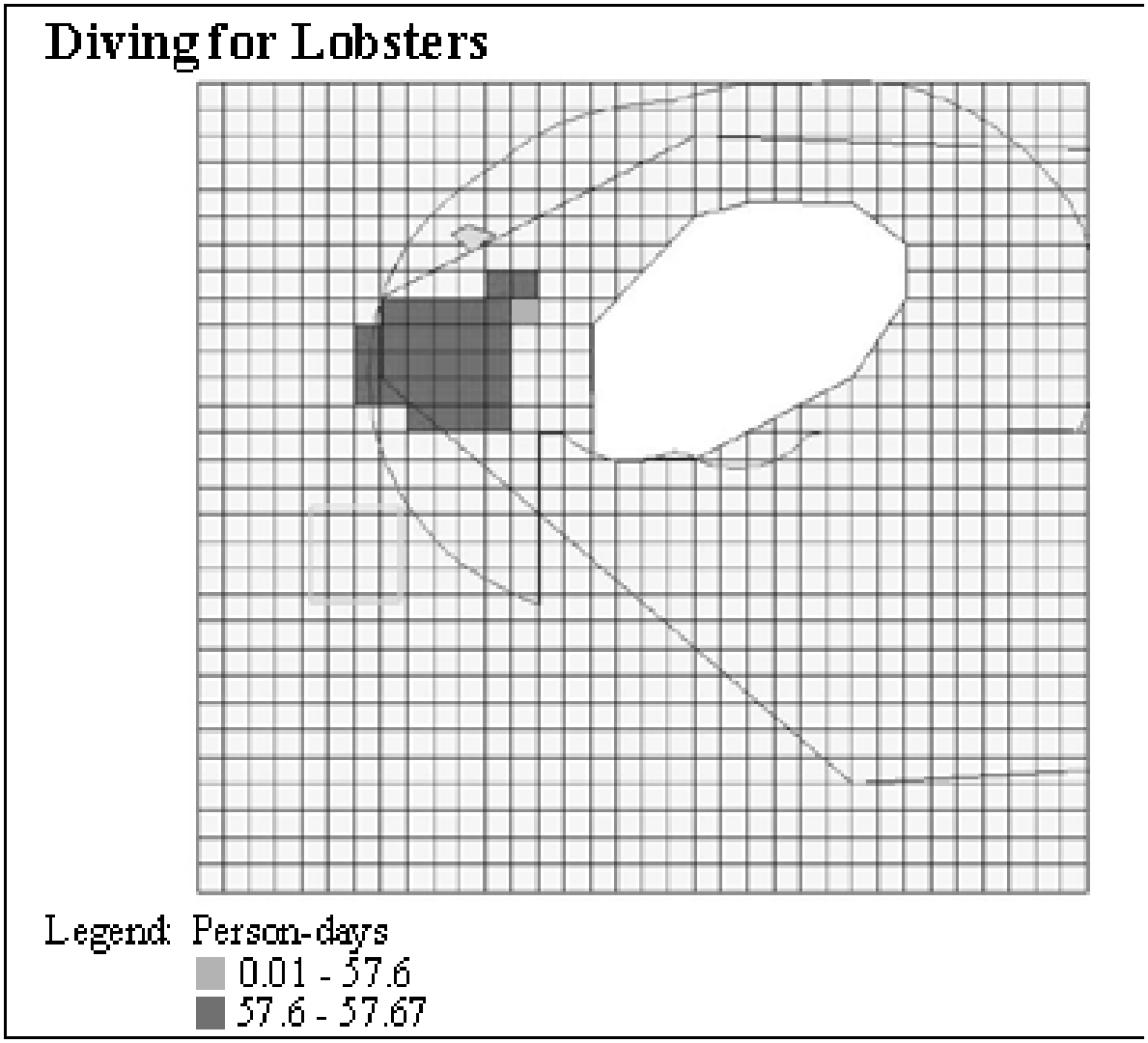


Figure 13. Recreational charter diving for lobster activity in the Tortugas region in 1998.

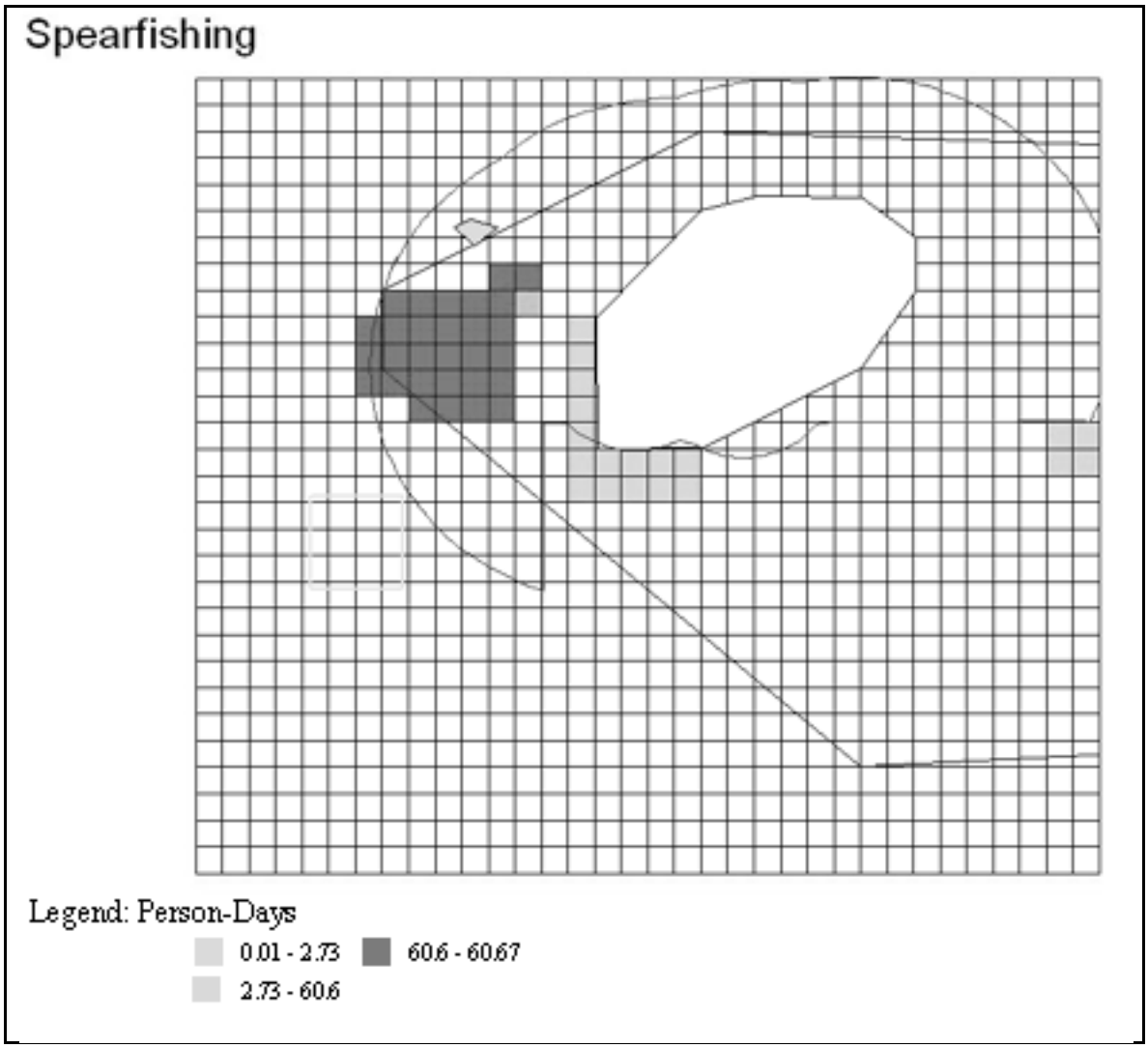


Figure 14. Recreational charter spearfishing activity in the Tortugas region in 1998.

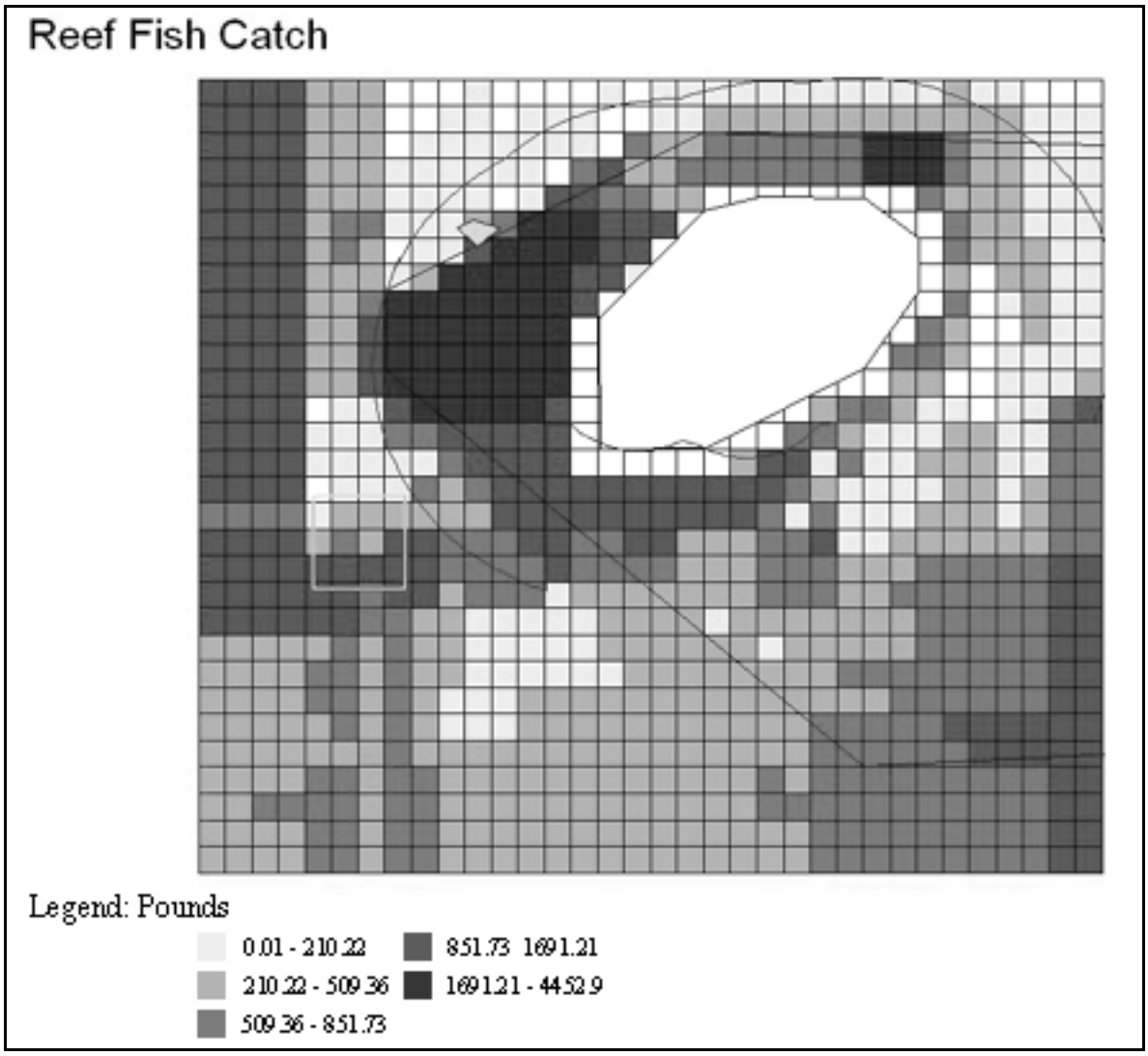


Figure 15. Commercial handline fishing (reef fish) activity in the Tortugas region in 1998.

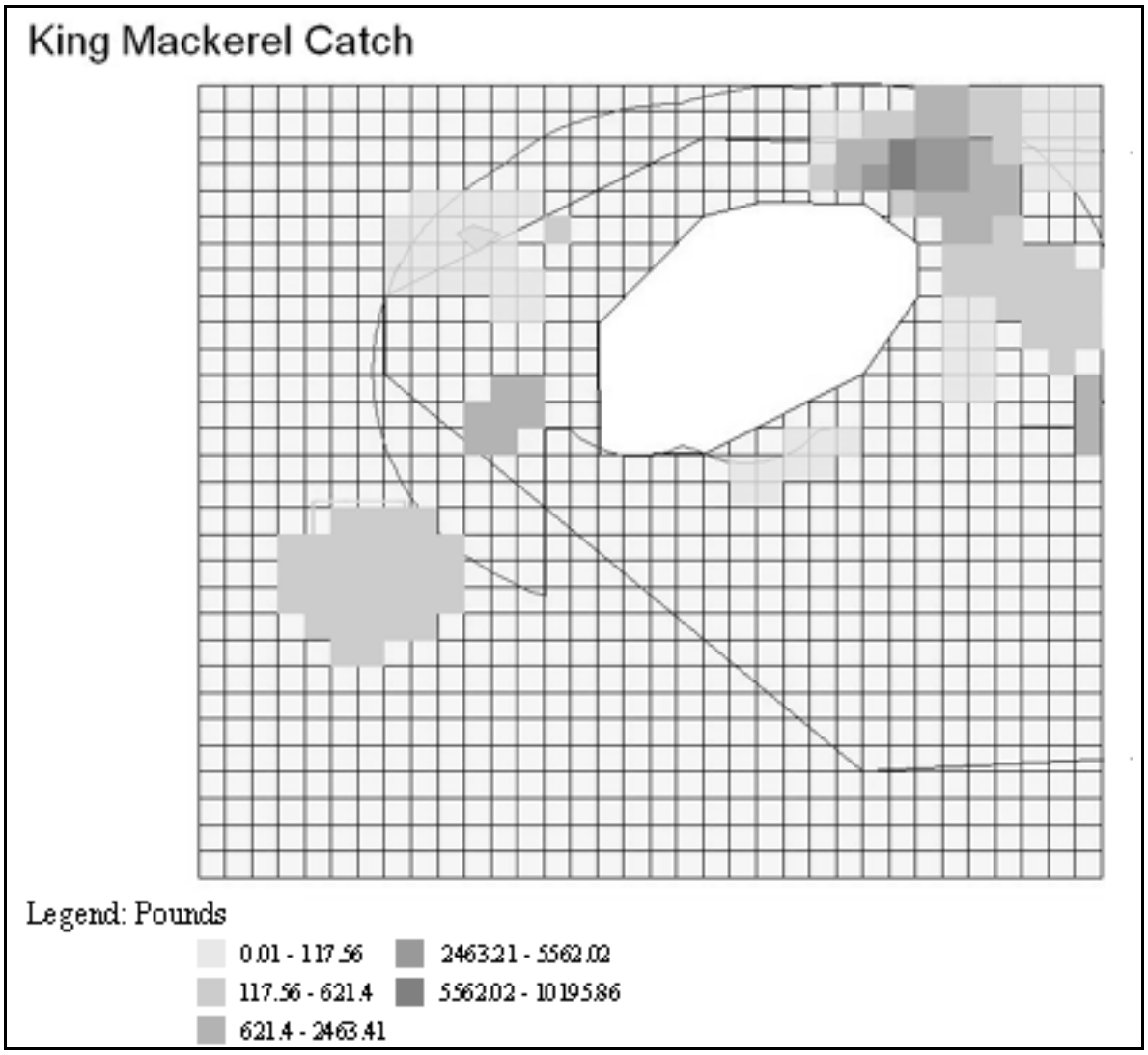


Figure 16. Commercial handline fishing (king mackerel) activity in the Tortugas region in 1998.

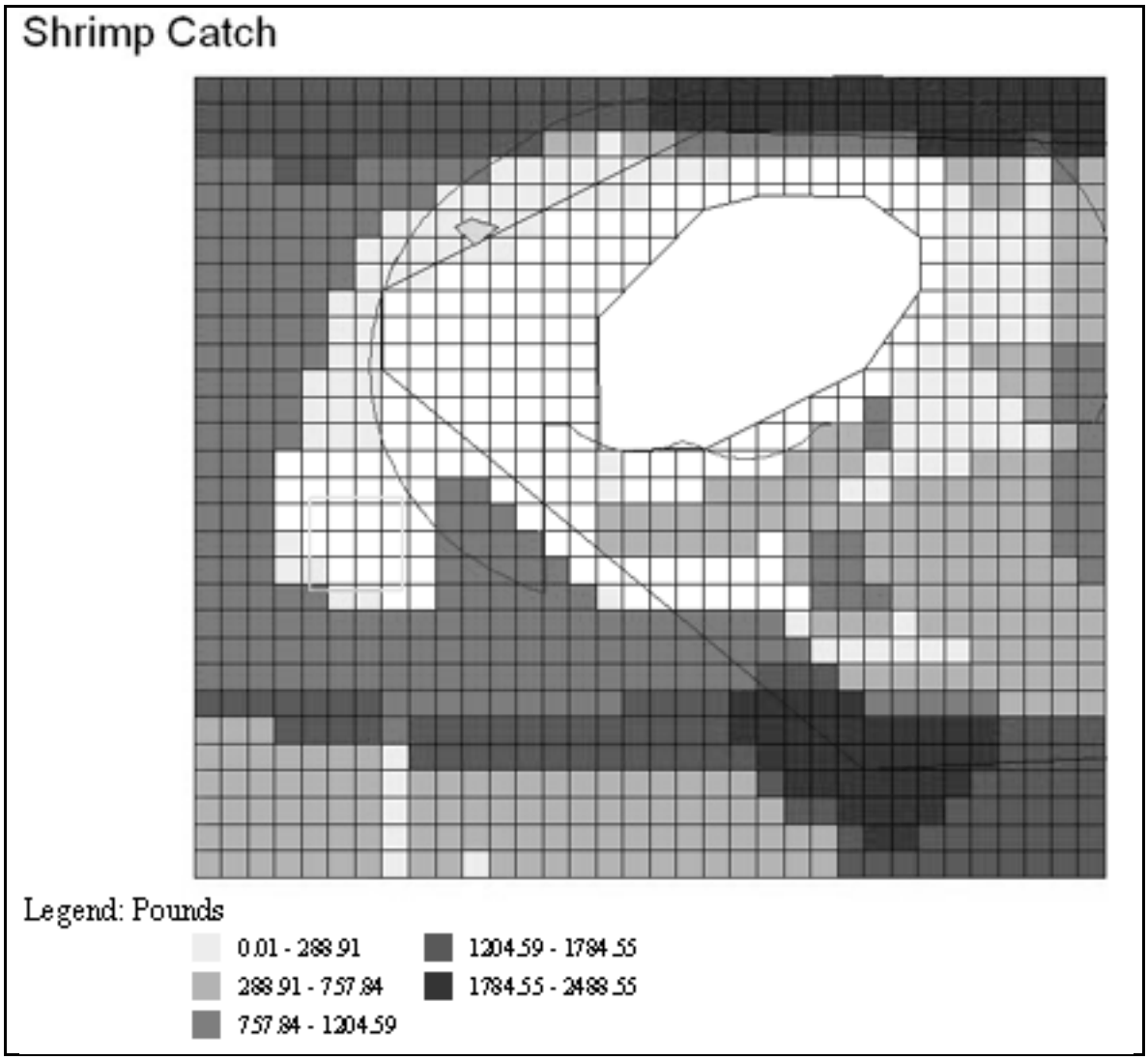


Figure 17. Commercial shrimp trawling activity in the Tortugas region in 1998.

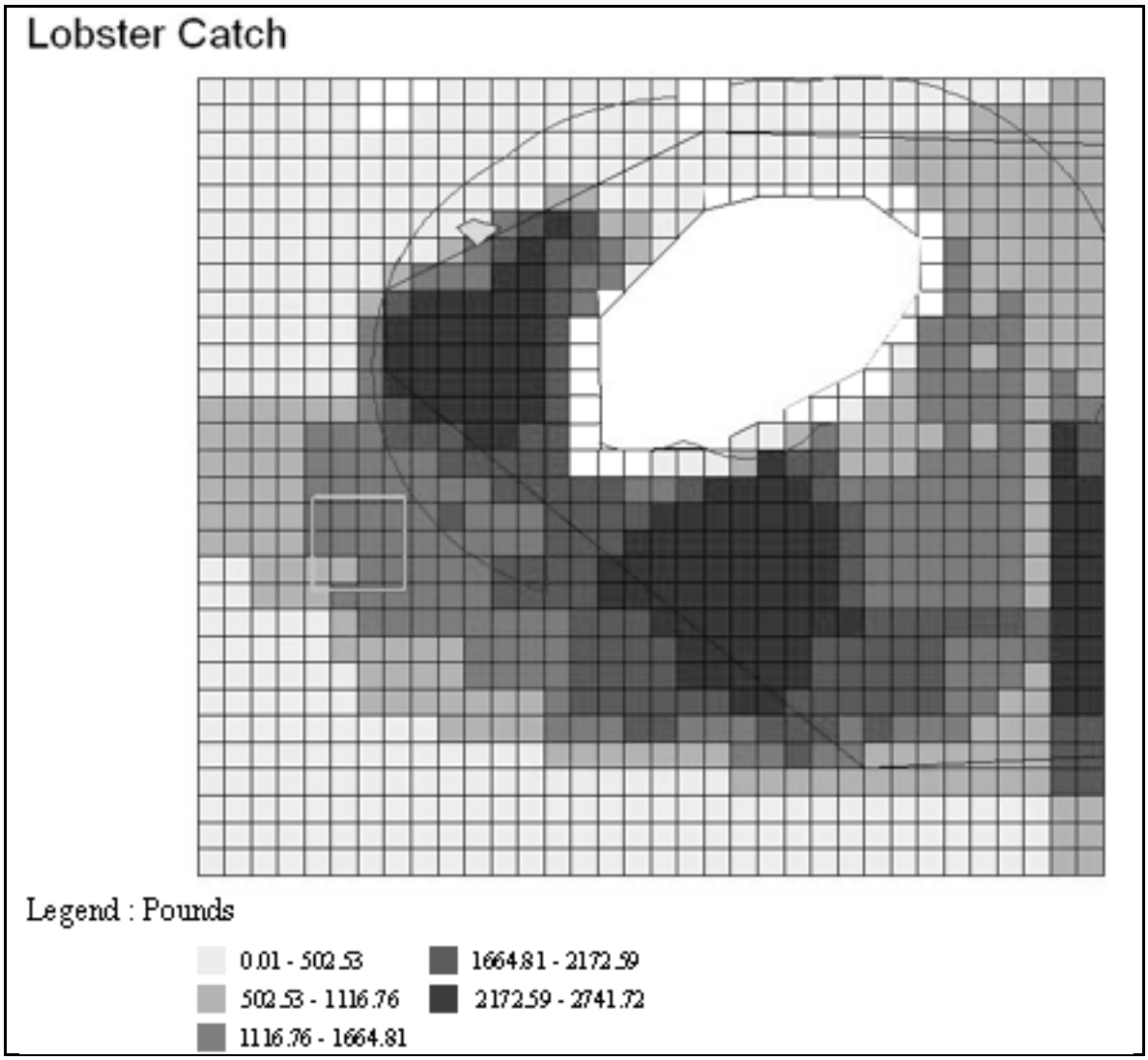


Figure 18. Commercial lobster trapping activity in the Tortugas region in 1998.

11.7 Environmental Consequences

This section compares the differences in environmental impacts among the management alternatives being considered for the marine reserves. In summary, compared to taking no action, the establishment of a marine reserve is expected to have positive environmental benefits.

Alternative 1: this action would establish a marine reserve in the portion of the proposed Tortugas North ecological reserve that resides in the EEZ.

Biological Impacts: establishing a marine reserve would protect EFH from fishery-related impacts and eliminate fishing mortality (assuming adoption of Alternative 7). Establishment of a marine reserve may introduce many benefits to the ecosystem, such as allowing species to achieve greater size and abundance. This may potentially improve reproductive success which could enhance recruitment to other areas in the Gulf of Mexico and the Florida Keys, and thereby contribute toward restoration of overfished stocks (See 9.5.4).

Conclusions: the Magnuson-Stevens Act requires Councils to minimize fishery-related impacts to EFH. This ecosystem-based management action meets this mandate, affording additional protection for habitat important to species for which the Council has management authority, as well as conserving managed and non-managed marine species.

Alternative 2: this action would establish a marine reserve in the EEZ with the same boundaries as the proposed Tortugas South ecological reserve.

Biological Impacts: establishing a marine reserve would protect EFH from fishery-related impacts and eliminate fishing mortality (assuming adoption of Alternative 7). Establishment of a marine reserve may introduce many benefits to the ecosystem, such as allowing species to achieve greater size and abundance. This may potentially improve reproductive success which could enhance recruitment to other areas in the Gulf of Mexico and the Florida Keys, and thereby contribute toward restoration of overfished stocks (See 9.5.4).

Conclusions: The Magnuson-Stevens Act requires Councils to minimize fishery-related impacts to EFH. This ecosystem-based management action meets this mandate, affording additional protection for habitat important to species for which the Council has management authority, as well as conserving managed and non-managed marine species.

Alternative 3: this action would establish a marine reserve in the EEZ at Riley's Hump with the current boundaries of the mutton snapper spawning aggregation site.

Biological Impacts: establishing a marine reserve would protect EFH from fishery-related impacts and eliminate fishing mortality (assuming adoption of Alternative 7). Currently, Riley's Hump only benefits from seasonal closures. Therefore, fishery-related impacts to EFH may still occur. Year-round protection may introduce other benefits as well, such as allowing species to achieve greater size and abundance. This may potentially improve reproductive success which could enhance recruitment to other areas in the Gulf of Mexico and the Florida Keys, and thereby contribute toward restoration of overfished stocks (See 9.5.4).

Conclusions: The Magnuson-Stevens Act requires Councils to minimize fishery-related impacts to EFH. This action meets this mandate, affording additional protection for habitat important to species for which the Council has management authority, as well as conserving managed and non-managed marine species. However, conservation of EFH and marine species and potential benefits are not as great as that offered in Alternative 2 because that area affected is six times larger.

Alternative 4: this action is the status quo or no action alternative.

Biological Impacts: this alternative assumes that no action would be taken and that the current trajectory of uses and concomitant threats to the area would continue. Cumulative impacts from fishing would continue to alter the ecosystem through the removal of top predators which has cascading effects on the trophic structure of the ecosystem and the removal of spawning aggregations. Fishing also could continue to degrade the genetic integrity of species making them less resilient to stress. Fishing would continue to skew the size structure of the population toward smaller individuals which produce significantly fewer eggs than large adults. Cumulative impacts to stock structure from harvest and bycatch and to EFH from fishing gear such as the use of shrimp trawls, lobster traps, fish traps, and illegal use of grapples for retrieving trap lines would continue to erode the integrity of the ecosystem by destroying habitat and juvenile organisms.

Conclusions: the Magnuson-Stevens Act requires Councils to minimize fishery-related impacts to EFH. This action fails to afford additional protection for EFH.

Alternative 5: this action would establish the marine reserves for a period of at least 10 years, to be evaluated at the same intervals the state of Florida evaluates the FKNMS (i.e., every 5 years starting in 2002, 2007, etc.). During these periods, the future status of the marine reserves will be considered by the Council and the FKNMS.

Biological Impacts: overall, the establishment of a marine reserve is expected to have positive environmental benefits. This time period should be sufficient to allow for accrued benefits to become apparent.

Conclusions: The Magnuson-Stevens Act requires Councils to minimize fishery-related impacts to EFH. This ecosystem-based management action meets this mandate, affording additional protection for habitat important to species for which the Council has management authority, as well as conserving managed and non-managed marine species.

Alternative 6a: permanent establishment of the marine reserves.

Biological Impacts: this alternative would permanently protect contiguous habitat areas and preserve portions of the marine ecosystem. This precautionary approach may benefit numerous commercial and recreational fisheries throughout the Florida Keys and southwest Florida, improve scientific understanding of coral reef communities, provide insight on the effect of fishing on EFH, and increase economic returns for non-consumptive businesses.

Conclusions: the Magnuson-Stevens Act requires Councils to minimize fishery-related impacts to EFH. This ecosystem-based management action meets this mandate, affording additional protection for habitat important to species for which the Council has management authority, as well as conserving managed and non-managed marine species. However, the Council opted for an alternative that facilitated the evaluation of the reserves after an allotted time period.

Alternative 6b: this action would establish the marine reserves for a period of 5 or 10 years, to be annually evaluated. Upon expiration of this period, the future status of the marine reserves will be considered by the Council and the FKNMS.

Biological Impacts: benefits from the establishment of the marine reserves may take several years to become apparent. Reproductive success and larval production will increase over time as species abundance is allowed to recover without fishing pressure. However, evaluation after only 5 years may not indicate immediate results for some species and may persuade individuals to abandon the effort without allowing sufficient time for the benefits of the marine reserves to accrue. If an evaluation period is specified, 10 years would be more appropriate.

Conclusions: The Magnuson-Stevens Act requires Councils to minimize fishery-related impacts to EFH. This ecosystem-based management action meets this mandate, affording additional protection for habitat important to species for which the Council has management authority, as well as conserving managed and non-managed marine species.

Alternative 7: this action would prohibit fishing for any species in the marine reserves.

Biological Impacts: protection would be offered to the entire local marine ecosystem, protecting EFH such as fragile coral reefs, as well allowing fishery resources to increase in size and abundance due to the elimination of fishing pressure. Spawning stock biomass and reproductive success may improve, possibly enhancing local fisheries throughout the Florida Keys and southwest Florida through larval emigration, and thereby contribute toward restoration of overfished stocks (See 9.5.4).

Conclusions: this option provides protection for EFH such as coral reefs, completely eliminating fishing pressure and its associated threats to EFH, complying with the Magnuson-Stevens Act EFH mandate. This option provides the most effective protection of EFH and fishery resources though some initial negative economic and social impacts would be experienced by Tortugas area fishermen. However, it is expected that overall the negative impacts would be offset by long-term benefits of the marine reserve.

Alternative 8: this alternative would prohibit all gear except trolling within the marine reserves.

Biological Impacts: trolling may be permitted since this activity is unlikely to directly affect the coral reef ecosystem. However, trolling has been known to harvest yellowtail and other bottom dwelling snappers. The removal of these species could alter the balance of the coral reef ecosystem and, therefore, have an indirect, harmful effect on EFH and other fish species. The use of planers or wire lines would allow the hooks to fish near the bottom and have the potential to impact EFH such as high-relief coral formations as they are pulled through the water column. The U.S. Coast Guard Council members indicated that they could not determine whether fishermen were fishing in the surface waters or bottom waters.

Conclusions: this option provides protection to EFH, however, it does not eliminate fishing pressure and still allows potential negative impacts to habitat such as coral reefs. Furthermore, this alternative presents allocation issues and complicates enforcement responsibilities, potentially encouraging poaching within the marine reserve.

Alternative 9: this action would prohibit all fishing within the marine reserves except for catch and release.

Biological Impacts: this alternative would allow for continued fishing activity within the marine reserves. Degradation of coral resources may still occur, though at a lower rate than currently. Fishery-related impacts may still occur from trolling, weights from bottom fishermen, and disposal/entanglement of fishing gear (See the discussion under Alternative 8 above). Release mortality of caught fish would impact reef communities to an unknown extent.

Conclusions: this option would prohibit harvest of any marine species, while allowing for catch and release fishing. This alternative introduces several management and enforcement complications. While some benefits would be accrued under this alternative, effectiveness may be hindered by potential poaching, release mortality of various marine species, and continued fishery-related impacts to EFH.

Alternative 10: this alternative would prohibit all fishing vessels from anchoring in the marine reserves except in emergencies.

Biological Impacts: prohibiting the anchoring of fishing vessels would eliminate degradation and destruction of habitat such as coral reefs and live bottom (sponges, etc.) which reduces available EFH. These resources would be protected, benefitting reef associated organisms.
Conclusions: this option provides protection for EFH such as coral reefs, completely eliminating habitat damage associated with anchoring of fishing vessels, thus complying with the Magnuson-Stevens Act EFH mandate. The FKNMS should prohibit anchoring by any vessel through their rules. The Council lacks such authority under the Magnuson-Stevens Act.

11.8 Socioeconomic Consequences

This section analyzes only the effects of creating marine reserves in the jurisdiction of the Council (i.e., Alternatives 1 and 2 outside of the FKNMS), whereas Section 8 also provides use information and economic analyses for the entire TERSA and the larger portion of the Tortugas North Ecological Reserve inside the FKNMS and state jurisdictions.

The selection of Alternatives 1 and 2 (establishing the Council EEZ portion of Tortugas North and all of Tortugas South) as proposed alternatives, when coupled with proposed

alternatives 7 and 10 essentially makes these proposed reserves no-use zones (The Council is also requesting that NOS prohibit non-consumptive diving). The potential adverse effects occur by the displacing the recreational activities and commercial fishing that was occurring in areas described by Alternatives 1 and 2. While the information in Section 8 provides the basis to evaluate the potential total losses if those activities were completely terminated, it does not provide a basis to determine the extent to which the losses would be mitigated by shifting the activities to other areas. Also, the ecological and economic benefits that will eventually accrue from the no-use reserves can only be qualitatively described at this time.

Figures 11 through 15 provide assessments of the relative importance of each nautical square mile within the TERSA to the recreational sectors utilizing the areas. The use value for each square mile is depicted in rates of person-days annually. With the exception of charter fishing activity (Figure 11) none of the other activities were occurring in the areas described by Alternatives 1 and 2, i.e., no charter non-consumptive diving (Figure 12), no charter diving for lobster (Figure 13), and no charter spearfishing (Figure 14). Charter fishing activity was occurring in 4 square nautical miles out of the 60 square nautical miles of the Alternative 2 area at a moderately high-use level. Therefore, the displacement of recreational activity by the proposed actions in this amendment is projected to be very minimal. The anticipated potential economic losses from diving for lobster and spearfishing (Table 10) and for non-consumptive diving (Table 16) is zero. The potential loss of revenue from charter fishing would be on the order of $28,000 (Table 10), if not mitigated by fishing other areas. Because of the remoteness of the areas involved the number of business operations providing for recreational activity in the entire TERSA was 12 (Table 5). The long-term benefits to recreational users are qualitatively described in Section 8.4.1.

Figures 15 through 18 provide assessments of the relative importance of each square nautical mile of the TERSA to the commercial sectors fishing for reef fish, king mackerel, shrimp, and lobster. The use values for each square mile are depicted in terms of relative catch per unit effort (CPUE) in pounds per trip. In viewing these figures the reader should be aware that all of these fisheries are seasonal and Keys fishermen at some time during the year may participate in most or all of them.

Figure 15 indicates the 48 vessels (Table 6) that handline for reef fish utilize, at some time, all of the square miles within the TERSA (except the Fort Jefferson National Park waters where commercial fishing is prohibited). The area that will be closed by Alternative 1 is depicted to be of little to moderate importance (based on CPUE), whereas the area that would be closed by Alternative 2 is comparatively much more important yielding high to medium CPUE. The total potential loss of reef fish harvest is estimated to be about 42,000 pounds (Table 18), provided the loss is not mitigated by fishing other areas.

Figure 16 depicts the relative importance of each square nautical mile of the TERSA to the 17 vessels (Table 6) that handline for king mackerel. The area that will be closed by Alternative 1 is depicted to be of little importance in terms of CPUE. Whereas about 1/3 of

the area that would be closed by Alternative 2 is of moderate importance. The total potential loss of king mackerel (Table 18) is estimated to be about 9,400 pounds, but should be mitigated by fishing other areas for the migratory species.

Figure 17 depicts the relative importance of each square nautical mile of the TERSA to the 75 vessels (Table 6) fishing for shrimp. Most of the areas with the highest and higher CPUE values are outside of the area proposed by FKNMS for Tortugas North and Tortugas South reserves. However, most of the area that will be closed by Alternative 1 and about 1/3 of the area that will be closed by Alternative 2 produce moderate to high CPUE. The total potential loss of shrimp (Table 18) is estimated to be about 50,000 pounds, but should be mitigated to some extent as the shrimp migrate out of the closed areas.

Figure 18 indicates the areas of importance to the 31 vessels that set traps for spiny lobster most of which are outside of the areas proposed by FKNMS for the Tortugas North and Tortugas South reserves. The area that would be closed by Alternative 1 is of minor importance compared to the area that would be closed by Alternative 2. The total potential loss of lobster is estimated at about 52,000 pounds (Table 18), provided the loss is not mitigated by fishing other areas.

Total potential loss of harvest revenue by the commercial sector from being displaced by Alternatives 1 and 2 is estimated at about $432,000, provided the loss is not mitigated. That is equivalent to 6 percent of harvest revenue derived from fishing the TERSA (Table 17). Potential long-term benefits to the commercial sector are qualitatively described under Section 8.4.2.

11.9 List of Preparers

Please refer to Section 13.4 for information on the list of preparers for this document.

11.10 List of Agencies, Organizations, and Persons Consulted

Please refer to Section 13.3 for information on the list of agencies, organizations and other individuals that consulted on this issue.

11.11 Public Comment and Responses

Please refer to Section 13.2 for the public comments and responses.

11.12 Public Letters

Please refer to Section 15.5 for public letters.

12.0 OTHER APPLICABLE LAW

12.1 Coastal Zone Management Act

Section 307(c)(1) of the Coastal Zone Management Act of 1972, as amended, requires that all federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. Based upon the assessment of this amendment's impacts in previous sections, it has been concluded that this amendment is an improvement to the federal management measures for EFH and various dependent marine species.

This amendment is consistent with the Coastal Zone Management Plan of Florida to the maximum extent practicable; this determination will be submitted to the Coastal Zone Management Program of the responsible state agency under Section 307 of the Coastal Zone Management Act. The amendment does not affect the Coastal Zone Management programs of the other states.

12.2 Endangered Species Act

Threatened and endangered species listed under the Endangered Species Act that may be associated with the proposed marine reserves include:

Green turtle	*Chelonia mydas*	(Threatened/Endangered)
Hawksbill turtle	*Eretmochelys imbricata*	(Endangered)
Kemp's ridley turtle	*Lepidochelys kempii*	(Endangered)
Leatherback turtle	*Dermochelys coriacea*	(Endangered)
Loggerhead turtle	*Caretta caretta*	(Threatened)

It is anticipated that the actions considered in this amendment will not jeopardize the recovery of endangered or threatened species or their critical habitat.

A Section 7 consultation was held with NMFS on the generic amendment with the following conclusion:

> There have been previous Section 7 consultations conducted on all of the affected FMPs and subsequent amendments. These consultations have found that implementation of these FMPs and subsequent amendments will not jeopardize the existence of any species protected by the ESA under NMFS purview or result in the destruction or adverse modification of critical habitat for those species. We believe that the proposed generic amendment does not change the basis for the findings of previous consultations on these FMPs. NMFS believes that the development of the Tortugas Marine

Reserves - Tortugas North and Tortugas South, in the vicinity of the Dry Tortugas, Florida - is beneficial to the protection and conservation of sea turtles and sea turtle habitat and is not likely to adversely affect the recovery of threatened or endangered species or their critical habitat under NMFS purview.

12.3 Essential Fish Habitat

Essential Fish Habitat Amendment 1 identified and described EFH for managed species in the Gulf of Mexico, as required by the Magnuson-Stevens Act. Threats to EFH and conservation recommendations were also included in Essential Fish Habitat Amendment 1; please refer to sections 6.0 (Threats to Essential Fish Habitat) and 7.0 (Conservation and Enhancement Measures for Essential Fish Habitat) found in Essential Fish Habitat Amendment 1.

The management measures in this amendment are intended to conserve and protect EFH, as well as protecting, and thus improving, spawning stock biomass, genetic diversity, population-age structure, recruitment supply, and ecosystem balance. No direct negative impacts to EFH are expected from the proposed management measures. However, negative impacts to EFH may indirectly occur from the proposed measures; increased fishing pressure and EFH degradation may be experienced along the boundaries of the marine reserves due to fishermen "fishing the line." Displacement of effort may occur due to the proposed actions in this amendment, resulting in the degradation of EFH in other areas.

12.4 Executive Order 12612

These actions do not contain policies with federalism implications sufficient to warrant preparation of a federalism assessment under E.O. 12612.

12.5 Executive Order 12898

On February 11, 1994, President Clinton issued Executive Order 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*." E.O. 12898 is designed to focus attention of federal agencies on the human health and environmental conditions in minority and low-income communities.

The proposed actions are not expected to adversely impact minority or low-income populations, rather it is expected to have a positive impact on these and other groups as fish populations increase outside of the reserve area. According to the socioeconomic impact analysis, the proposed action will not disproportionately affect minorities or low-income groups over other groups. The ethnicity of the groups affected by the preferred alternatives is: 78.1% White, 20.3% Hispanic, and 1.6% African American. The ethnicity of Monroe County in 1990 was: 72.1% White, 12.3% Hispanic, and 5.4% African American.

12.6 Executive Order 13089

The United States Coral Reef Task Force was established by President Clinton through Executive Order 13089 on June 11, 1998. E.O. 13089 directs all federal agencies to protect coral reef ecosystems to the extent practicable and calls for additional actions to protect and restore valuable coral reefs.

The proposed management measures comply with this E.O. by: (1) protecting large areas of coral reef habitat, (2) establishing marine reserves that include coral reef habitat, and (3) coordinating with other relevant federal agencies to achieve comprehensive protection of coral reef resources.

12.7 Executive Order 13158

These actions are consistent with E.O. 13158 on Marine Protected Areas, as the management measures strengthen and expand existing marine protected area (MPA) sites. Furthermore, these actions avoid causing harm to the resources protected by MPAs in the course of federally approved, funded, or conducted actions.

12.8 Marine Mammal Protection Act

It is anticipated that the actions considered in this amendment will not jeopardize the recovery of endangered or threatened species or their critical habitat.

12.9 National Environmental Policy Act

The discussion for the need of this amendment, management alternatives, the affected environment, and their environmental impacts are included in sections 6.0, 7.0, and the DSEIS. Council recommendations for protection and restoration of essential fish habitat are included in Essential Fish Habitat Amendment 1.

12.10 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control paperwork requirements imposed on the public by the federal government. The authority to manage information collection and record keeping requirements is vested with the Director of the Office of Management and Budget. The authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The Council is not proposing measures under this amendment that will involve increased paperwork and consideration under this Act.

12.11 Regulatory Flexibility Act

An IRFA was prepared for this amendment; please refer to section 9.0.

12.12 Vessel Safety

PL. 99-659 amended the Magnuson Act to require that a fishery management plan or amendment must consider, and may provide for, temporary adjustments (after consultation with the U.S. Coast Guard and persons utilizing the fisheries) regarding access to the fisheries for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of the vessels.

No vessel will be forced to participate in the fisheries under adverse weather or ocean conditions as a result of the imposition of management regulations set forth in this amendment. In fact the amendment proposes to prohibit all fishing in the Tortugas South area and in 17 square miles of Tortugas North; therefore, no management adjustments for fisheries access will be provided.

There are no fisheries conditions, management measures, or regulations contained in this amendment which would result in the loss of harvesting opportunity because of crew and vessel safety effects of adverse weather or ocean conditions. Navigation and vessel safety concerns raised by individuals engaged in the fisheries were addressed during the initial boundary designation process by the WG. No concerns have been raised by individuals engaged in the fisheries or by the U.S. Coast Guard that the proposed management measures directly or indirectly pose a hazard to crew or vessel safety under adverse weather or ocean conditions. In fact Alternative 10 does allow anchoring by vessel in the areas when emergencies occur, provided the vessel notifies the U.S. Coast Guard or other federal or state enforcement offices, before doing so Therefore, management measures in this amendment are not expected to affect vessel safety.

13.0 PUBLIC REVIEW

13.1 Public Hearing Locations and Dates

Public hearings on this amendment were held at the following locations and dates from 3:30 p.m. to 8:00 p.m. In addition, public testimony was accepted at the Council meeting at the Westin Beach Resort in Key Largo on July 12, 2000.

Wednesday, June 21, 2000
Sombrero Country Club
4000 Sombrero Blvd.
Marathon, Florida 33050

Thursday, June 22, 2000
Holiday Inn Beachside
3841 North Roosevelt Boulevard
Key West, Florida 33040

13.2 Public Comments and Responses

This section summarizes the public comment received during the respective comment periods for the amendment and the DSEIS, as well as testimony presented at the Council public hearings. An extensive amount of comments were received on the amendment and its DSEIS, the majority of which represent individuals in favor of the proposed management measures.

During the comment period for the amendment which ended June 30, 2000, the Council received 2,293 comments via e-mail and facsimile (**Appendix 15.5**); all of these comments were in support of the proposed management measures. No letters were received from recreational fishermen or organizations objecting to the proposed prohibition on all fishing during the public comment period. **The Council agrees with these comments**.

One letter was received that objected to the establishment of sections of Tortugas North, specifically the northwest portion of the Council's jurisdiction and the northeast corner in Florida waters. The basis for this objection is that the economic impacts on and usage by the shrimp industry were underestimated. The commenter contends that the economic and usage assessments (produced by the FKNMS) failed to take into consideration the number of shrimp vessels from counties other than Monroe County that were involved in the fishery. Therefore, both the economic assessment and the usage graph should have been based on interviews of about 200 vessel owners or operators instead for 75 vessels. Therefore, the commenter states that the assessments grossly underestimate the impacts. The commenter had no objection to the establishment of Tortugas South or most of Tortugas North. **This comment is addressed below.**

Comment letters on the amendment were received from numerous environmental organizations. The World Wildlife Fund (WWF) provided rationale supporting the Council's proposed alternatives 1, 2, 7, and 10. ReefKeeper International submitted comments on behalf of 29 organizations representing 2.5 million members. They supported establishing the 125-square mile Tortugas North and the 60-square mile Tortugas South marine reserves with take of any marine organisms prohibited. They stressed the importance of including these relatively pristine areas as marine reserves, pointing out that visitor use of the Dry Tortugas has doubled in the last three years. They cited numerous benefits such as the protection of biodiversity, protection of critical habitats, and replenishment of marine populations. They maintained that such areas would be relatively unimpacted and simplify enforcement, maximizing socioeconomic benefits. They proposed that the reserves be no-take areas and allow non-consumptive use. The Nature Conservancy has over 1 million members and has been active in the Florida Keys for over a decade with programs to monitor and protect marine communities. They cited benefits of no-take areas already established in the Florida Keys and the number of localized stocks (or aggregations) that appear to be overfished. They also set forth their recommendations for research needed to evaluate the marine reserves. **The Council agrees with these comments**.

During the comment period for the DSEIS which ended August 21, 2000, the Council received 1,630 comments via e-mail and facsimile in support of the proposed measures (**Appendix 15.5**). Numerous other comments were received by the Council via mail or during the Council meeting at the Westin Beach Resort in Key Largo on July 12, 2000. A few of these comments, including a minority report signed by two Council members, were opposed to the proposed management measures. **The Council agrees with the comments that support the management measures**; responses for specific comments are addressed below.

One commenter representing the Southeastern Fisheries Association (SFA) was primarily concerned with the boundaries of the proposed Tortugas North Ecological Reserve. The association did not believe that NOAA had provided adequate justification for the boundaries currently proposed. They recommended that the eastern boundary of the reserve be moved to 82° 57' W in the state portion of the reserve, and the northwestern corner of the reserve which is in the Council's jurisdiction be moved to the 20-fathom curve. The commenter further stated that, based on NMFS poundage from grid 2, in 1995 there were 7,395,285 pounds of shrimp caught. Using a factor of 10 percent, shrimp loss would total 739,528 pounds. In 1996, there was more production, using a 10 percent factor, shrimp loss would total 966,283 pounds. In 1997, using the 10 percent factor, shrimp loss would have totaled 464,806 pounds; this was the lowest year for shrimp production, and was the year chosen by NMFS in doing an economic study. The commenter also noted that a 1997 economic study (Leeworthy and Bowker) stated 6,565,000 pounds of shrimp originating from Zone 2, while the NMFS estimate out of Galveston, Texas, was 4,648,000 pounds; this constituted a 41.3 percent error. Furthermore, the Leeworthy and Wiley study used a price of $2.40 per pound while the NMFS study used a figure of $4.31 per pound, a 79 percent error which translates to a 27.1 percent error in value. The commenter also stated that shrimp lost due to the boundaries of the marine reserves could be replaced from other fishing areas is an incorrect assumption. The commenter maintained that the Leeworthy and Wiley study over-estimated the production, under-estimated the value, and under-estimated the price per pound.

The first claim that approximately one million pounds of shrimp would be lost to fishermen due to the Tortugas North and Tortugas South reserves (FKNMS boundaries) is not credible. No quantitative support is offered to support such an estimate. The only information offered is vessel tracking data for his fleet of six vessels. No quantities of catch are offered, only that 30 percent of their time is spent in the Tortugas North area. The sample of shrimp fishermen from Leeworthy and Wiley accounted for 90 percent of the 58,374 pound estimate. Non-sampled fishermen, including those that landed shrimp in counties other than Monroe and Lee (i.e., Hillsborough, Pinellas and Franklin counties) account for the other 10 percent. If all the shrimp catch from the non sampled population estimated in the TERSA were caught in Tortugas North and Tortugas South reserves (FKNMS boundaries), this still would only amount to 71,500 pounds. If 30 percent of all the shrimp caught in FMRI areas 2.0 and 2.9 (183,319 pounds) were caught in the Tortugas North and Tortugas South reserves (FKNMS boundaries) and then landed in Hillsborough, Pinellas, and Franklin counties, this would only amount to 54,996 pounds. None of these estimates approach the one million

pound estimate. The entire shrimp catch from the TERSA (715,500 pounds) does not even approach the one million pound estimate, and the Leeworthy and Wiley sample accounted for 90 percent of all the shrimp caught in FMRI Areas 2.0 and 2.9. The estimate of one million pounds of shrimp from the Tortugas North and Tortugas South reserves (FKNMS boundaries) simply does not hold up to scientific scrutiny.

Leeworthy and Wiley used an average price at the ex-vessel **level of $2.40 per pound**. The commenter cites an ex-vessel value from NMFS and calculates an average price of $4.31 per pound. Both of these prices are correct, however, they are calculated using different weights. The NMFS weights are heads-off weight, whereas in the economic impact analysis, a heads-on weight was utilized. To gain a head-off weight average, the heads-on weight must be multiplied by 0.65. This provides a heads-on price average of $3.69 per pound.

Council staff, in reviewing Leeworthy and Wiley's (1999) socioeconomic impact analysis did determine that their use of $2.40 per pound, heads on, as the ex-vessel value of the shrimp was inappropriate (Swingle memo dated 10/11/00). That is because during the study period 48.6 percent of the shrimp harvested from the study area were landed in Lee County Florida at an ex-vessel value of $3.16 per pound, heads on. Therefore, an average weighted value of $2.75 per pound, heads on, should have been used. Council staff utilized this weighted average to modify the economics used in this amendment.

One commenter opposed the exclusion of all user groups, stating that trolling and/or catch-and-release fishing should be permitted. The exclusion of all fishing is supported within the amendment. Catch-and-release fishing has a documented release mortality rate associated with the activity and therefore would not be compatible with the desired goals of the reserves. Furthermore, allowing trolling for pelagics and/or catch-and-release fishing complicates law enforcement and may encourage poaching activities, as noted in the amendment and from testimony from NOAA Law Enforcement and the U.S. Coast Guard.

A Council minority report signed by two Council members disagree with the proposed management actions and does not support the amendment. The report states that the proposed actions are in violation of National Standards 1 and 7 of the Magnuson-Stevens Act. It also states that the only reason the Council is drafting this amendment is due to a request from NOAA. A criticism of the use of marine reserves to benefit marine fisheries is also included, as well as a criticism of the inclusion of coastal pelagics (e.g., dolphin, wahoo) in the prohibition. Finally, the commenters believe that a double standard is being created between divers and anglers.

The amendment and the proposed management actions are in compliance with the National Standards of the Magnuson-Stevens Act. The assertion that the marine reserves violate National Standard 1, which states that "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery..." is unfounded. Documented benefits of marine reserves are included within the amendment, which support the desired goals and objective of the management actions. Numerous scientific studies state that size and age of fish increase within marine reserves.

Additionally, reproductive success can be improved, thus benefitting other areas through larval transport. It should also be noted that, as the marine reserves are closed year-round, the benefits are accrued "on a continuing basis." The comment that the amendment is in violation of National Standard 7, which states, "Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication" is not supported. The establishment of the marine reserves is a collaborative effort between the Council and the FKNMS, not two separate and disconnected actions. As the FKNMS does not have authority in the areas of Tortugas South and portions of Tortugas North, the Council is proceeding with similar management measures to complement those being established by the FKNMS, NPS, and the state of Florida.

While the section that outlined the problems requiring the amendment (Section 5.0) made mention of the request from NOAA, there were discussions in other areas of the document that detailed the need and purpose of marine reserves. Section 5.0 has been revised to address this issue, after editorial license was granted at the July Council meeting; information that was included elsewhere in the draft amendment has been condensed in Section 5.0 to better relate the need for this action. This information also details the drawbacks of conventional fishery management techniques and the niche that marine reserves may fill. Discussion on the inclusion of coastal migratory pelagics, as well as catch-and-release fishing was responded to in an earlier comment. No management actions were included for recreational divers as no authority to manage this sector is authorized under the Magnuson-Stevens Act.

13.3 List of Agencies and Persons Consulted

Gulf of Mexico Fishery Management Council:
Standing Scientific and Statistical Committee

Coastal Zone Management Programs:
Florida

National Marine Fisheries Service:
Southeast Regional Office
Southeast Fisheries Science Center
Headquarters

National Ocean Service:
Florida Keys National Marine Sanctuary

Associations:
Center for Marine Conservation
Environmental Defense Fund
Project ReefKeeper International

Coastal Conservation Association
National Coalition for Marine Conservation
GreenPeace
Gulf Restoration Network
Monroe County Commercial Fishermen, Inc.
Southeast Fisheries Association
Organized Fishermen of Florida
Southern Offshore Fishing Association
Islamorada Charter Boat Association
Recreational Fishing Alliance
Florida League of Anglers
Florida Keys Fishing Guides Association
Gulf and South Atlantic Fisheries Foundation
Florida Wildlife Federation
Isaac Walton League
Key West Charter Boat Association

13.4 List of Preparers

National Marine Fisheries Service:
Michael Barnette, Biologist

Gulf of Mexico Fishery Management Council:
Wayne Swingle, Biologist
Antonio Lamberte, Economist

Florida Keys National Marine Sanctuary:
Ben Haskell and Staff

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15.0 APPENDICES

15.1 Gulf of Mexico Fishery Management Plan Area Closures

Gulf Wide Closures	Area (square nautical miles)
Stressed Area Closure* (Figure 9)	48,400
Longline/Buoy Gear Area Closure (Figure 7)	
Eastern Gulf**	24,400
Central/Western Gulf*	47,900
Total	72,300
Florida Closures	
Tortugas Shrimp Sanctuary* (Figure 2)	3,652
Southwest Florida Seasonal Closure (Shrimp/Stone Crab)** (Figure 5)	
State Waters (1 October - 31 May)	2,562
Federal Waters (1 January - 20 May)	1,489
Total	4,051
Central Florida Shrimp/Stone Crab Separation Zones (Figure 6)	174
Florida Middle Ground HAPC* (Figure 8)	348
Riley's Hump (1 May - 30 June)*	11
Proposed Madison/Swanson Marine Reserve (Figure 8)*	*115*
Proposed Steamboat Lumps Marine Reserve (Figure 8)*	*104*
FLORIDA TOTAL	8,455
Texas Closures	
Cooperative Shrimp Closure (15 May - 15 July) (Figure 4)	
Initial 15 nautical miles offshore*	5,475
200 miles**	NA
Flower Garden Banks HAPC*	41
TEXAS TOTAL	5,516

*EFH Closures
**Gear Closures

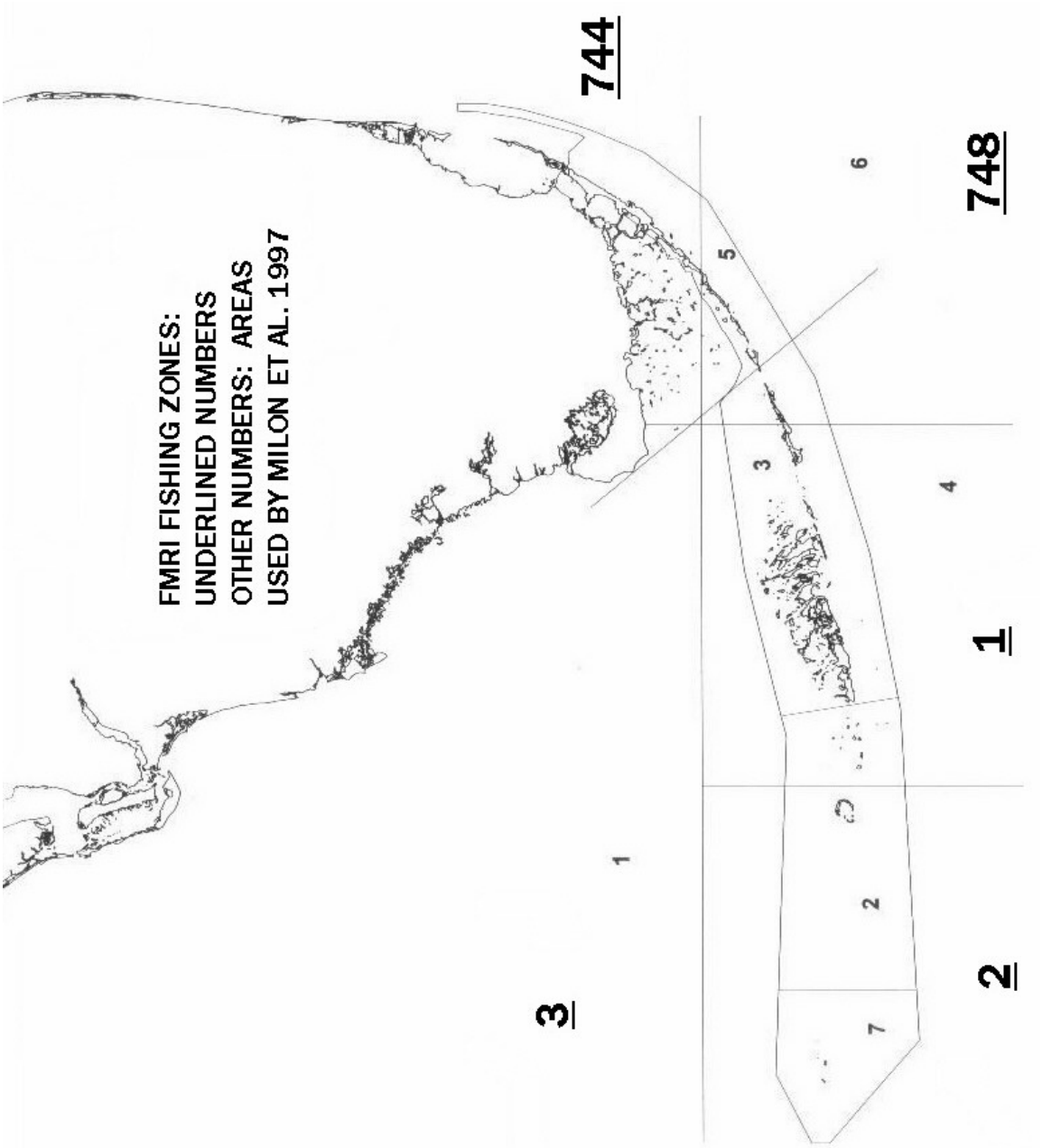

Figure 1. Florida Keys Fishing Zones (FMRI).

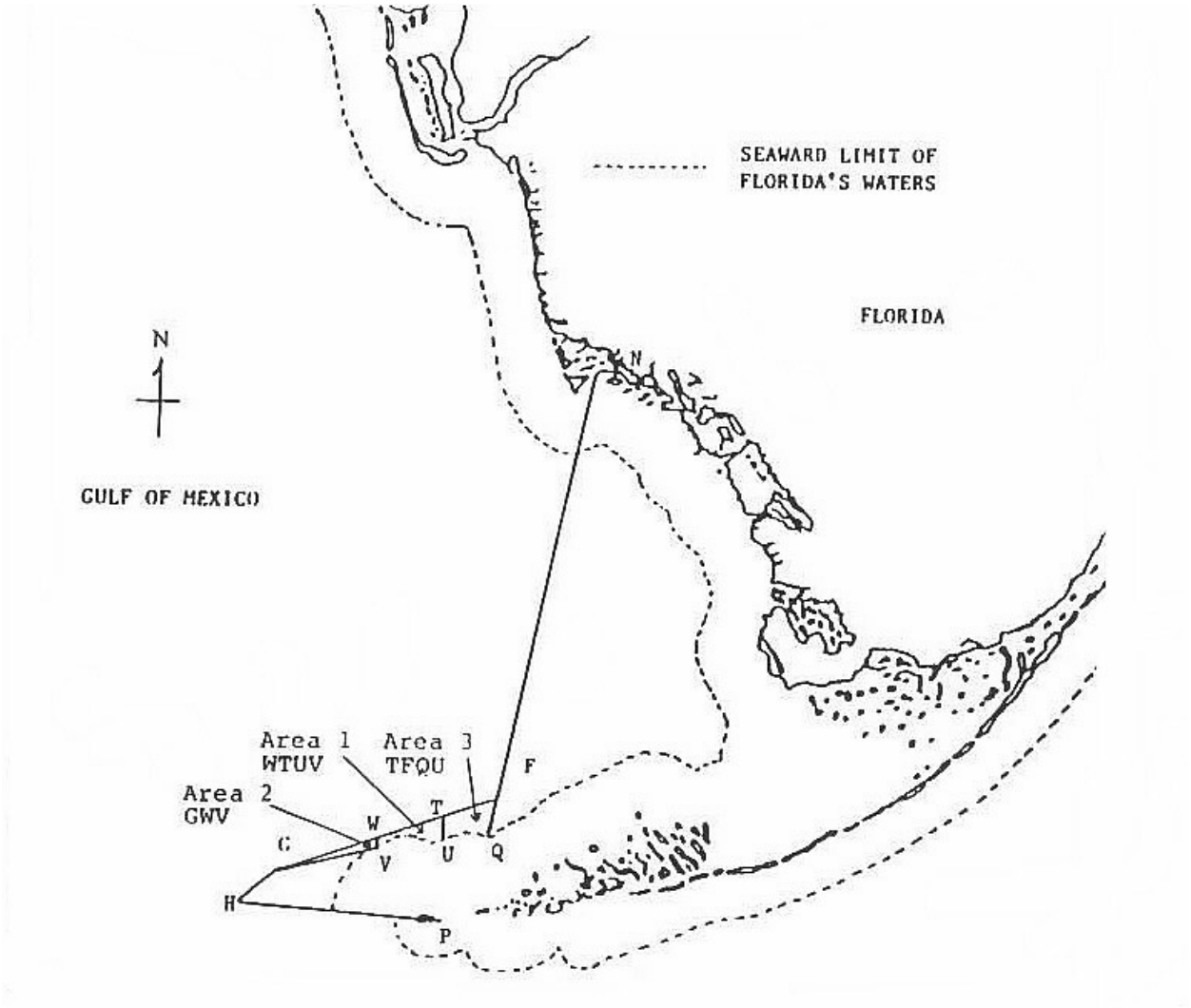

Figure 2. Tortugas Shrimp Sanctuary.

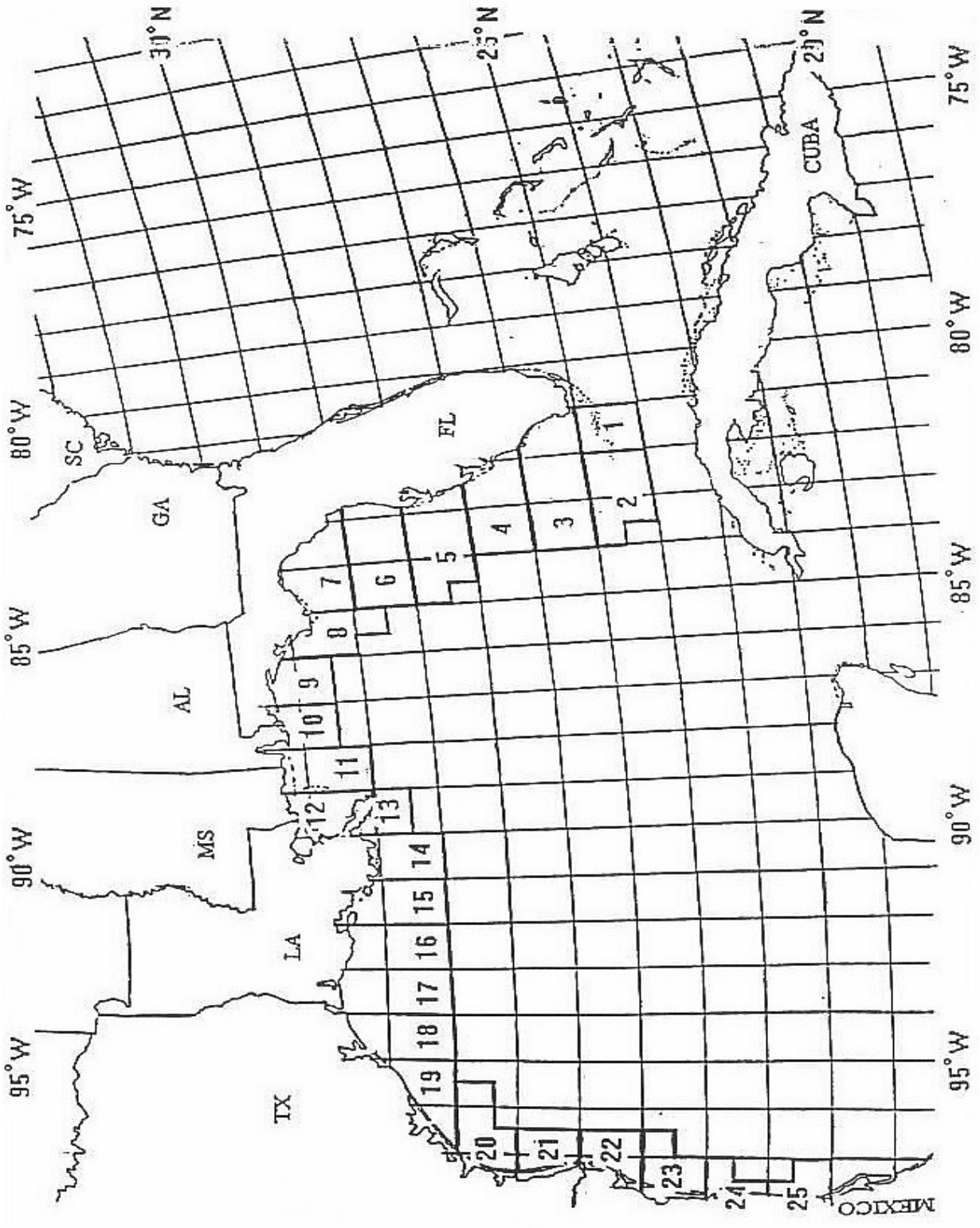

Figure 3. Gulf of Mexico Statistical Areas.

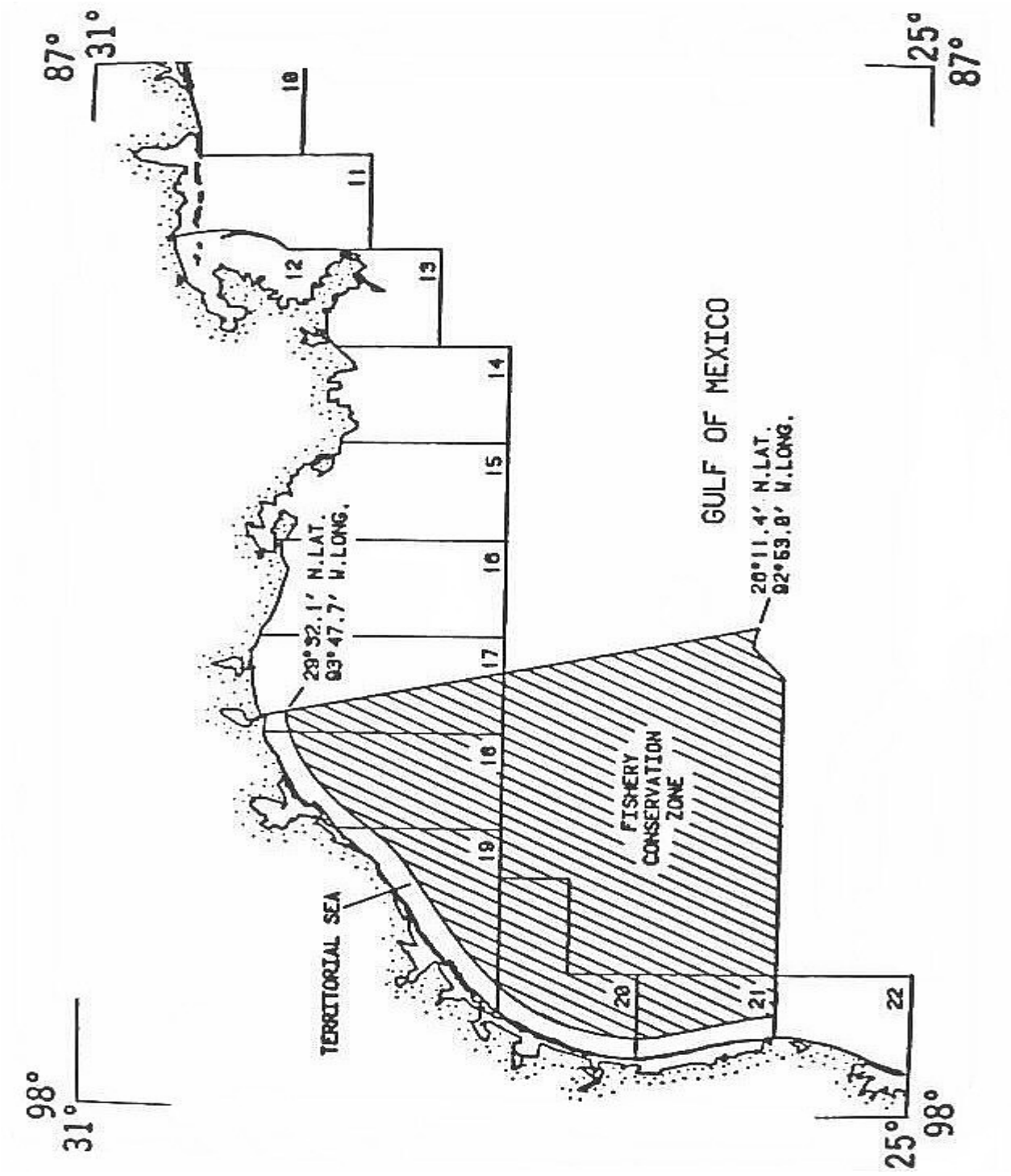

Figure 4. Cooperative Texas Shrimp Closure.

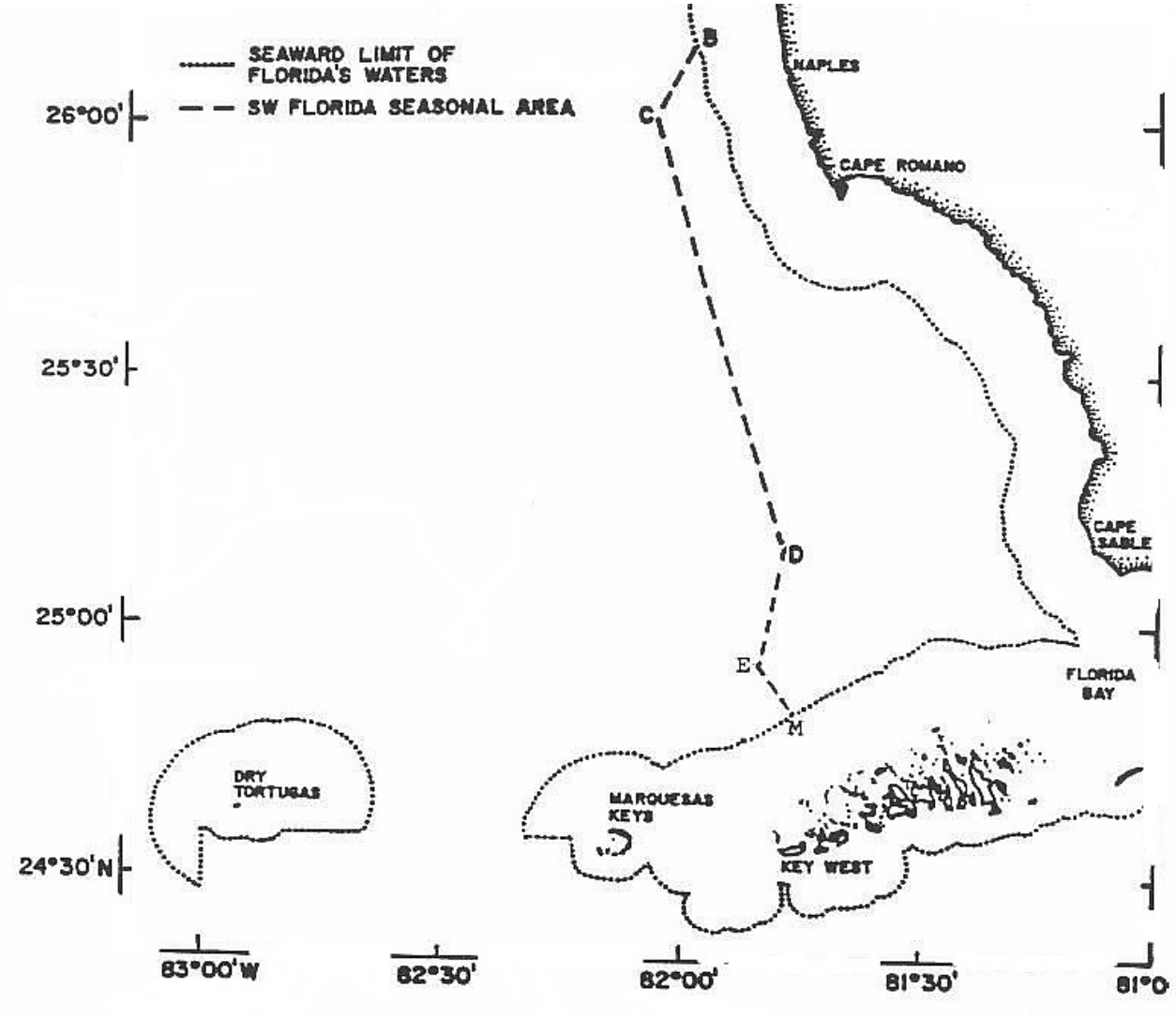

Figure 5. Southwest Florida Seasonal Trawl Closure.

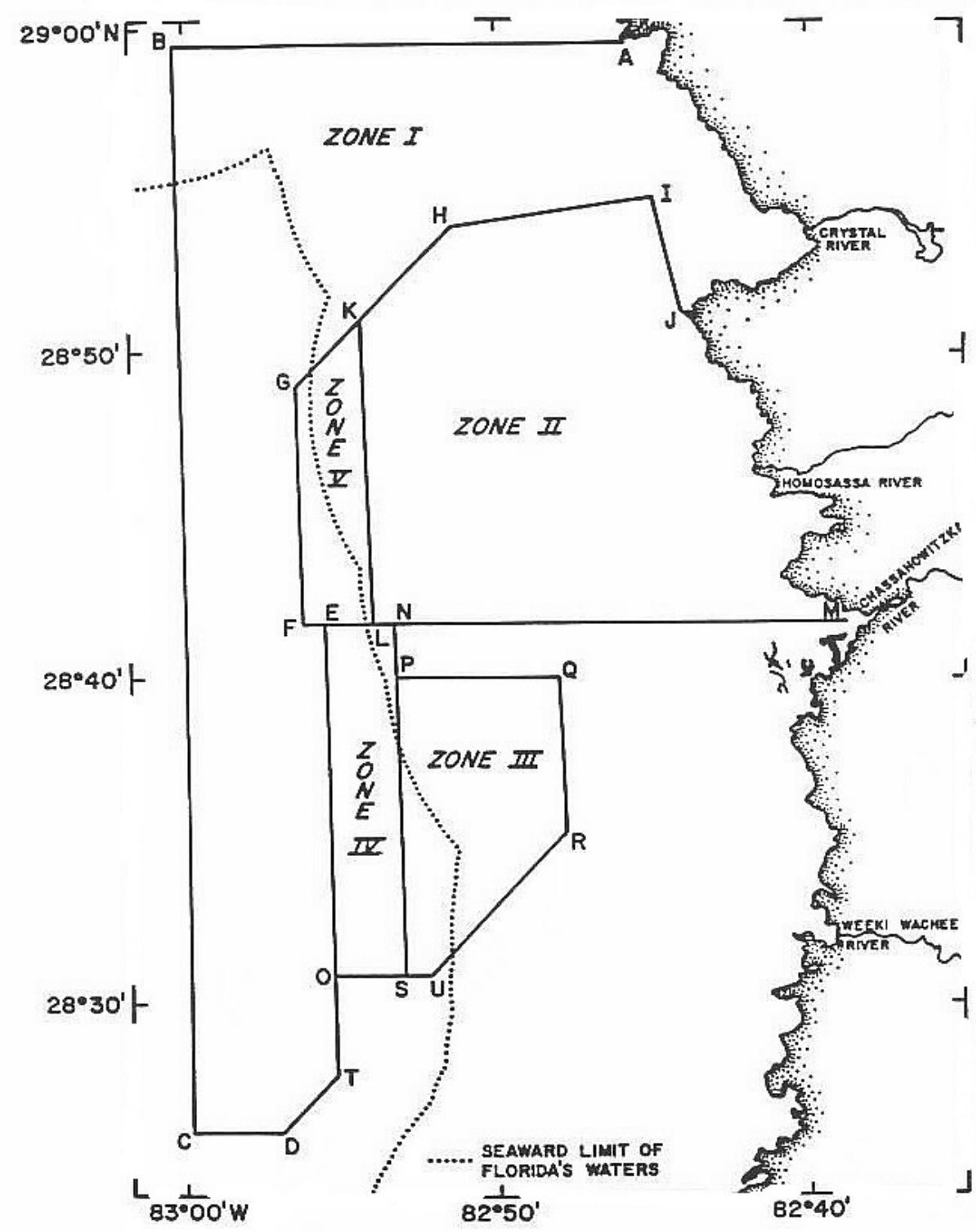

Figure 6. Shrimp/Stone Crab Separation Zones.

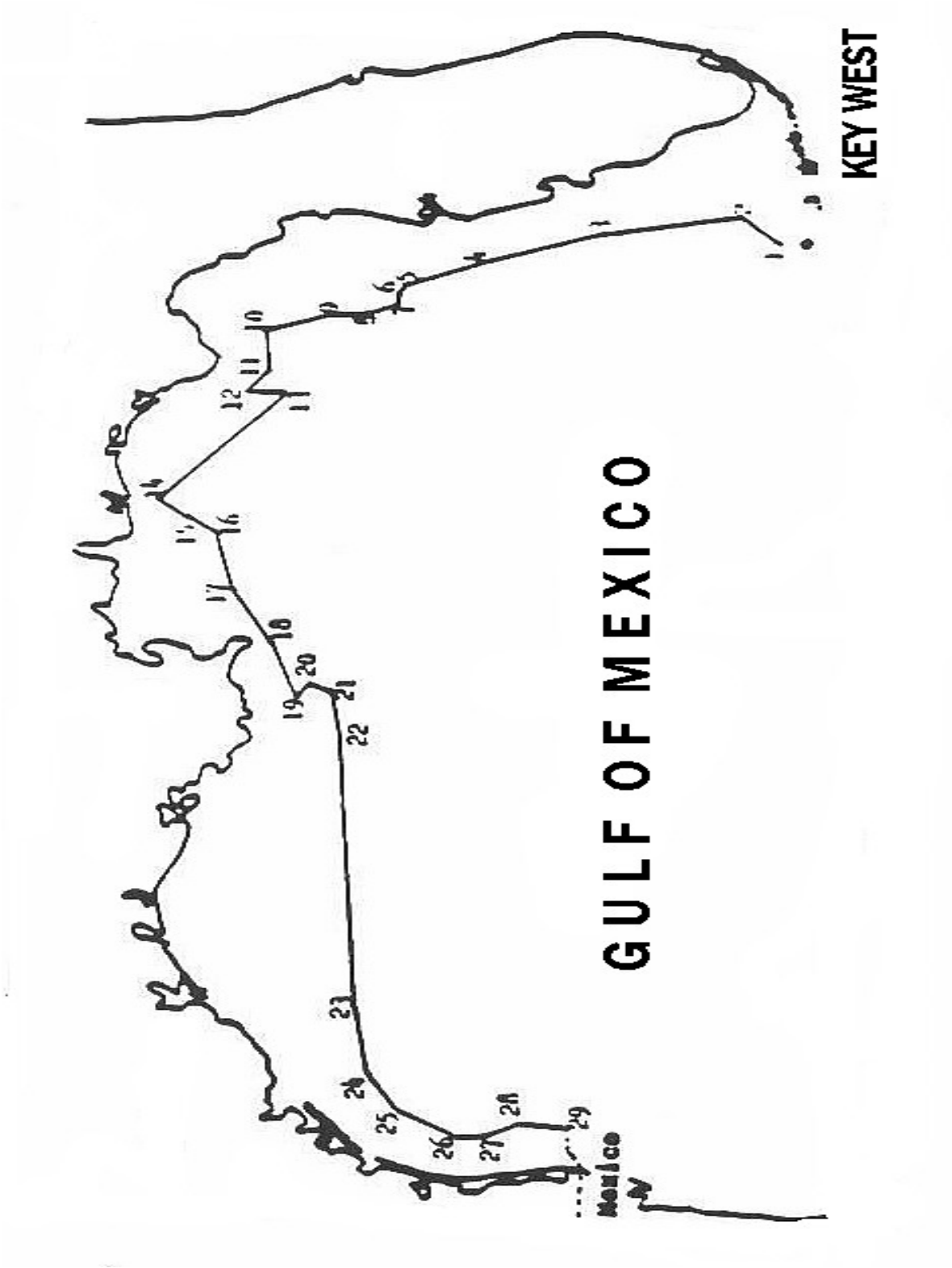

Figure 7. Seaward Limits of the Longline and Buoy Gear Restricted Area.

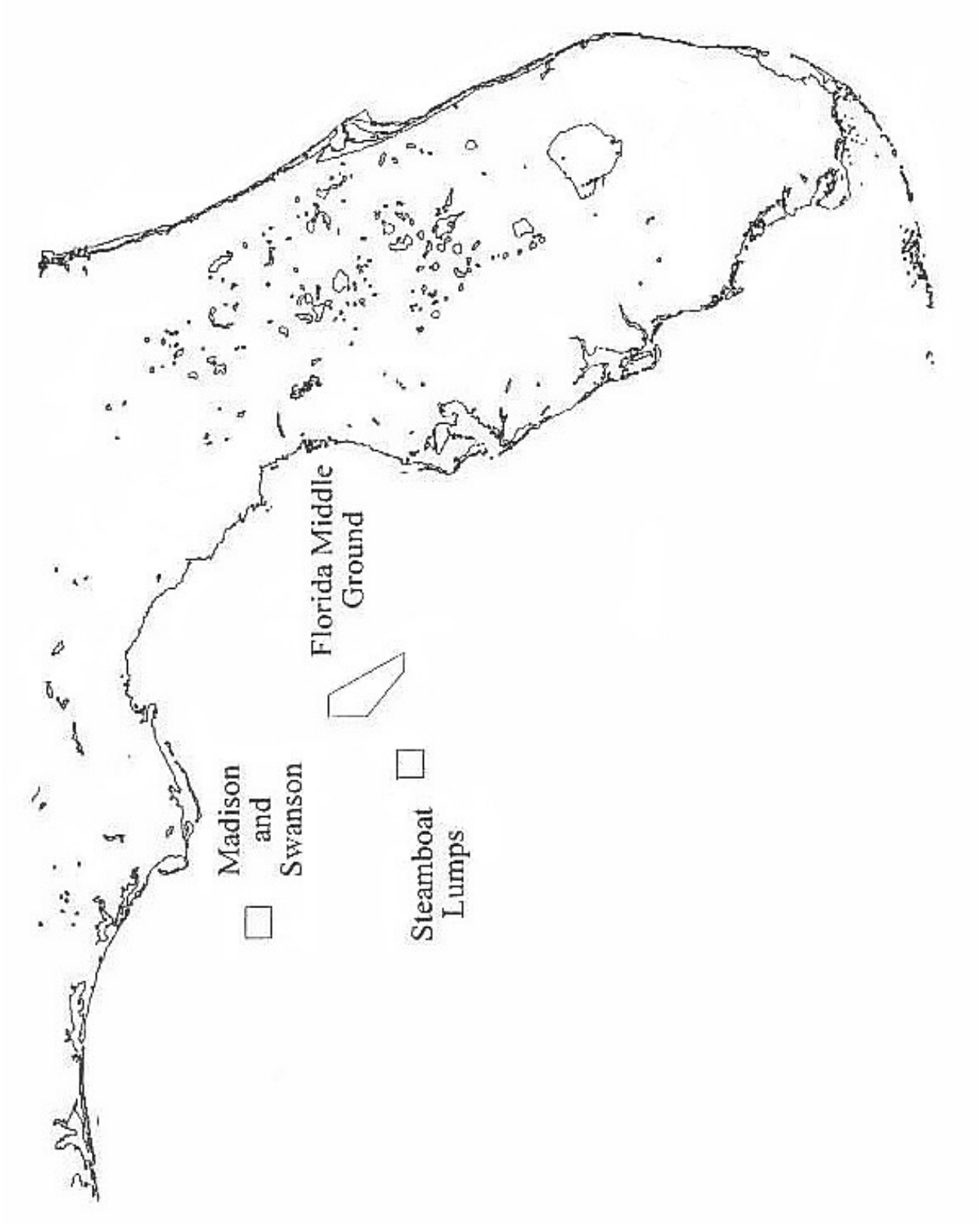

Figure 8. Florida Middle Ground HAPC and Proposed Madison/Swanson and Steamboat Lumps Marine Reserves.

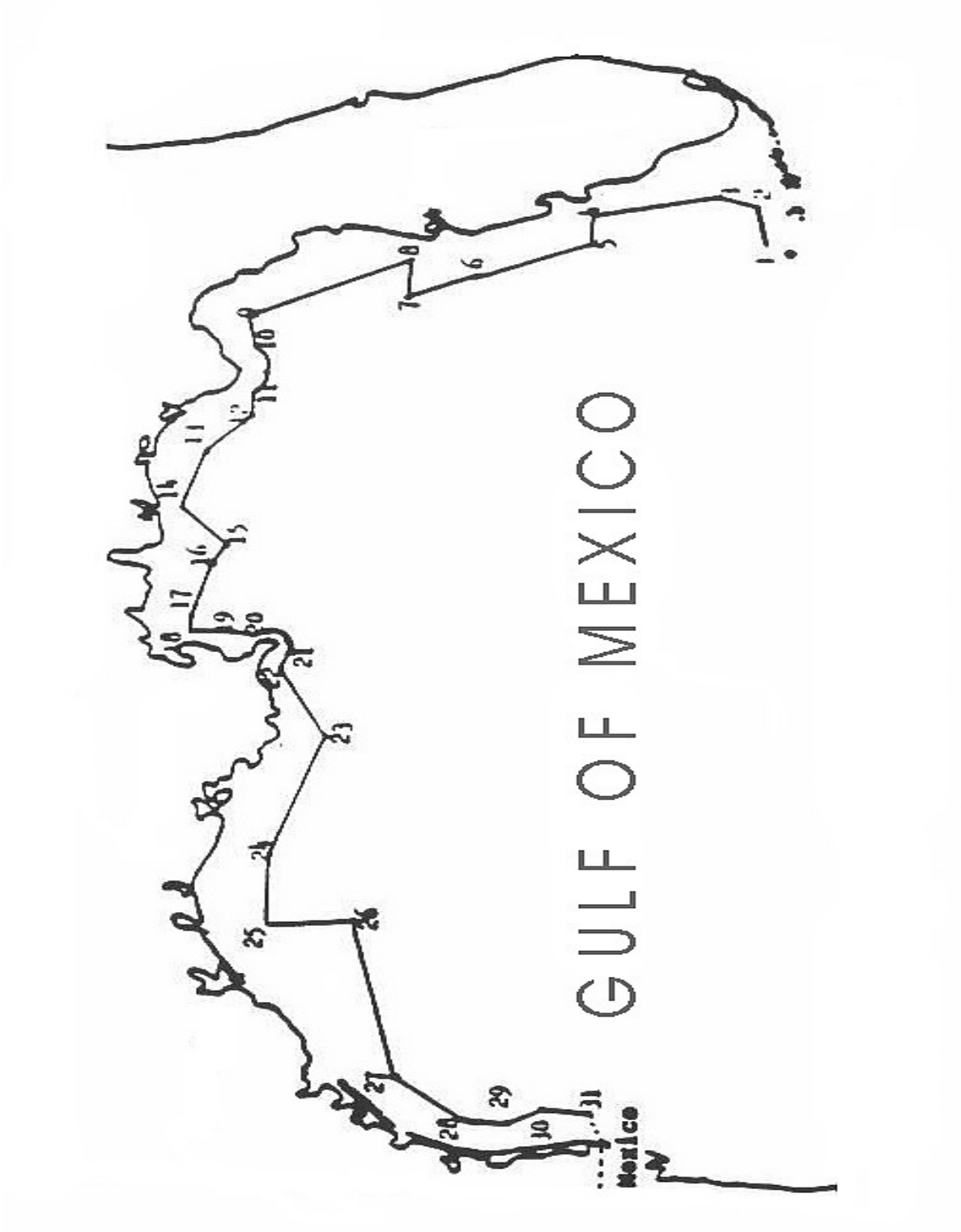

Figure 9. Seaward Limits of the Stressed Area.

15.2 Benoit Letter to the GMFMC (22 October)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Silver Spring, Maryland 20910

OCT 22 1999

Wayne Swingle
Executive Director
Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North
Tampa, Florida 33619-2266

Dear Mr. Swingle:

I am writing to present for the Gulf of Mexico Fishery Management Council's (Council) consideration the proposed establishment of the Tortugas Ecological Reserve in the westernmost portion of the Florida Keys National Marine Sanctuary and nearby areas. In accordance with section 304(a)(5) of the National Marine Sanctuaries Act, 16 U.S.C. 1434(a)(5), NOAA requests the Council to prepare draft regulations for fishing to achieve the purposes of the proposed ecological reserve.

Background

During the development of the management plan for the Sanctuary, NOAA initially proposed a 110 square nautical mile Ecological Reserve in the Tortugas area. The Council reviewed and concurred with NOAA's proposed zoning plan, including the proposed Tortugas Reserve. However, comments received on the draft plan included suggestions that the proposed Tortugas Reserve as originally configured would have significant economic impacts on fishermen, and that the proposed reserve should be reconfigured to incorporate additional reef communities. Consequently, NOAA deferred the establishment of a final boundary for the Tortugas Reserve for 2 years pending completion of its development.

As provided in the Sanctuary Management Plan, this continued planning process has involved working with the State of Florida, the National Park Service, the National Marine Fisheries Service (NMFS), the Council, the public and other interested parties. In October and November of 1998, we held a series of joint scoping meetings with the National Park Service which is in the process of rewriting its general management plan for the Dry Tortugas National

Park. On May 22, 1999, after 6 meetings and a year of information gathering, a 25-member working group of the Sanctuary Advisory Council (SAC) comprised of agency and user stakeholders (Attachment A) came to full consensus on a recommendation of a preferred alternative to the Sanctuary Advisory Council. On June 15, 1999, the SAC approved the Working Group's recommendation and submitted it to the FKNMS and the State for consideration.

Proposed Ecological Reserve

The recommended proposed ecological reserve consists of two areas: Tortugas North and Tortugas South. The proposed reserve not only includes a modification to the location and size of the originally proposed Tortugas Ecological Reserve within the Sanctuary boundary, but also includes two areas outside the Sanctuary boundary, Sherwood Forest and Riley's Hump. Sherwood Forest is located in the northwestern corner of the Tortugas North reserve and falls entirely within State waters. Riley's Hump is located within the proposed Tortugas South reserve which is entirely within the Council's jurisdiction. Attachment B provides a description of the areas included in the proposed reserve. The Working Group included these areas to achieve protection of a diverse array of habitats without consideration of political jurisdictions. Sherwood Forest and Riley's Hump would be included in the proposed reserve by an expansion of the Sanctuary boundary (depicted in Attachment C) to provide comprehensive ecosystem protection to the sensitive resources within these areas.

The Marine Sanctuaries Division and our co-trustee, the Florida Department of Environmental Protection, have accepted the SAC's recommendation for the proposed reserve. The majority of the proposed Tortugas North area is in State waters and we are working with the State of Florida to establish and develop draft regulations for the proposed ecological reserve. NOAA will draft an environmental impact statement that will analyze the impacts of the proposed reserve as well as other alternative boundary scenarios. The draft supplemental environmental impact statement (DSEIS) will supplement the final management plan/environmental impact statement plan for the Sanctuary. We expect the DSEIS to be issued in January, 2000, and will provide the Council with copies of the document.

Request for Council Action

The proposed ecological reserve will encompass and protect diverse habitats and biodiversity in the Tortugas area to restore and protect the biodiversity, genetic diversity, and sensitive habitats of the Tortugas region. We fully expect given the large size and current patterns of this area that there will be benefits to surrounding fish and shellfish populations through spillover and replenishment. To achieve the intended purposes of the ecological reserve all consumptive uses and activities that may degrade resources, such as fishing, diving, anchoring and discharging, would need to be restricted or prohibited within the reserve, similar to the Western Sambos Ecological Reserve.

We view this as a collaborative effort with the State, the Council and NMFS, as each can play a significant role in the establishment of the reserve. The Council has jurisdiction over a portion of the area within the proposed reserve, specifically all of Tortugas South and the northwesternmost corner of Tortugas North beyond State waters. Therefore, in accordance with section 304(a)(5) of the National Marine Sanctuaries Act, 16 U.S.C. 1434(a)(5), I request the Council to prepare fishing regulations to implement the purposes of the proposed ecological reserve in these areas. However, in this case instead of preparing draft fishing regulations to be issued as Sanctuary regulations, I request that the Council take this matter up at its November 8-11, 1999, meeting and begin preparation of regulations, pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, prohibiting fishing within the proposed reserve. Once these regulations are established, the Sanctuary Program may subsequently adopt them as Sanctuary regulations.

To assist the Council's review of this issue we have enclosed a site characterization (Attachment D), a draft socioeconomic impact analysis (Attachment E) as well as a summary of public comments received during the scoping process for this project (Attachment F).

The establishment of the Tortugas Ecological Reserve provides an opportunity for the Sanctuary and the Council to work together with other resource managers to take a major step in marine resource protection and conservation. I encourage the Council to review this project and join us in establishing a world-class ecological reserve in an area that will benefit generations to come.

Thank you for your cooperation and assistance in improving protection of marine resources in the Florida Keys. I look forward to the Council's response.

Sincerely,

Jeffrey R. Benoit
Director

Attachments:

A (Tortugas 2000 Working Group)
B (Description of Areas within the Proposed Reserve)
C (Map of Proposed Reserve w/Sanctuary Expansion)
D (Tortugas Site Characterization)
E (Draft Socioeconomic Analysis)
F (Summary of Public Comments Received During Scoping Process)

cc: Rebecca Lent (w/attachments)
Dr. Bill Hogarth (w/o attachments)
Dr. Andrew Rosenburg (w/o attachments)
Jim Mccallum (w/o attachments)
Billy Causey (w/o attachments)
Dr. Russell Nelson (w/o attachments)
Paula Allen (w/o attachments)
Anna Marie Hartman (w/o attachments)
Stephanie Thornton (w/o attachments)
Margo Jackson (w/o attachments)
Karl Gleaves (w/o attachments)
Gene Proulx (w/o attachments)
Karen Raine (w/o attachments)
Mike McLemore (w/o attachments)

15.3 Benoit/Dalton Letter to the GMFMC

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Silver Spring, Maryland 20910

November 10, 1999

Wayne Swingle
Executive Director
Gulf of Mexico Fishery Management Council
The Commons at Rivergate, Suite 1000
3018 U.S. Highway 301 North,
Tampa, Florida 33619-2266

Dear Mr. Swingle:

We wish to thank the Gulf of Mexico Fishery Management Council (Council) for providing us the opportunity to present information regarding the proposed establishment of the Tortugas Ecological Reserve yesterday at the Joint Meeting of the Marine Reserves/Reef Fish Management Committees. The purpose of this letter is to reiterate the views presented by Bill Hogarth, on behalf of NMFS, and Billy Causey, on behalf of NOS, and to encourage the Council to proceed with the development of a fishery management plan amendment to implement this ecological reserve. We request that the Council prepare its regulations pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, prohibiting fishing within the proposed reserve. After these regulations are in place, the Sanctuary Program may subsequently adopt them as Sanctuary regulations for the reserve.

This procedure will allow us to benefit from the Council's experience and expertise in fisheries management in the Tortugas Area as well as its direct involvement with individuals who use this area. A similar approach was successfully taken with the recent establishment of the Hind Bank Marine Reserve through the Caribbean Council.

We appreciate the Council's collaboration on this vital project to protect the marine resources and environment of the Florida Keys.

Penny Dalton
Assistant Administrator for
Fisheries

Jeffrey R. Benoit
Director, Office of Ocean and
Coastal Resources

15.4 Benoit Letter to the GMFMC (23 December)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Silver Spring, Maryland 20910

DEC 23 1999

Mr. Wayne Swingle
Executive Director, Gulf of Mexico
Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North
Tampa, Florida 33619-2266

Dear Mr. Swingle:

I am writing to consult with the Gulf of Mexico Fishery Management Council (Council) regarding the proposed boundary expansion for the Florida Keys National Marine Sanctuary (FKNMS or Sanctuary) as part of the proposed creation of the ecological reserve in the Tortugas region (the "*Tortugas 2000*" project). As the Council is aware, the proposed Tortugas Ecological Reserve under consideration by the National Oceanic and Atmospheric Administration's (NOAA) Marine Sanctuaries Division (MSD) would encompass and protect approximately 151 square nautical miles of diverse habitats and biodiversity in the Tortugas area. This effort is consistent with the President's Executive Order 13089 on coral reef protection.

Creating the proposed reserve would require an expansion of the existing Sanctuary boundary and would need to comply with the applicable requirements of Sections 303 and 304 of the National Marine Sanctuaries Act (NMSA), 16 U.S.C. §§ 1433, 1434. As part of this process, NOAA must consult with the appropriate officials of any Regional Fishery Management Council that may be affected by the proposed designation. We therefore wish to consult with the Council regarding the determinations and findings that are required to determine whether the area of the marine environment under consideration meets the standards for designation as a national marine sanctuary. Factors that must be considered include the area's natural resource and ecological qualities; its historical, cultural, archaeological, or paleontological significance; the present and potential uses and activities in the area; existing regulatory and management authorities; the manageability of the area; public benefits to be derived from sanctuary status; the negative impacts from management restrictions on income-generating activities; and socioeconomic effects of sanctuary designation.

MSD requests that the Council provide any information, recommendations, or other comments on the Tortugas region as well as on the proposed course of action. To ensure that your comments regarding the proposed Reserve are considered in preparing the DSEIS, I would appreciate receiving your response by January 21, 2000.

We appreciate your assistance with this action. If you have any questions, please contact Ben Haskell at (305) 743-2437, Extension 25.

Sincerely,

Jeffrey R. Benoit
Director

Enclosure

FAX # 813 225-7015

Copy CJTJ

P.O. Box 864
Eastpoint, FL
32328

4/2/2000

Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North
Suite 1000
Tampa, FL

Dear Dr. Shipp,

Please protect the Dry Tortugas with a no-take marine reserve in the waters surrounding the islands.

I strongly support the establishment of the Tortugas Ecological Reserve, consisting of two areas, Tortugas North and South. Both areas should be off-limits for all fishing and other taking of marine life - both flora and fauna.

The Tortugas South area, which falls under your jurisdiction, is vital for the spawning site, Riley's Hump. I hope the Council will act to safeguard this.

It seems to me that the entire area, Tortugas and Marquesas, out to be part of a much larger National Marine Sanctuary - using as a model, perhaps, the National Marine Sanctuary from Monterey to San Francisco in California. Perhaps that is wanting too much. The least we can do then is support the Tortugas Ecological Reserve - for the quality of the marine life therein and for our own quality of life down through the years.

Yours sincerely,
Jill Drew
Jill J. Drew

WWF

Copy CH TS + CMC

FAX TO: 813/225-7015
ALSO SENT VIA U.S. MAIL

Wayne Swingle, Executive Director
Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619

28 April 2000

Comments on "Draft Supplemental Environmental Impact Statement (DSEIS) for Generic Amendment to the Fishery Management Plans for the Gulf of Mexico to Establish the Tortugas Marine Reserve" (65 FR 16563).

Dear Mr. Swingle:

We are very pleased to be able to provide comments on behalf of World Wildlife Fund with respect to the DSEIS the Gulf Council has produced for Generic Amendment to the Fishery Management Plans of the Gulf of Mexico to create the Tortugas Marine Reserve.

World Wildlife Fund, known worldwide by its panda logo, leads international efforts to protect the diversity of life on earth. Working in the United States and in more than 100 countries around the world, WWF is recognized for its ability to translate decades of on-the-ground conservation experience into action at national, regional and even global scales. WWF is working to help restore the health of Florida Bay, protect and preserve the coral reef and restore the Everglades. World Wildlife Fund has more than one million members throughout the planet and maintains field offices in the Florida Keys and South Florida.

We are firmly committed to establishing strong and effective protection for the coral reefs and related marine ecosystems of the Florida Keys, including those under the jurisdiction of the Florida Keys National Marine Sanctuary, the Gulf of Mexico Fishery Management Council, the South Atlantic Fishery Management Council, the Florida Fish and Wildlife Conservation Commission and the Dry Tortugas National Park.

World Wildlife Fund
8075 Overseas Highway, Marathon, FL 33050 • Tel: (305) 289-1010, FAX: (305) 289-0113
Incorporating The Conservation Foundation. Affiliated with World Wide Fund for Nature.

Our Florida Keys Field Office, located in Marathon, has played a leading role in the development of the Sanctuary's Final Management Plan, and on both the Sanctuary Advisory Council and Tortugas 2000 Working Group since their inception. We are proud to have been a part of the powerful local consensus the Tortugas 2000 process generated among commercial and recreational fishermen, conservationists, divers, business owners, scientists, resource managers and others. This consensus, as you know, led to the design of a proposed Tortugas Marine Reserve endorsed unanimously by the diverse interests of both the Working Group and the Advisory Council.

World Wildlife Fund strongly believes that establishment of the no-take Tortugas Marine Ecological Reserve is essential for effectively protecting fish and invertebrate populations and the habitats they depend on. We fully endorse the Working Group's recommendations, and encourage the Gulf Council to maintain its recommendations that both Tortugas North and South be designated as closed to all fishing, and to the anchoring of vessels. We urge the Gulf Council and its colleague agencies with management responsibilities in the region to build on that consensus-based plan and work cooperatively to implement it in the most effective and expeditious manner possible.

We are convinced that the Gulf Council has a clear role and important responsibility for protecting the marine resources of this very unique, productive and diverse area under both the Magnuson-Stevens Fisheries Conservation and Management Act (MFCMA, 16 U.S.C. § 1801 et seq) and the National Marine Sanctuaries Act (NMSA, 16 U.S.C. §1431 et seq.). We request that as the Gulf Council develops its DSEIS, you work with your fellow agencies to develop a plan to maximize protection of the area's resources by utilizing tools provided in both statutes.

World Wildlife Fund is concerned that requirements under the NMSA are not being addressed by the Council. The Notice of Intent published in the Federal Register (65 FR 16563) referenced only the MFCMA authority and does not mention the Council's role and responsibility to prepare fishing regulations for a sanctuary in accordance with section 304(a)(5) of the NMSA. (U.S.C. 1434(a)(5)). The request made to the Council at its' November 1999 meeting that it draft fishing regulations for the proposed Tortugas Ecological Reserve under its MFCMA authority also did not address the Council's role under the NMSA. An earlier request to the Council from NOAA, dated October 22, 1999 to prepare fishing regulations permits MFCMA authority, but also asked that Council recommendations be "in accordance with section 304(a)(5) of that act [meaning the NMSA](16 U.S.C. 1434(a)(5))", requiring consideration of the NMSA. Though authority under the MFCMA provides a valid means to regulate fishery management in the proposed Tortugas Reserve, it may not individually be the most efficient, and the Council must also recognize its responsibilities under the NMSA. World Wildlife Fund strongly recommends that the scope of the Gulf Council's DSEIS cover the Council's roles and responsibilities not only under the MFCMA, but also under the NMSA, and includes alternatives that address both.

We urge the Gulf Council to include and evaluate alternatives that implement regulations, including fishery regulations, to protect that portion of the Tortugas Ecological Reserve within the Gulf Council's jurisdiction in accordance with the NMSA as sanctuary regulations (U.S.C. 1431 et. seq.), and as joint NMSA and MFCMA regulations, in addition to strictly MFCMA fishery management plan amendments/regulations in terms of resource protection. This should include the Gulf Council's draft regulations/ recommendations for sanctuary fishing regulations under (U.S.C. 1434(a)(5)), if the sanctuary boundaries are expanded to include portions of Tortugas North

and Tortugas South currently outside the FKNMS. Such draft regulations should be consistent with the MFCMA's National Standards to the extent they are compatible with the purposes of the sanctuary.

Since the Gulf Council has indicated that it intends to assess the environmental impacts of an alternative prohibiting all fishing, we also ask you to consider the full range of environmental benefits of such an alternative and the environmental impacts of anything less than a complete closure. Potential benefits, as identified by the Working Group, include but are not limited to: protection of Essential Fish Habitat, conservation of genetic diversity, achievement of natural size, age and gender structures, and restoration of natural community dynamics. Such benefits should be evaluated both within and outside the proposed reserve area.

World Wildlife Fund appreciates this opportunity to submit comments on the scope of the DSEIS and thanks you for your attention to our requests. If you have any questions regarding our position, please contact me at 305/289-1010.

Sincerely,

Debra S. Harrison,
Florida Keys Director

CENTER FOR MARINE CONSERVATION

S.E. Atlantic & Gulf of Mexico Regional Office
One Beach Dr., SE
Suite 304
St. Petersburg, FL 33701
Phone: (727) 895-2188
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Headquarters
1725 DeSales Street, NW
Suite 600
Washington, DC 20036
Phone: (202) 429-5609
Fax: (202) 872-0619
Web: www.cmoocean.org

Copy C+ TS + CMC

April 28, 2000

Mr. Wayne Swingle
Executive Director
Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619
FAX: (813) 225-7015

VIA FACSIMILE, & USMAIL

RE: Scoping Comments on "Draft Supplemental Environmental Impact Statement (DSEIS) for Generic Amendment to the Fishery Management Plans for the Gulf of Mexico to Establish the Tortugas Marine Reserve" (65 FR 16563).

Dear Mr. Swingle:

On behalf of the Center for Marine Conservation (CMC), we thank you for this opportunity to comment on the scope of the DSEIS that your agency intends to prepare for a Generic Amendment to the Fishery Management Plans of the Gulf of Mexico to establish the Tortugas Marine Reserves. CMC is a non-profit organization with more than 120,000 members who are committed to protecting ocean environments and conserving the global abundance and diversity of marine life. Within the state of Florida, CMC has a regional office located in St. Petersburg, a field office in Key West, and approximately 8,500 members.

CMC has actively sought stronger protections for the coral reef ecosystems surrounding the Florida Keys, the Florida Keys National Marine Sanctuary (FKNMS), the Dry Tortugas National Park (DTNP), and the reef fish and invertebrate communities under the jurisdiction of GMFMC, the South Atlantic Fishery Management Council (SAFMC), and the Florida Fish and Wildlife Conservation Commission (FFWCC) for over twenty years. CMC staff were part of the diverse Tortugas 2000 (T2000) Working Group that developed the remarkably strong local community consensus around the Tortugas Ecological Reserve and on the Sanctuary Advisory Council that unanimously endorsed it. In addition we have conducted extensive research in the Tortugas region, and have advocated adoption of the Tortugas Ecological Reserve before each of the agencies mentioned above, all of whom were also represented on the T2000 Working Group. **CMC believes that the Tortugas Marine Reserve proposal is critical to meeting the individual mandates of each of the above agencies, including the GMFMC, supports the Working Group recommendations, and strongly recommends that all of those agencies with management responsibilities in the region build on that consensus-based plan and work together to implement it in the most effective manner possible.**

CMC strongly supports the establishment of a no-take Tortugas Ecological Reserve (marine reserve) and believes that the GMFMC has roles and responsibilities for protecting the marine resources of this very special area under both the Magnuson-Stevens Fishery Conservation and Management Act (MFCMA, 16

U.S.C. § 1801 *et seq*) and the National Marine Sanctuaries Act (NMSA, 16 U.S.C. §1431 *et seq.*). Other agencies also have important roles and responsibilities in the Tortugas area under these and other authorities. **In developing your DSEIS, CMC strongly recommends that you consider your roles and responsibilities under both of the aforementioned statutes, as well as the roles and responsibilities of other agencies, and develop alternatives that maximize the protection of the area's resources, consistent with both statutes and in coordination with other authorities.**

I. Concerns:

CMC is concerned that requirements under the NMSA are not being addressed by the Council. The Notice of Intent published in the Federal Register (65 FR 16563) referenced only the MFCMA authority and does not mention the Council's responsibility to prepare fishing regulations for a sanctuary in accordance with section 304(a)(5) of the NMSA. (U.S.C. 1434(a)(5)). The request made to the Council at its November 1999 meeting that it draft fishing regulations for the proposed Tortugas Ecological Reserve under its MFCMA authority also did not address the Council's role under the NMSA. An earlier request to the Council from NOAA, dated October 22, 1999, to prepare fishing regulations acknowledges MFCMA authority, but also asked that Council recommendations be "in accordance with section 304(a)(5) of that act [meaning the NMSA](16 U.S.C. 1434(a)(5))", requiring consideration of the NMSA. The Council's actions must be consistent with both the MFCMA and the goals and purposes of the NMSA and the FKNMS. (16 U.S.C. 1434(a)(5)). **CMC strongly recommends that the scope of the Council's DSEIS cover the GMFMC's roles and responsibilities not only under the MFCMA, but also under the NMSA, and include alternatives that address both.** Additional specific recommendations on scope follow.

Additional Specific Comments on DSEIS Scope:

1. **Include and evaluate alternatives that implement joint regulations, for example under both MFCMA and NMSA, in addition to strictly MFCMA fishery management plan amendments/regulations to protect that portion of the Tortugas Ecological Reserve within the GMFMC's jurisdiction. This should include the GMFMC's draft regulations/ recommendations for sanctuary fishing regulations under U.S.C. 1434(a)(5), if the sanctuary boundaries are expanded to include portions of Tortugas North and Tortugas South currently outside the FKNMS. Such draft regulations should be consistent with the MFCMA's National Standards to the extent they are compatible with the purposes of the sanctuary (U.S.C. 1434(a)(5)).**

2. **Include and evaluate as an alternative the benefits of extending the current boundaries of the FKNMS to encompass those portions of Tortugas North and Tortugas South within the jurisdiction of the GMFMC versus the status quo boundaries in terms of resource protection.**

3. **Include and evaluate as an alternative, a larger Tortugas Ecological Reserve that links those portions of the proposed Tortugas North and Tortugas South reserves within the GMFMC's jurisdiction together and with adjacent areas to the west. CMC believes this is a worthwhile alternative to evaluate, even though we support the Working Group's proposal, based to the strong consensus developed for it.**

4. **CMC does not believe that the Council should generally address diving activities in its DSEIS since they will be more appropriately considered in the Sanctuary's documents. The council should only consider diving activities related to fishing within its DSEIS; evaluation of recreational no-take diving activities should not be included. However, if recreational no-take diving activities are addressed in the DSEIS, both benefits and costs of such activities within the reserve should be considered. If a request for a total prohibition is considered as an**

alternative, less drastic options that minimize potential costs and maximize potential benefits should also be evaluated. Such alternatives might consider a complete ban on all spearfishing and collecting and requests for restrictions on anchoring, contacting corals and other live bottom, "wilderness-type" permitting, and carrying capacities for diving in the reserve. Benefits of diving such as the value of increasingly rare opportunities to observe natural fish communities and the ability to observe the recovery of such communities after cessation of fishing should be considered.

5. Since the Council has indicated that it intends to assess the environmental impacts of an alternative prohibiting all fishing including fishing for Highly Migratory Species (HMS), it should also consider the full range of environmental benefits of such an alternative and the environmental impacts of anything less than a complete closure.

6. Include and evaluate as an alternative a permanent reserve in terms of its environmental and other benefits that might be periodically reviewed vs. a limited-term closure that would have to be periodically renewed.

II. Conclusion

CMC strongly supports the establishment of the proposed no-take Tortugas Marine Reserves and urges the Council to maintain its recommendations that both Tortugas North and South be designated as closed to all fishing, including fishing for HMS and to the anchoring of fishing vessels, to continue cooperation with other agencies that are involved with the marine reserve designation process.

CMC further supports the Council's decision to draft a DSEIS on the expected environmental impacts of prohibition of all fishing in the Tortugas North and South areas, including fishing for HMS, and strongly urges the Council to expand the scope of this DSEIS to also include its responsibilities under the NMSA .

Finally, CMC supports including within the DSEIS consideration of: joint regulations with other agencies, extension of the FKNMS boundaries to include the Tortugas Reserves, expanding the size of the Tortugas Reserves so that they form one larger area, exploring possibilities that include requesting limitation rather than elimination of recreational no-take diving activities (if diving is included), the full range of environmental benefits from a no-take area and the impacts of anything less than a complete closure, and the duration of the designation and take limitations.

CMC appreciates this opportunity to submit comments on the scope of the DSEIS and thanks you for considering our recommendations. If you have any questions regarding matters in this letter, please call Marianne Cufone at (727) 895-2188 or Kim Anaston at (305) 295-3370. CMC looks forward to future work with the GMFMC and NMFS in managing the proposed Tortugas Marine Reserves.

Sincerely,

Marianne Cufone,
Regional Fisheries Program Manager

Kim Anaston,
Florida Keys Office Manager

cc: D. Basta
B. Causey
M. McLemore

617 354 8581

Julie Winnette

2702 Wilsonwood Dr. , Denton, TX 76201

June 21, 2000

Dr. Bob Shipp
Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301 North; Suite 1000
Tampa, FL 33619-2266

Dear Bob Shipp:

As a citizen of the United States concerned about the earth, I urge your help in protecting our dwindling natural resources, especially in areas such as the Dry Tortugas. The Tortugas region of the Florida Keys is vital to protect since it is home to a multitude of species. I fully support a permanent "no-take" designation for the proposed Tortugas Ecological Reserve. Protection from the "taking" of any marine resource in this area needs to be complete. There should be no exceptions. Appropriate safeguards need to be in place to allow for replenishment of spawning stocks of fish, valuable coral reefs, and sea grass meadows in this region I am pleased to learn that the complex planning process surrounding the Tortugas Ecological Reserve has been coordinated between all involved agencies and stakeholders. The designation of the Tortugas Ecological Reserve will be a huge step towards reversing the decline of our fish stocks and coral reef health, but should be accompanied by other sound regulatory measures. Please continue to cooperate with the other agencies involved in this process and move forward with protecting this unique wild ocean place in a timely manner.

Sincerely,

Julie Winnette

VERSAGGI SHRIMP, CORP
P.O. Box 5777 • Tampa, Florida 33675 • 813/248-5089

TAB G NO. 5(d)

June 27, 2000

Mr. Wayne Swingle
Gulf Of Mexico Fishery Management Council
3018 U.S. Highway 301 North - Suite 1000
Tampa, FL 33619-2266

Re: Domestic Shrimp Producers Association
Tortugas North Ecological Reserve (TNER)
Florida Keys National Marine Sanctuary (FKNMS)

Dear Wayne:

The following are some comments concerning the Tortugas North Ecological Reserve expansion of the Florida Keys National Marine Sanctuary. Part of the TNER is an important source of production for commercial shrimping interests that belong to the Domestic Shrimp Producers Association, especially during the fall, winter, and spring months of the year. Most of the TNER lies within Florida State waters, and the State of Florida is drafting fishing regulations to prohibit fishing in the zone that lies within State waters. Under the Magnuson-Stevens Fishery Conservation and Management Act, the Gulf of Mexico Fishery Management Council (GMFMC) has primary federal responsibility for development of fishery management plans throughout the Gulf of Mexico. GMFMC has developed an Essential Fish Habitat Amendment to the Gulf of Mexico Fishery Management Plan, which includes the area of the proposed TNER that lies within federal waters. The result would be that the state regulations and the federal regulations would complement each other.

We as a commercial shrimping community have historically fished part of the area proposed for an ecological reserve for the past 48 years. The grounds I am referring to in state waters would be from 82 48' W. to 82 57' W longitude and 24 44' N to 24 47' N latitude. The federal zone would be approximately 83 00' W to 83 06' W longitude and 24 44' N to 24 47' N latitudes. This area is not ecologically sensitive, nor is it an essential fish habitat. However, it is an essential shrimp habitat in that it consists of mud, sand, and sand and shell mixed bottom. If any type of damage was being done to that bottom I doubt that we would be able to fish it for the past 48 years. We would propose that the eastern boundary of the reserve be move to 82 57' W in the state reserve, and the federal reserve on the northwestern corner of the TNER be moved to the 20 fathom curve. (See exhibits I and II).

Exhibit III will show you actual real time fishing for six vessels as recorded from a vessel monitoring system with GPS readings in the proposed ecological reserve. As you would expect some months are heavier than other months, but there is data for a full year. The top half of the pages show the vessels positions on a NOAA nautical chart, and the bottom half of the page gives the same positions in latitude and longitude. The pink box is the proposed ecological reserve. The year I have sent you is from June 1999 to May 2000, and the drought in Florida for the past 19 months may have impacted the area severely, and therefore shows less activity than normally might have been.

Exhibit IV shows the printed sightings of two vessels that fished part of the time in the proposed zone, and the percentage of time spent in the zone versus outside the zone for the time at sea. As you can see both vessels spent 32% of their time in the zone, but the NMFS study states that only 10% comes from this area.

Exhibit V will show the people who made up the working group that carved out these boundaries for the TNER. Please note that not one shrimp member was on the working group, and shrimp is the most valuable fishery in the Stat of Florida. Of the commercial interests on the working group, none were outside Monroe county. The whole west coast of Florida was ignored except for Monroe county. The commercial interests who were on the working group were primarily lobster and stone crab fishing interests.

Exhibit VI includes excerpts from the economic analysis of Boundary Alternatives in the plan. Please note that each alternative shows no economic losses to shrimpers, and no benefits for potential replenishment of the shrimp stock. Each alternative states that shrimp fishermen would be able to replace lost catch from other sites. Totally absurd! Why would boats run from Alabama, Louisiana, Mississippi, and Texas during the winter months to fish the Tortugas shrimp grounds if shrimp were more abundant somewhere else? Keep in mind that shrimp is an annual crop - you use them or lose them. You don't come back next year and catch them, or move to another site to replace them. They don't come to you.

Exhibit VII addresses the socioeconomic impact analysis by Leeworthy and Wiley. This study shows only three counties impacted, but there are at least four others, Hillsborough, Pinnellas, Franklin, and Bay. The last two are more fishery dependent than the others. These economists use an average price of $2.40 a pound ex-vessel price for shrimp to calculate the impact of the plan. This is ludicrous! NMFS statisics show an average price of $ 4.31 per pound for shrimp from this area, and I concur with that.

Exhibit VIII shows shrimp catch potentially lost from displacement for the year 1997 to be 58,374 pounds in the preferred alternative scenario. This is a joke. You could lose that amount a month. I think the science in this study is very thin, and they have relied heavily on extrapolations

to arrive at their conclusions. Why did they use 1997 which was a very poor production year? The shrimp industry has had 5,000,000 acres closed to it in the name of conservation on the Gulf coast of Florida alone. We can't fish on any type of bottom, and to close good productive areas that we have fished for the past 48 years, such as that proposed in the TNER, creates an economic hardship.

These are some of the glaring faults I see in this study, and I am sure if it were put to a peer review it would not get high marks. If you should have any further questions please do not hesitate to call.

Sincerely,

VERSAGGI SHRIMP CORP.

Sal Versaggi

Salvatore J. Versaggi
President

WWF

RECEIVED

JUN 29 2000

GULF FISHERIES COUNCIL

26 June 2000

Dr. Robert Shipp, Chairman
Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 US Highway 301 N, Suite 1000
Tampa, FL 33619-2266

Dear Dr. Shipp:

Attached please find the signatures of 245 conservationists who signed a petition in favor of the Tortugas Ecological Reserve presently under consideration by your agency. The petition was conducted on Earth Day (22 April 2000) on the National Mall in Washington, DC.

Their request to you (the petition text) is as follows:

We urge you to support the Tortugas Ecological Reserve designed by the Tortugas 2000 Working Group and unanimously endorsed by the Florida Keys National Marine Sanctuary Advisory Council.

The proposed reserve will protect myriad species, such as black coral, purple-mouthed morays, jewfish, and green sea turtles, plus irreplaceable habitats like seagrass beds, coral reefs and pinnacles, spawning grounds, and hardbottoms. It also promises significant fisheries benefits, such as larger, more abundant fish and replenished fish populations throughout the South Atlantic Bight.

Please support the reserve by agreeing to the boundaries and regulations endorsed by the Working Group. Your support will not only preserve one of the region's most pristine ocean wildernesses and productive spawning grounds, but it will also reward the collaborative efforts of conservationists, recreational and commercial fishermen, business interests , and others who worked together to design a reserve that everyone can live with and benefit from.

Thank you for your attention to their support for the Tortugas Reserve.

Sincerely,

Debra S. Harrison, Director
Florida Keys Field Office

enc.

World Wildlife Fund
8075 Overseas Highway, Marathon, FL 33050 • Tel: (305) 289-1010, FAX: (305) 289-0113
Incorporating The Conservation Foundation. Affiliated with World Wide Fund for Nature

The Nature Conservancy®

Florida Keys

RECEIVED

JUN 29 2000

GULF FISHERIES COUNCIL

June 28, 2000

Dr. Robert Shipp, Chair
Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619-2266

Re: Adoption of Proposed Tortugas Ecological Reserve

Dear Dr. Shipp:

The Nature Conservancy supports the adoption of the Tortugas Ecological Reserve. Specifically, we support adoption of the preferred alternative, Boundary Alternative III and Regulatory Alternative C (as a no-take zone, including a prohibition on catch-and-release fishing), identified in the Draft Supplemental Environmental Impact Statement. We urge you to diligently move forward with adoption of the proposed reserve and enaction of no-take zone regulations at the earliest possible opportunity.

The Nature Conservancy's mission is to protect plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. We have over one million members and operate internationally. In the Florida Keys, we have been active for over a decade with programs to monitor and protect marine natural communities, including coral reefs and sea grass meadows.

The immediate marine environs of the Dry Tortugas harbor nearly the full range of habitat and species diversity found in the shallow (depths of less than 100 feet) waters of the Florida Keys. In general, corals are healthier with less incidence of disease and cover of live corals is higher there than elsewhere in the Keys. Unique oceanographic conditions and processes in the area result in the Tortugas region playing a dynamic and important role in larval recruitment to marine ecosystems throughout the Florida Keys.

There is growing evidence of fisheries improvements resulting from no-take reserves. The existing no-take zones in the Florida Keys National Marine Sanctuary, though relatively small, after three years are showing increasing density and size of spiny lobster, groupers and snappers. Perhaps more representative of a larger reserve, the marine area near the Kennedy Space Center has been restricted from entry and fishing for decades for security reasons. Pronounced increases in abundance and size of several species of game fish now occur just outside the restricted area. It probably is no coincidence that a number of world record fish have been caught near this de facto reserve. Similar patterns have been observed in the Bahamas, Philippines and elsewhere. As a local example, commercial fishing and all taking of lobster have been banned inside Dry Tortugas National Park boundaries for many years. Lobster grow much larger there than in the remainder of the Keys.

P.O. Box 4958 • Key West, FL 33041-4958 • 305-296-3880 • fax 305-292-1763

Recent studies on regional current patterns indicate that seasonal gyres suspend both fish and invertebrate larvae long enough for self-replenishment and replenishment of the rest of the Florida reef tract. Riley's Hump, a known spawning aggregation for grouper and snapper species, lies within the southern part of the proposed Tortugas Ecological Reserve. Evidence indicates that 13 of 16 grouper species and 7 of 13 snapper species are below the 30% spawning potential ratio federal standard. The bathymetry of the area makes other aggregations plausible. For example, the Tortugas is a known spiny lobster spawning area and some evidence exists that suggests the area may be a blue fin tuna spawning area. The reserve thus may not only play an important role in maintaining populations of a number of species across a large area of the Keys, but migratory pelagic species as well.

While fisheries improvements result from no-take reserves, other important benefits that restore or enhance reef community structure are also likely to occur. Changes in biodiversity and biologically generated habitat that may result from this form of protection should be further investigated. In addition to monitoring of fisheries stocks and related research, the Tortugas Ecological Reserve should be accompanied by a broader research initiative. This program should include, at a minimum:

- Further identification and study of spawning aggregations including grouper, snapper, and jewfish. Other species that may be using the area for spawning aggregrations should be investigated including benthic invertebrates such as spiny lobster, corals, queen conch, long-spined urchins, and additional invertebrate species;
- Further studies of patterns of short- and long-distance larval dispersal;
- Complete inventories of biodiversity and habitat structure in the proposed Tortugas Reserve and other Sanctuary waters in the region;
- Further documentation of the distribution and abundance of threatened, endangered, and rare species in the proposed Tortugas reserve; and
- Field experiments and comparative studies to test hypotheses generated by these studies.

In light of the critical role the Tortugas region plays in providing biological seeding of the Keys reef tract, southern Florida, and possibly beyond, protection of key portions of the region with a no-take reserve is warranted. The no-take reserve should include a prohibition on catch-and-release fishing. The proposed boundaries of the reserve are the result of a thorough consensus-based process including all the stakeholders with an interest in the area. As a no-take reserve, The Nature Conservancy fully supports adoption of the preferred alternative of the proposed Tortugas Ecological Reserve.

Sincerely,

Jim Fryer
Director

WWF

FAX TO: 813/225-7015
ALSO SENT VIA U.S. MAIL

30 June 2000

Dr. Robert Shipp, Chair
Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619

Re: Comments on Draft Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves

Dear Dr. Shipp:

We are very pleased to be able to provide comments on behalf of World Wildlife Fund with respect to the Draft Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves for the proposed Dry Tortugas Ecological Reserve ("Draft Amendment").

World Wildlife Fund, known worldwide by its panda logo, leads international efforts to protect the diversity of life on earth. Working in the United States and in more than 100 countries around the world, WWF is recognized for its ability to translate decades of on-the-ground conservation experience into action at national, regional and even global scales. WWF is working to help restore the health of Florida Bay, protect and preserve the coral reef and restore the Everglades. World Wildlife Fund has more than one million members throughout the planet and maintains field offices in the Florida Keys and South Florida.

We are firmly committed to establishing strong and effective protection for the coral reefs and related marine ecosystems of the Florida Keys, including those under the jurisdiction of the Florida Keys National Marine Sanctuary, the Gulf of Mexico Fishery Management Council, the South Atlantic Fishery Management Council, the Florida Fish and Wildlife Conservation Commission and the Dry Tortugas National Park.

Our Florida Keys Field Office, located in Marathon, has played a leading role in the development of the Sanctuary's Final Management Plan, and on both the Sanctuary Advisory Council and Tortugas 2000 Working Group since their inception. We are proud to have been a part of the powerful local consensus the Tortugas 2000 process generated among commercial and recreational fishermen, conservationists, divers, business owners, scientists, resource managers and others. This consensus,

World Wildlife Fund
8075 Overseas Highway, Marathon, FL 33050 • Tel: (305) 289-1010, FAX: (305) 289-0113
Incorporating The Conservation Foundation. Affiliated with World Wide Fund for Nature.

as you know, led to the design of a proposed Tortugas Marine Reserve endorsed unanimously by the diverse interests of both the Working Group and the Advisory Council.

World Wildlife Fund strongly believes that establishment of the no-take Tortugas Marine Ecological Reserve is essential for effectively protecting fish and invertebrate populations and the habitats they depend on. We fully endorse the Working Group's recommendations, and encourage the Gulf Council to maintain its recommendations that both Tortugas North and South be designated as closed to all fishing, and to the anchoring of fishing vessels. We believe that the Gulf Council has built upon that consensus-based plan through the development of the Gulf Council's preferred alternative, which proposes alternatives 1, 2, 7, and 10 of the Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves.

World Wildlife Fund supports Alternative 1 and 2 of the Draft Amendment, which would establish the Tortugas North and South Ecological Reserves within the Exclusive Economic Zone (EEZ). These boundaries are consistent with the recommendations of the Tortugas Working Group, consisting of a divergent, broad-based membership representing a cross-section of interests including sports fishers, commercial fishers, fishing guides, divers, scientists, conservationists and agency representatives. The boundaries were also endorsed by the Florida Keys National Marine Sanctuary Advisory Council, a local citizens advisory panel to the Sanctuary.

The boundaries succeed in capturing a variety of contiguous habitats, including seagrass meadows, hardbottom communities, patch reefs, shallow water reefs and deep reef communities. Some of the areas densest coral cover, Sherwood Forest, is included within the proposed boundaries. Additionally, critical spawning areas are included within the boundaries of the Reserves, areas so important to the production and dispersal of fish that the area has been defined by observers as a "natural fish factory". Drifter buoy studies have demonstrated that circulation patterns and gyres will disperse fish produced within the Tortugas Reserves throughout the Florida Keys to as far north as Fort Lauderdale.

World Wildlife Fund further supports the Gulf Council's preferred Alternatives 7 and 10. Alternative 7 of the Draft Amendment would prohibit fishing within the EEZ of the Tortugas Ecological Reserve, and Alternative 10 would prohibit the anchoring of fishing vessels in these areas, except in the case of emergencies. These two alternatives are consistent with the recommendations made by the Tortugas Working Group, the Sanctuary Advisory Council and with regulations proposed by the state of Florida, the National Park Service, and the Florida Keys National Marine Sanctuary. A prohibition on all fishing within the Tortugas Ecological Reserves would protect spawning aggregations of many economically important species, allow for natural ecosystem structure and function to be achieved, and provides a source area to replenish fisheries throughout the region.

World Wildlife Fund supports the Gulf Council's decision not to include Alternatives 8 or 9 in their preferred alternative for the Tortugas Reserves. Alternative 8 would allow trolling within the EEZ of the Tortugas Reserve, while Alternative 9 would allow catch and release fishing. These uses were discussed extensively by the Tortugas Working Group during their deliberations on the Tortugas proposal. Neither use was included in their recommendations due to concerns about enforcement, fisheries and habitat problems that would arise as a result of those activities.

World Wildlife Fund is concerned about mortality associated with these fishing methods, and that such mortality is inconsistent with the goals of the ecological reserve, as outlined by the objectives of the Gulf Council's Reef Fish Fishery Management Plan to rebuild stock, conserve habitat and provide for protection for juveniles. As a member of the Tortugas Working Group, we were reminded over and over again by representatives of the Florida Marine Patrol, the U.S. Coast Guard, and the Sanctuary enforcement personnel of the of the enforcement problems that would arise as a result of any fishing activity taking place within the proposed Tortugas Reserve.

The Gulf Council's preferred Alternative 10 provides that no anchoring shall take place within the Tortugas Marine Reserve. World Wildlife Fund recognizes that such a provision assures the protection of the very important habitat included within the Tortugas boundaries. This alternative compliments the actions currently being proposed by the state of Florida, National Park Service and the Florida Keys National Marine Sanctuary. Again, this alternative is consistent with the recommendations of the Tortugas Working Group and the Sanctuary Advisory Council.

World Wildlife Fund applauds the Gulf Council's work in proposing preferred Alternatives 1, 2, 7, and 10 of the Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves and highly encourages their approval during the Gulf Council's upcoming deliberations scheduled for July 10 – 14, 2000 in Key Largo.

World Wildlife Fund appreciates this opportunity to submit comments on the Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves, and thanks you for your attention to our requests. If you have any questions regarding our position, please contact me at 305/289 1010.

Sincerely,

Debra S Harrison

Debra S. Harrison, Florida Keys Program Director
World Wildlife Fund

CENTER FOR MARINE CONSERVATION

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July 06, 2000

Mr. Wayne Swingle
Executive Director
Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619
FAX: (813) 225-7015

VIA FACSIMILE, & USMAIL

RE: Comments on the Generic Amendment to the Fishery Management Plans for the Gulf of Mexico to Establish the Tortugas Marine Reserves

Dear Mr. Swingle:

On behalf of the Center for Marine Conservation (CMC), we thank you for this opportunity to comment on the Generic Amendment to the Fishery Management Plans of the Gulf of Mexico to establish the Tortugas Marine Reserves ("Generic Amendment"). CMC is a non-profit organization with more than 120,000 members who are committed to protecting ocean environments and conserving the global abundance and diversity of marine life. Within the state of Florida, CMC has a regional office located in St. Petersburg, a field office in Key West, and approximately 8,500 members.

CMC has actively sought stronger protections for the coral reef ecosystems surrounding the Florida Keys, the Florida Keys National Marine Sanctuary (FKNMS), the Dry Tortugas National Park (DTNP), and the reef fish and invertebrate communities under the jurisdiction of GMFMC, the South Atlantic Fishery Management Council (SAFMC), and the Florida Fish and Wildlife Conservation Commission (FFWCC) for over twenty years. CMC staff were part of the diverse Tortugas 2000 Working Group (T2000WG) that developed the remarkably strong local community consensus around the Tortugas Ecological Reserve and on the Sanctuary Advisory Council that unanimously endorsed it.

We believe that the designation of the Tortugas Ecological Reserves is critical to maintaining a healthy functioning ecosystem with abundant and diverse marine life. CMC supports the consensus-based recommendations to create the Tortugas Ecological Reserves and strongly urges the GMFMC to adopt the preferred alternatives, as amended by our recommendations herein, in the Generic Amendment as the Council's recommendation to NMFS.

I. Support for the Reserves:

The Dry Tortugas, a small cluster of islands, coral reefs and shoals, are located 70 miles west of Key West. They lie beyond the undeveloped Marquesas and stretch into the Gulf of Mexico. This is an area of extraordinary ocean environment that supports a wide range of important marine life. It is less

troubled by water quality problems than reefs closer to populated and developed areas in the Keys, and boasts a diverse array of coral types, reef fishes, marine birds and sea turtles. The site includes spawning and nursery grounds for numerous fish and contributes to the ability of the ecosystem to function as a whole. If protected from fishing pressure, the Dry Tortugas area can help maintain the health and diversity of marine populations throughout the Florida Keys, the east coast of Florida and beyond.

CMC strongly believes that the proposed measures currently in the preferred alternatives of the Draft Generic Amendment, as amended by our recommendations herein, will help the council to meet its mandate under both the Magnuson-Stevens Fishery Conservation and Management Act (MFCMA, 16 U.S.C. § 1801 *et seq*) and also responsibilities under the National Marine Sanctuaries Act (NMSA, 16 U.S.C. §1431 *et seq.*), including protecting essential fish habitat, reducing bycatch and preventing overfishing.

The Tortugas area is filled with important marine resources that require immediate protection to maintain their future health and abundance and permit them to help replenish fish stocks and other important marine life throughout the southeastern United States. The primary duty of the Fishery Management Councils under the MSFCMA is "to take immediate action to **conserve and manage** the fishery resources found off the coasts of the United States…(emphasis added.)"[1]. The councils also have responsibility to conserve and manage fishery resources under the NMSA[2], as is discussed below. **We believe that establishing no-take reserves in the Tortugas area will provide protection to the important resources located there and enable the Council to conserve and manage these resources in compliance with the MSFCMA and NMSA, in an effective manner**.

Of the 15 commercially targeted reef fish found in the Keys whose status is known, 13 of them are considered overfished[3]. Recent studies of fish populations in the Tortugas region indicate that there are fewer and smaller fish there than in the past[4]. This is largely due to increased fishing pressure[5]. The MSFCMA requires the Council to prevent overfishing[6]. Studies indicate that marine reserves can produce larger and more abundant fish populations and therefore contribute to reducing overfishing and help to rebuild depleted stocks[7]. **We believe that establishing no-take reserves in the Tortugas area will help provide a location for fish to feed, live and reproduce without severe negative impacts from fishing pressure, helping to rebuild stocks and prevent overfishing.**

Many of the fish in the Tortugas inhabit similar areas. Because both commercially and recreationally important fish are often found together with other species that are less desirable to the fishing community, many fish are caught unintentionally while targeting commercially and recreationally valuable species. These incidentally taken fish increase bycatch in the area. The MSFCMA requires the Council to minimize bycatch[8]. **We believe that establishing no-take reserves in the Tortugas area will provide a site where mixed stock complexes can exist without severe negative impacts from fishing pressure, protecting the most vulnerable species within the complex and minimizing bycatch on those species within the area.**

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[1] 16 USC §1801 (b)(1).
[2] 16 USC §1434 (a) (5).
[3] Fisheries of the United States, Report to Congress 1999.
[4] Site Characterizations for the Dry Tortugas Region Fisheries and Essential Habitats: Schmidt, Ault and Bohnsack 1999.
[5] Id.
[6] 16 USC §1851 (a) (1).
[7] Effectiveness of an Existing Estuarine No-take Fish Sanctuary: Johnson, Funicelli and Bohnsack 1999.
[8] 16 USC §1851 (a) (9).

Intense use of an area can have severe impacts to various forms of habitat located there, for example damage to livebottom from derelict or carelessly used fishing gear and anchors. In addition to direct physical impacts, alteration of natural community structure can also negatively impact habitat, especially delicate coral reefs, by changing competitive, prey-predator, and symbiotic interactions (e.g. algal-coral interactions). Preventing gear impacts and disruption to essential habitat and fish is a part of the GMFMC's responsibilities under MSFCMA[9]. **We believe that establishing no-take reserves in the Tortugas area where anchoring is prohibited except for in emergencies will help prevent damage to essential habitat and fish located there.**

Since the Tortugas Ecological Reserve is also partially within a National Marine Sanctuary and entirely within a proposed National Marine Sanctuary, provisions of the NMSA apply to the Council as well. This Act provides an opportunity for the fishery management councils to participate in the designation process of the proposed sanctuary by recommending fishing regulations for the area, as long as these proposed actions are consistent with the purposes of the NMSA and the goals of the sanctuary[10]. These proposed regulations will be issued as the fishing regulations in the area unless they are found to be inconsistent with the purpose of the sanctuary [11].

The GMFMC has been given the opportunity to prepare draft fishing regulations for fishing within the exclusive economic zone portion of the Tortugas Ecological Reserves, as is required in the NMSA[12]. In drafting fishing regulations for a sanctuary or proposed sanctuary, the Council must follow the requirements of the national standards in the MSFCMA, to the extent that they are compatible with the goals and objectives of the proposed designation.[13]

The primary goal of the Florida Keys National Marine Sanctuary is to protect the marine resources of the Florida Keys[14]. We understand that the purpose of the proposed sanctuary expansion and creation of the Tortugas Ecological Reserves is to conserve an area of the marine environment as a whole functioning ecosystem with minimal disturbance. **We believe that expanding the FKNMS and establishing no-take reserves in the Tortugas area will help to conserve this very special site and the many resources within it so that the ecosystem can continue to function effectively as a whole and contribute to the health and ecological integrity of downstream areas and their fish and invertebrate communities, in furtherance of the purposes of the NMSA and the Florida Keys National Marine Sanctuary and Protection Act.**

CMC commends the Council for choosing the consensus-based T2000WG recommendations as the preferred alternatives in the GMFMC Draft Generic Amendment and urges the Council to adopt these preferred alternatives, as amended by our recommendations herein, in the Generic Amendment at the July 2000 Council meeting.

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[9] 16 USC §1853 (a) (7).
[10] 16 USC §1434 (a) (5).
[11] Id.
[12] Id.
[13] 16 USC § 1851.
[14] P.L. 101-605, 1990 HR 5909

II. Specific Concerns:

Below are specific comments to the various preferred alternatives, the numbers correspond to those in the GMFMC's Draft Generic Amendment.

7.1: Marine Reserves Area:

The areas known as "Tortugas North" and "Tortugas South" comprise approximately 126 square nautical miles and includes Riley's Hump, a known spawning aggregation site, corals, sea grass beds, and other important shallow and deepwater habitat areas. The Tortugas North and South sites were selected by the T2000WG and are endorsed by members of the fishing community, conservation community, divers and other important stakeholders in the Tortugas area. **While CMC believes the marine reserve areas may not be sufficient to achieve all of their objectives or maximize their benefits, CMC supports the proposed preferred alternative sites based on their consensus-based selection and their potential for positive contribution to the conservation of the marine environment. We recommend that the GMFMC adopt these sites in the Generic Amendment that will be sent to NMFS for approval.**

7.2 Marine Reserves Duration:

The proposed duration for the Tortugas Ecological Reserves is currently stated as "for a period of at least 10 years, to be evaluated at the same intervals the state of Florida evaluates the FKNMS. During these periods the future status of the marine reserves will be considered by the Council and the FKNMS". CMC supports the 10-year minimum proposed duration since benefits from establishment of a marine reserve may take several years to become apparent. While a minimum of 10 years should permit observation of increased size and number in fish populations, healthier habitat and a better functioning ecosystem, we believe it is not sufficient to attain maximum benefit from the reserve. Our understanding of science surrounding marine reserves includes the concept that over time benefits from a reserve increase while costs decrease, making the reserve more valuable as time passes. **CMC recommends the establishment of a permanent reserve with the 10-year period serving as a periodic review to monitor progress. This would enable more data to be collected displaying long-term benefits to the immediate area and beyond and also prevent the Council and other agencies from wasting valuable time meeting at required times in order to renew the existence of the already established reserves. We recommend that language in the preferred alternative be changed to establish the reserves permanently, with scheduled reviews to monitor success of the reserves and to maintain the existence of the reserves in the event review is delayed or does not occur or if no action is taken during the review. We urge replacing the language in the preferred alternative with the following: The Tortugas Ecological Reserves are to remain in effect unless the Secretary finds affirmatively that the sites are not contributing to the conservation goals of the reserves or the sanctuary, during periodic reviews, with the first to be after a minimum of a 10-year duration. In the event that evaluation of the areas does not occur during the allotted time periods or if no action is taken to alter the status of the marine reserves, the Tortugas Ecological Reserves will remain as designated with all regulations in the Generic Amendment continuing in effect".**

CMC supports an evaluation schedule for the marine reserves that is standard among the various entities involved in the Tortugas Ecological Reserves designation. This will simplify the

review process and enhance coordination among the different agencies with jurisdiction in the area.

7.3 Marine Reserves Allowable Activities:

Fishing:

CMC strongly supports the establishment of a no-take area, including prohibition on fishing for highly migratory species (HMS) in the Tortugas Ecological Reserves. Permitting fishing in the area is very likely to cause enforcement problems since determining the type of fishing activity from afar can be difficult. Permitting any fishing in the area is very likely to create the need for more officials to maintain proximate and frequent surveillance of vessels in the area, increasing expense. Also, permitting certain types of fishing and not others may encourage illegal activities, such as poaching, if enforcement personnel are not available to closely monitor the areas.

We understand that the primary purpose for the reserves is to conserve an area of the marine environment as a whole functioning ecosystem with minimal disturbance. Though currently the preferred alternative in the Draft Generic Amendment prevents all fishing in the Tortugas Reserves, allowing catch and release and/or trolling remain options under consideration. CMC strongly opposes both trolling and catch and release activities in the Tortugas Ecological Reserves. Allowing take of any resources could disrupt the delicate balance of the ecosystem, causing harmful effect on essential fish habitat and preventing the reserve from achieving goals of rebuilding and conserving fish populations and other marine organisms. There is incidental mortality associated with catch and release, and incidental take associated with trolling, both of which could result in increased bycatch and overfishing. These activities can contribute to disturbance of natural community and population structure and natural behaviors. Further, permitting trolling and/or catch and release encourages poaching since it may be difficult for enforcement officials to monitor which resources are being taken and what methods are being used to take these resources without constant intense patrol of the area.

Fishing gear impacts are also a concern in the Tortugas area since delicate corals, sea grass beds and important marine life including fish can be severely depleted by carelessly used or derelict fishing gear. Prohibiting all fishing in the reserves can help prevent very real threats from fishing gear to the marine environment and enable the resources within the Tortugas Ecological Reserves to exist and rebuild with minimal disturbance from fishing pressure and contribute to maintaining the health and ecological integrity of the FKNMS and other downstream areas.

CMC strongly urges the Council to consider the serious negative impacts from permitting any type of fishing in the Tortugas Ecological Reserves and strongly advocates that the Council recommend to NMFS that both Tortugas North and South be designated no-take areas in the Generic Amendment. We realize that the GMFMC authority does not extend to HMS, but recommend that the Council request NMFS HMS Division, Office of Sustainable Fisheries to enact a companion rule to the Generic Amendment prohibiting fishing for HMS in the Tortugas reserves as well.

Anchoring:

CMC supports banning the anchoring of fishing vessels within the Tortugas Ecological Reserve except in emergency situations. Anchors can damage coral, sea grass and other livebottom habitat. This can impact the important marine life that uses these areas for shelter, as nurseries and for gathering food. **We urge the council to adopt the preferred alternative in the Draft Generic Amendment**

preventing fishing vessels from anchoring in Tortugas North and South other than in emergency situations as its final recommendation to NMFS in the Generic Amendment.

Diving:

CMC believes that the Council should not address diving activities generally in its Generic Amendment since they are more appropriately considered in the FKNMS's document. The council's authority to regulate diving activities is limited to adopting recommendations to regulate diving activities related to fishing. **We urge the council to exercise this authority by adopting a prohibition on fishing by divers in the Generic Amendment. Suggestions with respect to recreational no-take diving activities should not be included in the Council's Generic Amendment. However, if the GMFMC chooses to address recreational no-take diving activities in the Generic Amendment, we recommend that the Council also include a statement acknowledging that the Council does not have regulatory authority over recreational diving activities.**

We understand that the Council has already written a letter requesting prohibition of all diving in the area. We believe that benefits of diving, such as the value of increasingly rare opportunities to observe natural fish communities and the ability to observe the recovery of such communities after cessation of fishing can be valuable. **We urge the Council to write a new letter requesting that less drastic options than a total ban on diving be considered to minimize potential costs and maximize potential benefits. We suggest the following alternatives: requests for restrictions on anchoring, fines for contacting corals and other live bottom and issuance of specialized diving permits.**

III. Conclusion:

CMC strongly supports the establishment of the proposed no-take Tortugas Ecological Reserves and believes that the GMFMC has roles and responsibilities for protecting the marine resources of this very special area under both the MSFCMA and the NMSA. We urge the Council to adopt the preferred alternatives currently in the Draft Generic Amendment, as amended by our recommendations herein: that both areas known as Tortugas North and South be established as permanently closed to all fishing, including fishing for HMS, that these areas be reviewed periodically to monitor success, that these sites be closed to the anchoring of fishing vessels, that diving activities be left to management by the FKNMS and that cooperation continue with other agencies that are involved with the marine reserves designation process.

CMC thanks you for considering our recommendations. If you have any questions regarding matters in this letter, please contact me at the above number or address. CMC looks forward to future work with the GMFMC in managing the proposed Tortugas Marine Reserves.

Sincerely,

Marianne Cufone,
Regional Fish Conservation Manager

cc: D. Basta

Copy C + B

ORGANIZATIONS IN SUPPORT OF A TORTUGAS ECOLOGICAL RESERVE

NATIONAL ORGANIZATIONS

AMERICAN LITTORAL SOCIETY

AMERICAN OCEANS CAMPAIGN

BIODIVERSITY LEGAL FOUNDATION

CENTER FOR MARINE CONSERVATION

CORAL - THE CORAL REEF ALLIANCE

COUSTEAU SOCIETY

ENVIRONMENTAL DEFENSE

FISH FOREVER

FISH UNLIMITED

MARINE CONSERVATION BIOLOGY INSTITUTE

NATIONAL AUDUBON SOCIETY

NATIONAL ENVIRONMENTAL TRUST

NATIONAL PARKS CONSERVATION ASSOCIATION

NATURAL RESOURCES DEFENSE COUNCIL

OCEANWATCH

REEF CHECK

June 30, 2000
Updated July 20, 2000

Billy Causey
Florida Keys National Marine Sanctuary
PO Box 500368
Marathon, Florida 33050

RECEIVED
JUL 24 2000
GULF FISHERIES COUNCIL

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Dr. Robert Shipp, Chair
Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619-2266

Commissioner Julie Morris, Chair
Florida Fish and Wildlife Conservation Commission
620 S. Meridian St.
Tallahassee, Florida 32399-1600

Dear Agency Decision Makers:

We, the undersigned 55 groups representing over 3.8 million members, respectfully request that the above referenced regulatory agencies approve the establishment of the Tortugas Ecological Reserve as proposed by the Tortugas 2000 Working Group and unanimously endorsed by the Florida Keys National Marine Sanctuary Advisory Council.

We request that your agencies, consistent with your respective legislative mandates, approve the preferred alternative to create a Dry Tortugas Ecological Reserve, to include a 125-square-mile Tortugas North reserve and a 60-square-mile Tortugas South reserve, with the taking of any marine organisms prohibited in both areas.

REEFKEEPER INTERNATIONAL

SIERRA CLUB

WILDLIFE CONSERVATION SOCIETY

WORLD WILDLIFE FUND

Regional Organizations
Barbados Marine Trust

Bigelow Laboratory for Ocean Sciences

Boston University Marine Program

Broward County Sea Turtle Conservation Project

Citizens for a Clean Environment

Clean Ocean Action

Coastal Research and Education

Coastal Waters Project

Dive Paradise

Dive Training Magazine

Diving Locker

EcoFlorida Magazine

Environmental Solutions International

Fathom 5 Marine and Coastal Research

Florida Institute of Oceanography

WHY ARE THE TORTUGAS IMPORTANT AND WHAT THREATENS ITS MARINE LIFE?

Located 70 miles west of Key West and over 140 miles from the mainland, the coral reefs in the Tortugas are isolated from land runoff, resulting in the cleanest, clearest waters in the Florida Keys. The marine resources of the Tortugas are the crown jewel of the Sanctuary, with the highest coral coverage and the healthiest coral in the region, high biodiversity, high productivity and important spawning sites.

The Tortugas support a thriving seabird population, including the only roosting population of magnificent frigate birds in North America. Of great significance, the Tortugas are located at a crossroads of major ocean currents, which carry larvae of fish, lobster and other creatures downstream to replenish populations in the Florida Keys and beyond.

While the Tortugas are in relatively good condition, threats are on the increase. Fishing pressure has increased dramatically. Over 100 commercial fishing vessels and many recreational fishers work the ocean environment outside of the Dry Tortugas National Park. Divers converge on the area to view its breathtaking coral reefs. Visitor use at the Dry Tortugas National Park has doubled in the last three years, increasing to 60,000 visitors per year. The Sanctuary has prohibited anchoring by freighters on the lush reefs of Tortugas Bank, but this practice still threatens other parts of the region. All of these factors have resulted in threats of depleted fish populations and habitat damage.

THE PREFERRED ALTERNATIVE

In an initiative called Tortugas 2000, a 25-member working group representing commercial fishing, recreational angling, diving, conservation, science, citizens-at-large, and government agencies used the best available scientific and socioeconomic information to develop a boundary and regulatory proposal for the Ecological Reserve. The proposed Tortugas Ecological Reserve is a product of consensus by twenty-five diverse representatives of every constituency concerned with the reserve. The Tortugas 2000 Working Group unanimously recommended reserve boundaries that would:

- protect biodiversity;
- protect a diversity of critical habitats;
- protect ecological structure, function, and integrity;
- capture a suite of habitats critical to productivity;
- have influence beyond its boundaries;

Friends and Volunteer of Refuges (FAVOR)

Friends of Clear Creek

Friends of Virgin Islands National Park

Gulf Restoration Network

Hall's Marine Ranch

Hawaii Audubon Society

Living Oceans Society

Nova Southeastern Univ. Oceanographic Center

Ocean Research and Education Foundation

Pacific Whale Foundation

Paradise Island Boat Rentals

Reefology

Safer Waters In Massachusetts

Southpoint Divers

St. Petersburg Audubon Society

Tennessee RiverKeeper

Texas Marine Education Association

Tri-County PET LLC

Univ. of Miami Marine Program

Western Pacific Fisheries Coalition

- be able to function to replenish marine populations;
- be relatively unimpacted;
- have simplified boundaries for users and enforcement;
- maximize socioeconomic benefits;
- be no take;
- and allow non-consumptive use.

In June 1999, the Florida Keys National Marine Sanctuary Advisory Council, also composed of members representing users of the Sanctuary resources such as fishers, divers, scientists, and tourism officials, reviewed the recommendation of the Working Group. The Sanctuary Advisory Council unanimously endorsed the proposal.

The proposed Dry Tortugas Ecological Reserve would consist of 2 sections, Tortugas North and Tortugas South, totaling 185 square miles.

Tortugas North is a 125-square-mile area west of the Dry Tortugas that lies primarily within the Sanctuary, with some portions falling under State of Florida control. Tortugas North would include the lush and pristine coral reefs of Sherwood Forest, and the extremely productive northern half of Tortugas Bank. In addition, Tortugas North would include 30 square miles of important mangrove, seagrass and shallow coral reefs inside Dry Tortugas National Park.

Tortugas South is a 60-square-mile area south of the Dry Tortugas that is managed by the Gulf of Mexico Fishery Management Council. Tortugas South would give year-round protection to Riley's Hump, an important spawning site for snapper and grouper species. Tortugas South would also reach south to include valuable deepwater habitats for golden crab, tilefish and snowy grouper.

The Working Group recommended that both sections be completely "no-take", with all fishing and collecting prohibited. Other regulations, such as restrictions on anchoring, would mirror those established for the existing Western Sambos Ecological Reserve. Only by truly preserving the flora and fauna in this area will the ecosystem be able to thrive for generations to come.

We look forward to your support for our request that your agencies approve the preferred alternative to create a Tortugas Ecological Reserve, to include a 125-square-mile Tortugas North reserve and a 60-square-mile Tortugas South reserve, with the taking of any marine organisms prohibited in both areas.

Respectfully submitted,

(authorizations on file)

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DIVING LOCKER
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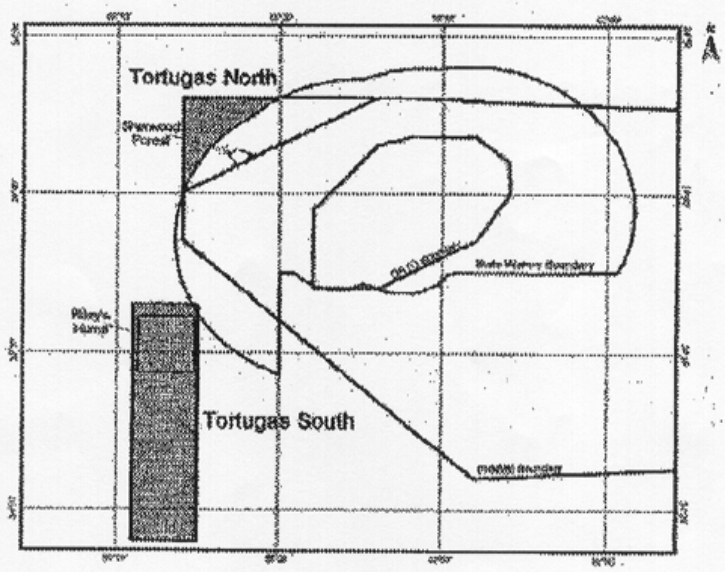
PUBLIC COMMENT FORM
for
Draft Generic Amendment Addressing Establishment of Tortugas Marine Reserves

Marine Reserve Areas Proposed Alternatives

1. Establish a marine reserve in that portion of the proposed Tortugas North ecological reserve (Figure 2) that resides in the EEZ.

2. Establish a marine reserve in the EEZ with the same boundaries as the proposed Tortugas South (Figure 2) ecological reserve.



Note: The Council wants your comments only on these two areas.

I support both alternatives	☐	I oppose both alternatives	☑
I support only Alternative 1	☐	I oppose only Alternative 1	☐
I support only Alternative 2	☐	I oppose only Alternative 2	☐

Comments: THERE IS NO NEED FOR ANY OTHER PROTECTION ON THIS VERY REMOTE AREA THAT VERY FEW PEOPLE USE. THERE IS VERY LITTLE IMPACT ON THIS AREA COMPARED TO OTHER SURROUNDING AREAS OF THE FLORIDA KEYS. PLEASE DON'T GIVE IT TO THE FKNMS.

Marine Reserve Duration

Proposed Alternative: establish the marine reserves for a period of at least 10 years, to be evaluated at the same intervals the state of Florida evaluates the FKNMS (i.e., every 5 years starting in 2002, 2007, etc.). During these periods, the future status of the marine reserves will be considered by the Council and the FKNMS.

Alternative 5: Permanent establishment of the marine reserves.

Alternative 6: Establish the marine reserves for a period of 5 or 10 years, to be annually evaluated. Upon expiration of this period, the future status of the marine reserves will be considered by the Council and the FKNMS.

I support the proposed alternative	☐	I oppose the proposed alternative	☑
I support only Alternative 5	☐	I oppose only Alternative 5	☐
I support only Alternative 6	☐	I oppose only Alternative 6	☐

I propose another alternative (see below):

Comments: _____

_____

_____

_____

Marine Reserve Allowable Activities Proposed Alternatives

Alternative 7: Prohibit fishing for any species in the marine reserve.

Alternative 10: Prohibit all fishing vessels from anchoring in the marine reserves, except in emergencies.

Vessels in continuous transit across the reserves with no fishing gear deployed are not considered to be fishing, even though there may be fishing gear and fish aboard the vessel. However, fishing rods and other fishing gear must be in the rack or stored appropriately, and the hooks must be off the rods.

I support both alternatives	☐	I oppose both alternatives	☑
I support only Alternative 7	☐	I oppose only Alternative 7	☐
I support only Alternative 10	☐	I oppose only Alternative 10	☐

I propose another alternative (see below):

Comments: _____

_____

_____

_____

Marine Reserves Allowable Activities (Alternatives Considered and Not Selected)

Alternative 8: Prohibit all gear except trolling within the marine reserves.

Alternative 9: Prohibit all fishing within the marine reserves except catch and release.

Instead of Alternative 7 (previous page):

I support Alternative 8	☐	I oppose Alternative 8	☐
I support Alternative 9	☐	I oppose Alternative 9	☐

I propose another alternative (see below):

Comments: _____

Personal Use of Areas Proposed by Council for Marine Reserves

Have you ever participated in any of the following activities within either of the two areas depicted in Figure 2 above:

a. Recreational Bottom Fishing	Yes	☑	No	☐
b. Trolling for Recreational Fish	Yes	☐	No	☐
c. Diving	Yes	☑	No	☐
d. Diving for Lobster	Yes	☑	No	☐
e. Spearfishing	Yes	☑	No	☐
f. Commercial Reef Fish Fishing	Yes	☐	No	☐
g. Commercial King Mackerel Fishing	Yes	☐	No	☐
h. Commercial Shrimping	Yes	☐	No	☐
i. Commercial Lobster Fishing	Yes	☐	No	☐

Comments (Describe the Importance of this Activity to You): I run a liveaboard diving company called Sea-Clusive Charters. We do 3 to 4 day recreational spearfishing trips to Tortugas Bank and Riley's Hump.

Name: Bob DeMauro

Signature: Robert DeMauro

Address: 17195 Kingfish Ln. West
Sugarloaf Key, FL 33042
(305) 744-9928

Background: Recreational Fisherman ☑
Commercial Fisherman ☐
Environmental ☐
Other ☑ Diving Charters

GULF OF MEXICO FISHERY MANAGEMENT COUNCIL

The Commons at Rivergate
3018 U.S. Highway 301 North, Suite 1000 • Tampa, Florida 33619-2266
(813) 228-2815 • FAX (813) 225-7015
e-mail: gulf.council@noaa.gov

August 29, 2000

00.AUG 30 *005214

Dr. William Hogarth
Regional Administrator
National Marine Fisheries Service
9721 Executive Center Drive, North
St. Petersburg, Florida 33702

Dear Dr. Hogarth:

We, the undersigned, submit this letter as a minority report in disagreement with the proposed Generic Amendment Addressing the Establishment of Tortugas Marine Reserves that proposes to create two marine reserves.

The action taken by the Gulf of Mexico Fishery Management Council (Council) is unnecessary, and is not authorized by the ten national standards of the Magnuson-Stevens Act. It is a "top-down" marine reserve instead of a "bottom-up" reserve.

It is our understanding that the National Marine Sanctuaries Act (NMSA) can close areas to fishing regardless of the wishes of the Council. The National Oceanographic and Atmospheric Administration (NOAA) must consult with the appropriate officials of any regional fishery management council regarding the determinations and findings that are required to determine whether the area of the marine environment under consideration meets the standards for designation as a national marine sanctuary. However, there is no requirement that the Council create a plan amendment to establish a reserve. This was explained to the Council at its November 1999 meeting by NOAA Attorney Michael Weiss. The only reason the Council has participated in the drafting of the amendment is that, as stated on page 5 of the amendment, Ms. Penny Dalton, NOAA Assistant Administrator for Fisheries, and Dr. Jeffrey Benoit, Director of the Office of Ocean and Coastal Resources of the National Oceans Service asked the Council to proceed with the development of a fishery management plan (FMP) amendment to implement the Tortugas 2000 ecological reserve and to prepare regulations prohibiting fishing within the proposed reserve. In other words, the development of this amendment is more of a reaction to NOAA/National Marine Fisheries Service (NMFS) policy rather than being necessary to address any fishery problem encompassed within the scope of the National Standards. Therefore, this amendment violates one of the primary purposes of Congress for the Magnuson-Stevens Act (Section 2 (b) (4)) which is "to provide for the preparation and implementation, in accordance with national standards, of fishery management plans which will achieve and maintain, on a continuing basis, the optimum yield from each fishery". In addition, because this amendment establishes closed areas that can be and are being accomplished through the NMSA, this measure is not needed and should be considered to violate National Standard 7 that states, "Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication."

The amendment purports to fulfill two objectives of the Reef Fish Fishery Management Plan which are: (1) rebuild the declining reef fish stocks wherever they occur in the fishery; and, (2) conserve and increase habitat for reef fish to increase reef fish populations and provide protection for juveniles. If NMFS feels that these objectives are important, then why are other more efficient measures to protect stocks such as bag and size limits, seasonal closures, quotas, catch-and-release-only fishing, artificial reefs, or gear restrictions not being considered. Based on information provided in the "Regulatory Amendment to the Reef Fish Fishery Management Plan to Set 1999 Gag/Black Grouper Management Measures (Revised)," many of these other measures provide better protection to reef fish stocks. The two reserve areas described in this regulatory amendment comprising a total of 219 square nautical miles will only reduce commercial landings of gag and black grouper by about 2 percent. No information was presented for the reduction in landings in recreational fisheries; however, this reduction for this fishery should also be minimal. In contrast, the overall reduction in landings of gag and black grouper in the Gulf presented in the document can be as high as 12 percent by increasing the size limits (to 24 inches total length commercial and 22 inches recreational), and a potential 10 to 39 percent commercial and 11 to 23 percent recreational using seasonal closures of one to four months. In other words, compared to size limits and seasonal closures, marine reserves do not appear to be as effective for reducing landings. In addition, NMFS had a chance to restrict reef fish fishing gear by shortening the phase-out period for fish traps in Reef Fish Amendment 16A. Not only would this provision reduce fishing pressure on reef fish stocks (help rebuild stocks), but they would also decrease damage by these traps to corals (protect habitat). However, NMFS rejected this measure.

Another concern that we share is that the prohibition on all fishing in the reserve excludes the harvest of coastal pelagic species (including dolphin and wahoo) even though there does not appear to be any need for or benefit from the reserves for these stocks. None of the stated objectives of this amendment addresses coastal pelagic species. The amendment purports to fulfill two objectives of the Reef Fish FMP (stated above) and purports to fulfill two objectives of the Coral and Coral Reefs FMP: (1) minimize, as appropriate, adverse human impacts on coral and coral reefs; and, (2) increase public awareness of the importance and sensitivity of coral and coral reefs). No mention is made of fulfilling objectives of the Coastal Pelagics FMP. Further, there has been no analysis of what affect the prohibition of fishing these areas will have on reductions to coastal pelagic stocks. Spanish mackerel are presently not considered overfished, a preliminary assessment of dolphin suggests this stock is not overfished, and king mackerel, while still considered overfished, do not appear to be suffering from overfishing. Unless these stocks are being fished at a level above optimum yield (OY) or they are not under a rebuilding plan, then there is no need for the Council to prohibit the harvest of these stocks (i.e., prohibit their harvest in a reserve). To do so would violate the intent of National Standard 1, "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."

The best available science indicates that marine reserves are not an appropriate management technique for coastal pelagics (including dolphin and wahoo). Coleman et al. (2000) state that species (such as reef fish) that will benefit from marine reserves have life history characteristics such as slow growth, late maturity, high site fidelity, ontogenetic seasonal and spawning migrations, complex social structures, and sex reversal. With the exception of seasonal migrations, coastal pelagics do not share any of these characters, and the migration patterns of coastal pelagics are so extensive that vast areas would need to be set aside to protect these species. Further, as stated in the amendment (page 35), there are no replenishment benefits to king mackerel. These stocks can be (and are being) rebuilt by other means such as size limits, bag limits, seasons, quotas, and gear restrictions.

In Council discussions, one of the major reasons given for prohibiting fishing in the marine reserve is to make enforcement easy. The difference between fishing for coastal pelagics (including dolphin and wahoo) and reef fish is obvious and is enforced without complaint elsewhere (e.g. fishing for king mackerel when the red snapper fishery is closed). With the rule stating that fishing gear must be stowed on the vessel, the major assessment means, aerial surveillance, should detect if a vessel is violating the rules. At the same time, non-consumptive diving will be allowed in the reserve areas. When asked if aerial surveillance could detect whether a diver is spearfishing or not, the answer by the United States Coast Guard (USCG) was no. Given that diving for lobsters occurs in the Tortugas Ecological Reserve Study area at a level 1.65 times greater than non-consumptive diving (1,730 vs 1,048 person-days, Table 3, page 17 of the amendment), and that spearfishing occurs at a level 1.79 times greater than non-consumptive diving (1,872 vs 1,048 person-days), the potential for illegal lobster fishing or spearfishing within these reserves is a real possibility.

It seems to us that it should be easier to enforce trolling than diving. A fishing vessel trolling will be in gear and moving while a diver is operating under water and is not visible to enforcement personnel from either the air or from the surface. Therefore, if the same logic being applied to anglers is also applied to divers, then divers should be excluded from the reserve area to ensure that fishery resources are protected. An added benefit to keeping divers out of the reserve will be the protection of corals. Extensive damage has occurred to corals by divers, either accidentally or purposefully, touching corals in protected areas such as the John Pennekamp Coral Reef State Park.

Finally, we would like to express our concern about the monitoring of marine reserves by NMFS. When the two reserves were established in the northeastern Gulf in the "Regulatory Amendment to the Reef Fish Fishery Management Plan to Set 1999 Gag/Black Grouper Management Measures (Revised)," concerns from the industry about both the areas selected for closure and the science describing the benefits of closed areas to gag populations created questions about the utility of areal closures to protect species. We were assured that studies would be conducted by NMFS to study the potential effects of closed areas on reef fish species, and this was part of the reason why this measure was approved by the Council. It was disconcerting to hear Dr. Nancy Thompson from the Southeast Fishery Science Center (SEFSC) indicate that no formal monitoring program had been established.

Marine reserves are a new management concept to Gulf fisheries, and their utility in managing fish stocks has not been proven. If a formal monitoring program were developed to evaluate these northeastern Gulf reserves, then it would not be necessary to establish the Tortugas Marine Reserves for the same purpose. We feel strongly that NMFS needs to develop a monitoring program for these marine reserves so that we can properly evaluate their management utility in the future.

We strongly urge NMFS to reject this management measure proposed by the Council. This measure violates National Standards 1 and 7 of the Magnuson-Stevens Fishery Management and Conservation Act, other measures such as size limits and seasonal closures are more effective at reducing landings than marine reserves, the measure has no management advantage for coastal pelagic fisheries, and the measure creates a double standard between divers and anglers. Fishing for coastal pelagics and highly migratory species should be allowed with reasonable and necessary restrictions.

Thank you for your time and consideration in allowing us to express our views. If you have any questions, please do not hesitate to get in touch with us.

Sincerely,

Alex Jernigan

Alex M. Jernigan

Maumus Claverie

Maumus F. Claverie, Jr.

AJ:MC:PH:jb

c: Gulf Council
Billy Causey
Sebastian O'Kelly
Staff

Literature Cited:

Coleman, F. C., and eight co-authors. Long-lived reef fishes: the grouper snapper complex. Fisheries, 25(3): 14-21.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

RECEIVED
JUL 26 2000
GULF FISHERIES COUNCIL

JUL 13 2000

In Reply Refer To:
FWS/R4/RF/RS-III

Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619 - 2266

Mr. Billy Causey, Superintendent
Florida Keys National Marine Sanctuary
Post Office Box 500368
Marathon, Florida 33050

Dear Sirs:

Please register these comments for the Southeast Regional Office of the Fish and Wildlife Service, including the Ecological Services Office in Vero Beach and the national wildlife refuges of the Florida Keys. These comments are provided on the Draft Supplemental Environmental Impact Statement of the Florida Keys National Marine Sanctuary proposing the establishment of "no-take" Ecological Reserves (marine reserves) in the Tortugas region of Monroe County, Florida.

The importance of the Tortugas area as a spawning site and "source" reef for the fish communities found in the Key West and Great White Heron National Wildlife Refuges, while always assumed, is just beginning to be understood scientifically. The ability of the Refuges to maintain a healthy ecosystem for the wildlife that inhabit it is directly dependent upon a healthy marine component. The traditional avian trust resources of the Florida Keys Refuge feed upon the fish communities that live within the habitats that we have been charged to protect since 1908. At the same time, the fish communities' dependence upon a healthy "upstream" ecosystem and fishery are related to the success of resource management in the Tortugas region. Our collective trust resources are intertwined in the web of life in south Florida and beyond.

We believe there is sufficient evidence to support the utility of marine reserves as a viable tool for resource protection, both site-based and in fisheries management. The protection of marine resources, including fish stocks, within reserves has many benefits. These include, but are not limited to: an increased abundance and size of target fishery species, thereby translating into increased egg production and export; protecting genetic quality of species; protecting biodiversity; protecting ecological processes; and enhancing scientific exploration and educational opportunities. These benefits in the Tortugas region will translate into benefits to the trust resources of the Fish and Wildlife Service and the National Wildlife Refuge System.

As a result, we endorse the establishment of the pair of reserves as defined in the Tortugas 2000 preferred alternative and proposed rules, without alteration or amendment, as expeditiously as possible.

Thank you for the opportunity to provide comments on this most important issue. If you need any further information, please feel free to contact me at 404/679-4000 or Refuge Manager Jim Halpin at 305/872-2239.

Sincerely yours,

for Sam D. Hamilton
Regional Director

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

August 18, 2000

4EAD

Mr. William Hogarth
National Marine Fisheries Service
Southeast Regional Office
9721 Executive Center Drive N.
St. Petersburg, FL 33702

RE: EPA Review and Comments on
Draft Supplemental Environmental Impact Statement (DSEIS)
Draft Generic Amendment Addressing the Establishment of the
Tortugas Marine Reserves
CEQ No. 000230

Dear Mr. Hogarth:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the subject Draft Supplemental Environmental Impact Statement (DSEIS). The document provides information to educate the public regarding general and project-specific environmental impacts and analysis procedures. We appreciate your consistency with the public review and disclosure aspects of the NEPA process, as well as your conservation efforts.

The DSEIS proposes to establish the Tortugas North and South Marine Reserves in the Gulf of Mexico Exclusive Economic Zone (EEZ), which will encompass the Riley's Hump mutton snapper spawning aggregation site. All fishing and anchoring of fishing vessels would be prohibited in the proposed marine reserves. The stated purpose of the amendment is to establish fishery regulations under the Magnuson-Stevens Act within portions of the proposed ecological reserve that reside in Federal waters.

Based on our review, we rate the DSEIS "LO," that is, we have no objections to implementing this action. However, further discussion of Environmental Justice and ecological monitoring is warranted in the Final DSEIS. Our detailed comments are attached.

Thank you for the opportunity to comment on this project. If you have any questions or require technical assistance you may contact Ramona McConney of my staff at (404) 562-9615.

Sincerely,

Heinz J. Mueller, Chief
Office of Environmental Assessment

Attachment

Comments on
Draft Supplemental Environmental Impact Statement (DSEIS)
Draft Generic Amendment Addressing the Establishment of the
Tortugas Marine Reserves
CEQ No. 000230

Alternatives - The proposed action is to establish the Tortugas North & South marine reserves in the Gulf of Mexico Exclusive Economic Zone (EEZ). All fishing and anchoring of vessels would be prohibited in the proposed marine reserves for at least 10 years. The purpose of this action is to conserve marine resources in the area. It is noted in the DSEIS that present conditions have led to impacts from anchoring and fishing.

Endangered Species: We note that federally-protected species are listed for the area by the U.S. Fish and Wildlife Service (FWS). EPA principally defers to the FWS regarding endangered species assessments and encourages continued coordination with the FWS as appropriate.

Figures - Overall, the graphics in the document are clear and legible. However, some figures in the document lack milage scales, which makes the areal extent of some delineated areas unclear. If these figures are not to scale, please state this. Figure 8 species names are blurred and difficult to read.

Management Details: Will there be a plan to educate and communicate with boaters regarding the environment and conservation in the area? If so, please decribe the media used to communicate this information.

Further details are needed regarding measurable activities that could be used to evaluate the results of the proposed action on the natural resources in the proposed marine reserves. In particular, information should be given regarding the frequency and parameters of ecological monitoring activities.

Environmental Justice (EJ): We note the profiles in the DSEIS of potentially impacted fishermen on pages 29-30. However, consistent with Executive Order 12898 (2/11/94), potential EJ impacts should be considered in the NEPA document. The purpose of an EJ survey is to ensure equitable environmental protection regardless of race, ethnicity, economic status or community, so that no segment of the population bears a disproportionate share of the consequences of impacts attributable to a proposed project.

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