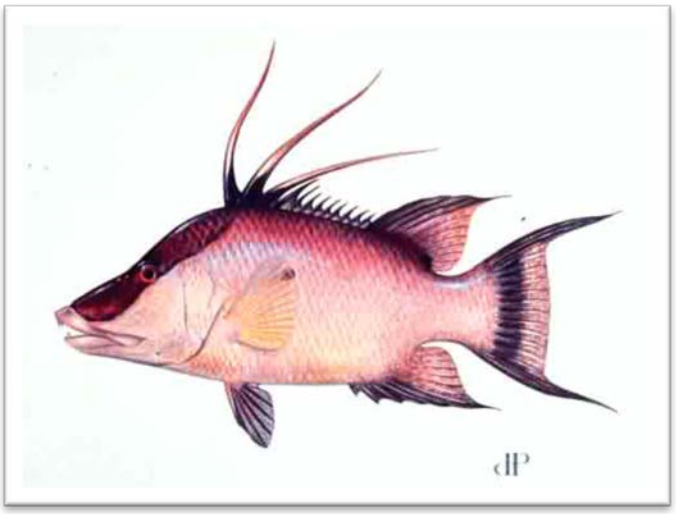
Amendment 37 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region



Modification to the hogfish fishery management unit, fishing level specifications for the two South Atlantic hogfish stocks, rebuilding plan for the Florida Keys/East Florida stock, and establishment/revision of management measures for both stocks

Summary for Scientific and Statistical Committee

April 14, 2016

Abbreviations and Acronyms

ABC	acceptable biological catch
ACL	annual catch limits
AM	accountability measures
ACT	annual catch target
B	a measure of stock biomass in either weight or other appropriate unit
B_{MSY}	the stock biomass expected to exist under equilibrium conditions when fishing at F_{MSY}
B_{OY}	the stock biomass expected to exist under equilibrium conditions when fishing at F_{OY}
B_{CURR}	The current stock biomass
CPUE	catch per unit effort
DEIS	draft environmental impact statement
EA	environmental assessment
EEZ	exclusive economic zone
EFH	essential fish habitat
F	a measure of the instantaneous rate of fishing mortality
$F_{30\%SPR}$	fishing mortality that will produce a static SPR = 30%
F_{CURR}	the current instantaneous rate of fishing mortality
F_{MSY}	the rate of fishing mortality expected to achieve MSY under equilibrium conditions and a corresponding biomass of B_{MSY}
F_{OY}	the rate of fishing mortality expected to achieve OY under equilibrium conditions and a corresponding biomass of B_{OY}
FEIS	final environmental impact statement
FMP	fishery management plan
FMU	fishery management unit
M	natural mortality rate
MARMAP	Marine Resources Monitoring Assessment and Prediction Program
MFMT	maximum fishing mortality threshold
MMPA	Marine Mammal Protection Act
MRFSS	Marine Recreational Fisheries Statistics Survey
MRIP	Marine Recreational Information Program
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OFL	overfishing limit
OY	optimum yield
RIR	regulatory impact review
SAFMC	South Atlantic Fishery Management Council
SEDAR	Southeast Data Assessment and Review
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
SIA	social impact assessment
SPR	spawning potential ratio
SSC	Scientific and Statistical Committee

Introduction

What Actions Are Being Proposed in this Amendment?

Amendment 37 includes 12 actions to address:

- Separating the hogfish fishery management unit into two stocks: Georgia through North Carolina (GA-NC stock) and Florida Keys/East Florida (FLK/EFL stock)
- Specification of Acceptable Biological Catch, Annual Catch Limits, and Optimum Yield for both stocks
- Rebuilding plan for the FLK/EFL stock
- Commercial and recreational management measures for both stocks
- Accountability Measures for both stocks

Why are the South Atlantic Council and NMFS Considering Action?

The Florida Fish and Wildlife Conservation Commission completed a stock assessment for hogfish in 2014 (SEDAR 37 2014). Based on genetic evidence it was recommended that hogfish in the South Atlantic be managed as two stocks: Georgia through North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL). Because of insufficient data, fishing level recommendations for the GA-NC stock are based on landings data only using the Only Reliable Catch Stocks approach of the South Atlantic Fishery Management Council's (South Atlantic Council) acceptable biological catch (ABC) control rule, and the status of that stock is unknown. For the FLK/EFL stock, the stock assessment results showed the stock is *undergoing overfishing and is overfished* and; therefore, in need of a rebuilding plan.

Amendment 37 would specify the boundary between the FLK/EFL hogfish stock, managed by the South Atlantic Council, and the Gulf of Mexico hogfish stock, managed by the Gulf of Mexico Fishery Management Council. This demarcation would aid in enforcing regulations and properly tracking landings for each stock. Amendment 37 also includes actions to specify ABC, annual catch limits (ACLs), and optimum yield for both stocks, establish a rebuilding plan for the FLK/EFL stock, and implement or modify management measures for both stocks to attain the desired level of harvest.

What Management Measures are Being Considered for Hogfish in Georgia and the Carolinas?

Because of insufficient data, the status of the GA-NC stock of hogfish is unknown. An ABC (level of total removals that is biologically feasible) has been estimated based on an approach that uses only landings data. The ABC for this stock is 35,716 pounds whole weight (lbs ww). Estimates of maximum sustainable yield (MSY) and minimum stock size threshold (MSST) are obtained from a stock assessment and, are therefore unknown for the GA-NC stock. Below are some of the management changes the South Atlantic Council is considering for this stock:

- Define the management unit from the Georgia/Florida state boundary northward to the North Carolina/Virginia state boundary – **Action 1**
- Re-calculate sector allocations based on the redefined geographic boundary to maintain current apportionment - the re-calculated allocations would be 69.13% commercial and 30.87% recreational – **Action 4**
- Specify the commercial ACL in 2017 (based on recalculated allocation and 95% ABC) = 23,456 lbs ww (the average of commercial landings from 2010 to 2014 is 20,454 lbs ww) – **Action 4**
- Specify the recreational ACL in 2017 (based on re-calculated allocation and 95% ABC) = 988 fish (the average of recreational landings from 2010 to 2014 is 545 fish) – **Action 4**
- Increase in minimum size limit (for both sectors) to 17 inches fork length (currently the limit is 12 inches fork length) – **Action 8**
- Commercial trip limit of 500 pounds gutted weight (lbs gw; currently there is no trip limit in federal waters) – **Action 9**
- Establish a recreational bag limit to 2 fish per person per day (the bag limit is not currently specified in federal waters off Georgia and the Carolinas) – **Action 10**

What Management Measures are Being Considered for Hogfish in Florida and the Florida Keys?

The stock assessment results showed that the hogfish stock in Florida and the Florida Keys is overfished and undergoing overfishing. When a stock is overfished the South Atlantic Council must put in place a rebuilding plan to bring the population back up to a sustainable level. The stock assessment produced estimates of MSY and MSST for this stock and the South Atlantic Council would adopt them through this amendment. In addition, the South Atlantic Council must decide how they plan to rebuild the stock (i.e., over what time period and at what level of fishing). Below are some of the management changes the South Atlantic Council is considering for this stock:

- Define the management unit from the Georgia/Florida state boundary to a line just south of Cape Sable, Florida, running due west (25^0 09'.000 North Latitude) – **Action 1**
- Specify a rebuilding plan that sets the ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success (this was the recommendation from the South Atlantic Council's Scientific and Statistical Committee) – **Action 5**
- Re-calculate sector allocations based on the redefined geographic boundary to maintain current apportionment - the re-calculated allocations would be 9.63% commercial and 90.37% recreational – **Action 6**
- Establish a commercial ACL in 2017 (based on recalculated allocation and 95% ABC) = 3,510 lbs ww (the average of commercial landings from 2010 to 2014 is 13,976 lbs ww) – **Action 6**
- Establish a recreational ACL in 2017 (based on re-calculated allocation and 95% ABC) = 15,689 fish (the average of recreational landings from 2010 to 2014 is 121,329 fish) – **Action 6**

- Increase in minimum size limit (for both sector) to 16 inches fork length (currently the limit is 12 inches fork length) – **Action 8**
- Specify a commercial trip limit of 25 lbs gw (currently there is no trip limit in federal waters) – **Action 9**
- Decrease the recreational bag limit to 1 fish per person per day from current 5 fish limit – **Action 10**
- Establish an annual recreational fishing season from July through October – **Action 11**

Purpose for Actions

The *purpose* of this amendment is to modify the management unit for hogfish, specify fishing levels based on Scientific and Statistical Committee recommendations for the Georgia-North Carolina and Florida Keys/East Florida stocks of hogfish, and modify or establish management measures. For the Florida Keys/East Florida stock of hogfish, establish a rebuilding plan to increase hogfish biomass to sustainable levels within a specified time period based on results of the recent stock assessment.

Need for Actions

The *need* for this amendment is to align the management boundaries for hogfish with the best available science (i.e., genetic information), and end overfishing and rebuild the Florida Keys/East Florida stock of hogfish while minimizing, to the extent practicable, adverse social and economic effects.

What are Annual Catch Limits and Accountability Measures and Why are they Required?

A reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) in 2007 required implementation of new tools to end and prevent overfishing to achieve the OY from a fishery. The tools are annual catch limits (ACLs) and accountability measures (AMs). An ACL is the level of annual catch of a stock that, if met or exceeded, triggers some corrective action. The AMs are the corrective action, and they are management controls to prevent ACLs from being exceeded and to correct overages of ACLs if they occur. Two examples of AMs include an in-season closure if catch is projected to reach the ACL and reducing the ACL by an overage that occurred the previous fishing year. Amendment 37 includes alternatives that would revise the current ACLs and AMs for hogfish.

Definitions

Annual Catch Limits (ACLs)
The level of annual catch (pounds or numbers) that triggers accountability measures to ensure that overfishing is not occurring.

Annual Catch Targets (ACTs)
The level of annual catch (pounds or numbers) that is the management target of the fishery, and accounts for management uncertainty in controlling the actual catch at or below the ACL.

Accountability Measures (AMs)
Management controls to prevent ACLs, including sector ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur.

Allocations
A division of the overall ACL among sectors (e.g., recreational and commercial) to create sector ACLs.

Maximum Sustainable Yield (MSY)
Largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.

Optimum Yield (OY)
The amount of catch that will provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems.

Minimum Stock Size Threshold (MSST)
A status determination criterion. If current stock size is below MSST, the stock is overfished.

How Does the South Atlantic Council Determine the Annual Catch Limits?

ACLs are derived from the overfishing limit (OFL) and the ABC **(Figure 1.6.1)**. The South Atlantic Council's SSC determines the OFL from the stock assessment and the ABC (based on the South Atlantic Council/SSC's ABC control rule), and recommends those to the South Atlantic Council. The OFL is an estimate of the catch level above which overfishing is occurring. The ABC is defined as the level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty.

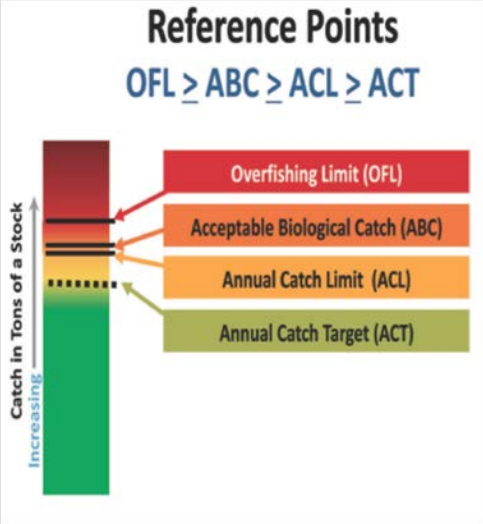


Figure 1.6.1. The relationship of the reference points to each other.

How is the Council Modifying the Overfishing Definition for Hogfish and Other Assessed Snapper Grouper Species?

The Magnuson-Stevens Act National Standard 1 Guidelines provide a definition of overfishing that allows overfishing to be determined in two ways, by a fishing mortality rate or by a level of catch:

50 C.F.R § 600.310 (e)(2)(i)(B)

> *Overfishing (to overfish) occurs whenever a stock or stock complex is subjected to a level of fishing mortality or annual total catch that jeopardizes the capacity of a stock or stock complex to produce maximum sustainable yield (MSY) on a continuing basis.*

The National Standard 1 Guidelines provide more detail about these two methods, and require that fishery management plans (FMP) describe which method will be used to determine an overfishing status:

50 C.F.R. § 600.310 (e)(2)(ii)(A)

> *Status Determination Criteria to determine overfishing status. Each FMP must describe which of the following two methods will be used for each stock or stock complex to determine an overfishing status.*
>
> *(1) Fishing mortality rate exceeds maximum fishing mortality threshold (MFMT). Exceeding the MFMT for a period of 1 year or more constitutes overfishing. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.*
>
> *(2) Catch exceeds the overfishing limit (OFL). Should the annual catch exceed the annual OFL for 1 year or more, the stock or stock complex is considered subject to overfishing.*

The OFL is defined as an annual level of catch that corresponds directly to the MFMT, and is the best estimate of the catch level above which overfishing is occurring.

MFMT Method - Overfishing occurring if fishing mortality exceeds the MFMT

This method is a more direct way than the OFL method (see below) of comparing the fishing rate to the maximum allowed rate of fishing, and it is less sensitive to recent fluctuations in recruitment. The estimates of fishing mortality are based on the maximum annual fishing mortality at any age. However, fishing mortality rates cannot be directly measured. They must be calculated as part of a stock assessment or assessment update, thus fishing mortality rates are only available for years when assessments are conducted.

The "current" fishing mortality rate for an assessed stock corresponds to the last year of data used in the assessment. Therefore, use of the "current fishing mortality" rate may not reflect the true status of the stock in years following a stock assessment, particularly if actions are taken to constrain effort and harvest.

OFL Method - Overfishing occurring if annual landings exceed the OFL

The OFL method is based on catch levels that are more easily understood by constituents than fishing mortality. Unlike fishing mortality rates, a determination can be made on an annual basis as soon as catch totals are available. However, the use of the OFL method might not be appropriate for stocks with highly variable recruitment that cannot be predicted and therefore incorporated into the forecast of stock condition on which the OFL is based.

Overfishing Definition for the FLK/EFL stock of hogfish and other assessed snapper grouper stocks in the South Atlantic region

Each of the two methods for determining overfishing has benefits and drawbacks with MFMT being a better estimate of overfishing status in a year in which a stock is assessed and OFL a better estimate of overfishing status in years when a current estimate of fishing mortality is not available. Therefore, the South Atlantic Council has approved using both the MFMT and OFL as metrics to determine the overfishing status of the following assessed snapper grouper species: red grouper (Amendment 24; SAFMC 2011), yellowtail snapper (Regulatory Amendment 15; SAFMC 2013a), black sea bass (Regulatory Amendment 19; SAFMC 2013b), blueline tilefish (Amendment 32; SAFMC 2014), snowy grouper (Regulatory Amendment 20; SAFMC 2015a), gag (Regulatory Amendment 22; SAFMC 2015b), and wreckfish (Regulatory Amendment 22; SAFMC 2015b). Through this amendment, the South Atlantic Council is adopting this overfishing determination methodology for the following assessed snapper grouper species: FLK/EFL stock of hogfish, vermilion snapper, mutton snapper, golden tilefish, red porgy, greater amberjack, black grouper, and gray triggerfish. For these species overfishing will be determined on an annual basis by the MFMT and OFL methods. The estimate of F_{MSY} (MFMT) for an assessed stock is a single value, while the corresponding OFL values will change with changes in the magnitude of the stock. If either the MFMT (during an assessment year) or the OFL method (during a non-assessment year) is exceeded, the stock will be considered to be undergoing overfishing.

Proposed Actions and Alternatives

Action 1. Modify the Fishery Management Unit (FMU) for hogfish

Alternative 1 (No action). There is a Gulf of Mexico stock and South Atlantic stock of hogfish separated at the jurisdictional boundary between the South Atlantic Fishery Management Council and the Gulf of Mexico Fishery Management Council:
The boundary coincides with the line of demarcation between the Atlantic Ocean and the Gulf of Mexico, which begins at the intersection of the outer boundary of the EEZ, as specified in the Magnuson-Stevens Act, and 83°00' W. long., proceeds northward along that meridian to 24°35' N. lat., (near the Dry Tortugas Islands), thence eastward along that parallel, through Rebecca Shoal and the Quicksand Shoal, to the Marquesas Keys, and then through the Florida Keys to the mainland at the eastern end of Florida Bay, the line so running that the narrow waters within the Dry Tortugas Islands, the Marquesas Keys and the Florida Keys, and between the Florida Keys and the mainland, are within the Gulf of Mexico.

Preferred Alternative 2. Modify the snapper grouper fishery management unit (FMU) to specify two separate stocks of hogfish: (1) a Georgia through North Carolina (GA-NC) stock from the Georgia/Florida state boundary to the North Carolina/Virginia state boundary, and (2) a Florida Keys/East Florida (FLK/EFL) stock from the Florida/Georgia state boundary south to:

Sub-alternative 2a. The South Atlantic/Gulf of Mexico Council boundary.

Sub-alternative 2b. The Monroe/Collier County line.

Preferred Sub-alternative 2c. A line just south of Cape Sable running due west (25^0 09'.000 North Latitude).

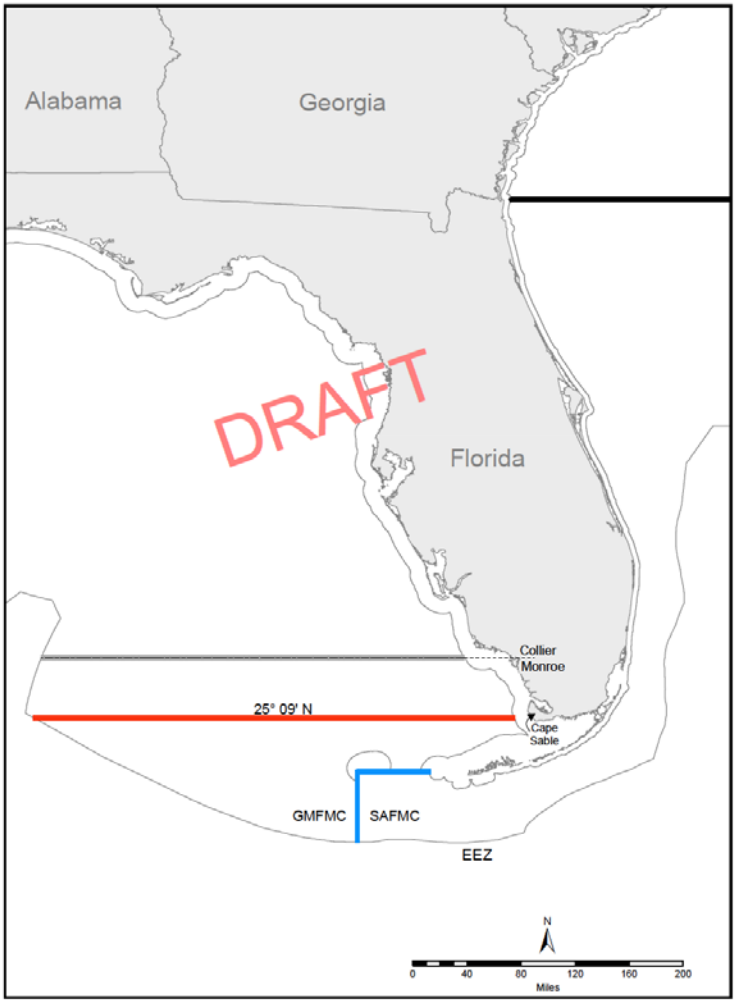


Figure 2.1.1. Proposed boundary Sub-alternatives 2a (blue), 2b (gray) and **2c (Preferred)** (red) to separate the Florida Keys/East Florida stock of hogfish from the Gulf of Mexico stock .
Source: Amanda Frick, NMFS SERO

4.1.1 Biological Effects

Hogfish are currently managed as a single stock within the South Atlantic Fishery Management Council's (South Atlantic Council) area of jurisdiction. Recently; however, research on the genetic structure of hogfish (Seyoum et al. 2015) indicated that three genetically distinct population segments are present in the Southeastern U.S.: (1) the eastern Gulf of Mexico, (2) the Florida Keys and the southeast coast of Florida, and (3) the Carolinas. Two of the population segments are within the South Atlantic Council's area of jurisdiction. An amendment to the Snapper Grouper FMP (SAFMC 1983) is therefore needed to delineate the two stocks of hogfish.

Under **Alternative 1 (No Action)**, hogfish would continue to be managed as s single stock, thus ignoring the latest scientific evidence. As such, management measures might not be as

effective because biological parameters such as growth rates, natural mortality, etc. might not accurately be ascribed to at least some portion of the population. **Preferred Alternative 2** would specify a Georgia through North Carolina (GA-NC) stock of hogfish north of the Georgia-Florida border and a Florida Keys/East Florida (FLK/EFL) stock south of the Georgia-Florida border according to recommendations in Seyoum et al. (2015). Hence, **Preferred Alternative 2** would result in positive biological benefits since management would be based on the latest scientific research and regulations could be better tailored to address specific management issues pertinent to each stock. **Sub-alternatives 2a-2c (Preferred)** specify the dividing line between the Gulf of Mexico stock (under the jurisdiction of the Gulf of Mexico Fishery Management Council [Gulf Council]) and the FLK/EFL stock. Seyoum et al. (2015) state that the two stocks split from each other along the "coastal area west of the Florida Everglades". Thus, from a biological standpoint, **Sub-alternatives 2a-2c (Preferred)** would result in similar biological effects. No changes to how landings are monitored for tracking annual catch limits (ACLs) would result from any of the sub-alternatives considered under this action.

Preferred Sub-alternative 2c in **Action 1** would modify the snapper grouper FMU to specify two separate stocks of hogfish, one from GA-NC, and the other from the Georgia-Florida state boundary south to a line just south of Cape Sable running due west (25^0 09'.000 North Latitude). According to local law enforcement officials, this would be a good demarcation point because it is far enough north of the Florida Keys and far enough south of Naples and Marco Island, which might translate to less fishing effort across this boundary, and in turn help reduce bycatch (see **Appendix D**, Bycatch Practicability Analysis (BPA) for more details).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on Endangered Species Act (ESA)-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on essential fish habitat (EFH) or EFH-Habitat Areas of Particular Concern (HAPC) are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic region).

4.1.2 Economic Effects

The economic effects analysis for each action and alternative in this amendment will be analyzed separately. The Regulatory Impact Review (**Appendix E**) will have the combined economic effects analysis for the preferred alternatives of all of the actions.

As described in **Section 4.1.1**, modifying the management unit for hogfish is not expected to alter the current harvest or use of the resource. Therefore, **Alternative 1 (No Action)** and **Alternative 2** (along with its sub-alternatives) are not expected to have any direct economic effects. Indirect economic effects may come about from this action due to its effects on other actions in this amendment that would make modifications to the harvest of hogfish.

4.1.3 Social Effects

Changes to management of hogfish and access to the resource could affect fishermen who target hogfish, and associated communities and fishing businesses. **Section 3.4** provides detailed information about communities that could be affected by management changes and ACLs, particularly for fishermen and communities in the Florida Keys.

Modifying the snapper grouper FMU to specify separate stocks of hogfish would not be expected to result in direct social effects. However, there may be some indirect effects on fishermen and associated communities associated with aligning management with the most recent stock assessment, and also with any associated management changes due to designation of the two hogfish stocks.

Although additional effects would not usually be expected from retaining the FMU under **Alternative 1 (No Action)**, this would be inconsistent with the stock assessment. **Preferred Alternative 2** would align hogfish management with updated scientific information. However, if changes in the quota or other management measures restrict access for fishermen, harvesting hogfish in specific areas, there may be some negative social effects.

Any indirect effects from **Sub-alternatives 2a-2c (Preferred)** would be similar for all fishermen targeting hogfish, except for fishermen in the Florida Keys. Under **Sub-alternatives 2a** and **2b**, management of hogfish in the Florida Keys would be split between the Gulf and South Atlantic Councils' jurisdiction. This would pose problems for the Florida Keys fishermen, as some vessels fish in both jurisdictions and may be subject to separate sets of (present and future) fishing regulations. Under **Preferred Sub-alternative 2c**, the Florida Keys would be managed exclusively by the South Atlantic Council. Thus, some additional benefits would be expected from **Preferred Sub-alternative 2c**, compared to **Sub-alternatives 2a** and **2b**.

4.1.4 Administrative Effects

Alternative 2 (Preferred) would split the current stock of hogfish in the South Atlantic into two stocks, GA-NC and FLK/EFL, separated by a line due west from just south of Cape Sable (**Sub-alternative 2c, Preferred**). **Sub-alternative 2c (Preferred)** would have greater administrative effects compared with **Sub-alternatives 2b** and **2a**, since the South Atlantic/Gulf of Mexico Council boundary and the Monroe/Collier County line are already established boundaries. Under **Sub-alternative 2c (Preferred)**, the Gulf Council would need to remove the portion of hogfish in Monroe County, Florida, from the Reef Fish FMU and give management jurisdiction to the South Atlantic Council. Compared to **Alternative 1 (No Action)**, the preferred alternatives would increase the administrative burden for both Councils (South Atlantic and Gulf of Mexico) and for the National Marine Fisheries Service (NMFS). Administrative impacts resulting from the new regulations would include tracking ACLs for two stocks instead of one and educating the public and law enforcement personnel on the new boundaries. However, according to input received from Florida law enforcement personnel, **Sub-alternative 2c (Preferred)** would offer benefits over **Sub-alternatives 2a** and **2b** since the proposed

boundary " is far enough north of the Florida Keys and far enough South of Naples and Marco Island so that Monroe is not simply shifting the regulatory problem north to Collier County."

Although management of the FLK/EFL stock of hogfish in the EEZ off the Florida Keys below either of the boundaries proposed in **Sub-alternatives 2b** and **2c (Preferred)** would be under the South Atlantic Council, the existing Gulf of Mexico rules and requirements for for-hire and commercial permits would remain in place until changed through a future amendment. Under current regulations, vessels operating as for-hire or commercial vessels in the Gulf region[1] and catching reef fish species, including hogfish, are required to have the applicable federal Gulf Reef Fish Charter/Headboat permit or a Gulf Reef Fish Commercial permit. In the South Atlantic region, vessels operating as for-hire or commercial vessels and harvesting snapper grouper species, including hogfish, are required to have the applicable federal South Atlantic Snapper Grouper Charter/Headboat permit, South Atlantic Snapper Grouper 225-pound Commercial permit, or a South Atlantic Snapper Grouper Unlimited Commercial permit. The operators of the federally permitted vessels would also follow the sale and reporting requirements associated with each permit with regards to hogfish. This means that federally permitted South Atlantic vessels do not need a Gulf federal permit to harvest hogfish in the east Florida/Florida Keys hogfish management unit when fishing in the South Atlantic region, but would need a Gulf federal permit if they are fishing for hogfish in the Gulf Region.

[1] For the purpose of this paragraph, Gulf region refers to federal waters in the Gulf of Mexico seaward of Florida-Texas as defined in 16 USC 302(a)(1)(E) and South Atlantic region refers to federal waters in the Atlantic ocean seaward of the states of Florida-North Carolina as defined in 16 USC 302(a)(1)(C). The boundary between the regions is defined in 50 CFR 600.105(c).

Action 2. Specify Maximum Sustainable Yield (MSY) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). Currently, the maximum sustainable yield (MSY) equals the yield produced by F_{MSY}. $F_{30\%SPR}$ is used as the F_{MSY} proxy for hogfish in the South Atlantic.

Preferred Alternative 2. MSY equals the yield produced by F_{MSY} or the F_{MSY} proxy ($F_{30\%SPR}$). MSY and F_{MSY} are recommended by the most recent SEDAR/SSC.

Preferred Sub-alternative 2a. GA-NC stock of hogfish.

Preferred Sub-alternative 2b. FLK/EFL stock of hogfish.

Alternatives	Equation	F_{MSY}	MSY Values (lbs whole weight)
Alternative 1 (No Action)	MSY is not defined for the GA-NC stock or the FLK/EFL stock	unknown	unknown
Alternative 2 (Preferred)	**MSY equals the yield produced by F_{MSY} or the F_{MSY} proxy. MSY and F_{MSY} are recommended by the most recent SEDAR/SSC.**	**Sub-alt 2a: GA-NC = unknown Sub-alt 2b: FLK/EFL = 0.138**	**GA-NC = unknown FLK/EFL = 346,095**

4.2.1 Biological Effects

The maximum sustainable yield (MSY) is a reference point used by managers to assess fishery performance over the long term. Defining MSY for each of the stocks of hogfish under **Preferred Alternative 2** would not alter the current harvest or use of the resource. Specification of MSY merely establishes a benchmark for resource evaluation on which additional management actions would be based, if necessary. MSY in **Alternative 1 (No Action)** is defined as the yield produced by F_{MSY} where $F_{30\%SPR}$ is used as a proxy for F_{MSY} and represents the overfishing level defined in Amendment 11to the Snapper Grouper FMP (SAFMC 1998b) for a combined hogfish stock. MSY is not defined for the Georgia through North Carolina (GA-NC) or the Florida Keys/East Florida (FLK/EFL) stocks of hogfish.

In **Alternative 1 (No Action)**, a poundage for MSY is not specified since one was not specified in Amendment 11. **Alternative 2 (Preferred)** would allow for periodic adjustments of

F_{MSY} and MSY values based on estimates from new assessments without the need for a plan amendment. Because the SEDAR 37 (2014) stock assessment was not considered applicable to the GA-NC stock of hogfish, **Sub-alternative 2a (Preferred)** would essentially maintain the status quo for that stock. However, it differs from **Alternative 1 (No Action)** in that it would allow future adjustments without the need for a plan amendment if a stock assessment were to produce an estimate of MSY for that stock. **Sub-alternative 2b (Preferred)** would redefine MSY for the FLK/EFL stock based on the recommendation of SEDAR 37 (2014) and the South Atlantic Council's Scientific and Statistical Committee (SSC) to equal the value associated with the yield at F_{MSY} (346,095 pounds whole weight [lbs ww]). The specification of a MSY equation would have beneficial effects on the FLK/EFL stock of hogfish as it provides a reference point to monitor the long-term performance of the stock.

As none of the alternatives considered under this action would have direct effects on resource harvest or use, biological effects would be neutral. However, **Alternative 2 (Preferred)**, which is recommended in the most recent SEDAR and by the SSC, has a better scientific basis and thus provides a more solid ground for management actions that have economic and social implications. Bycatch and discards would not increase or decrease as a result of this action. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic region).

4.2.2 Economic Effects

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

Since there would be no direct effects on resource harvest or use, there would be no direct effects on fishery participants, associated industries or communities. Direct effects only accrue to actions that alter harvest or other use of the resource. Specifying MSY, however, establishes the platform for future management, specifically from the perspective of bounding allowable harvest levels. In this sense, MSY may be considered to have indirect effects on fishery participants.

As a benchmark, MSY sets off the parameters that condition subsequent management actions, and as such, defining MSY takes special significance. Of the alternatives considered in this action, **Alternative 2 (Preferred)** and its sub-alternatives, which is recommended in the most recent SEDAR and by the SSC, has a better scientific basis. Hence, it provides a more solid ground for management actions that have economic implications.

4.2.3 Social Effects

Social effects of management specifications such as MSY for a stock would be associated with both the biological and economic effects of the MSY value in the rebuilding plan. A MSY level that reflects the best available information (**Preferred Alternative 2**, **Preferred Sub-alternative 2a** and **Preferred Sub-alternative 2b**) could result in lower fishing mortality values in the rebuilding plan, and consequentially lower ACLs, which would likely affect fishermen targeting hogfish. However, an informed and relevant MSY (**Preferred Alternative 2**) is expected to contribute to the success of the rebuilding strategy, resulting in greater expected long-term benefits to the commercial fleet and recreational fishermen who target hogfish than under **Alternative 1 (No Action)**.

4.2.4 Administrative Effects

The potential administrative effects of these alternatives differ in terms of the implied restrictions required to constrain hogfish stocks to the respective benchmarks. Defining a MSY proxy establishes a harvest goal for the hogfish portion of the snapper grouper fishery, for which management measures would be implemented. Those management measures would directly impact the administrative environment according to the level of conservativeness associated with the chosen MSY and subsequent restrictions placed on the fishery to constrain harvest levels. For the GA-NC stock of hogfish, **Sub-alternative 2a (Preferred)** differs from **Alternative 1 (No Action)** in that it would allow for periodic adjustments of F_{MSY} and MSY values based on estimates from new assessments without the need for a plan amendment. As such, **Sub-alternative 2a (Preferred)** would reduce the administrative burden from current levels. For the FLK/EFL stock of hogfish, **Sub-alternative 2b (Preferred)** would allow for adoption of the MSY value recommended by the latest stock assessment as well as subsequent adjustments as new assessments or updates are conducted without the need for a plan amendment. Therefore, none of the alternatives considered under this action would result in significant changes in administrative effects compared to **Alternative 1 (No Action).**

Action 3. Specify Minimum Stock Size Threshold (MSST) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). Minimum stock size threshold (MSST) for hogfish in the South Atlantic is equal to SSB_{MSY} ((1-M) or 0.5, whichever is greater).

Alternative 2. MSST = SSB_{MSY} ((1-M) or 0.5, whichever is greater).
Sub-alternative 2a. For the GA-NC stock of hogfish.
Sub-alternative 2b. For the FLK/EFL stock of hogfish.

Alternative 3. MSST = 50% of SSB_{MSY}
Sub-alternative 3a. For the GA-NC stock of hogfish.
Sub-alternative 3b. For the FLK/EFL stock of hogfish.

Preferred Alternative 4. MSST = 75% of SSB_{MSY}
Preferred Sub-alternative 4a. For the GA-NC stock of hogfish.
Preferred Sub-alternative 4b. For the FLK/EFL stock of hogfish.

Alternatives	MSST Equation	M	MSST Values (lbs whole weight)
1 (No Action)	MSST = SSB_{MSY} ((1-M) or 0.5, whichever is greater).	0.25	unknown
2	MSST = SSB_{MSY} ((1-M) or 0.5, whichever is greater).	0.179	GA-NC = unknown FLK/EFL = 1,888,621
3	MSST = 50% of SSB_{MSY}	0.179	GA-NC = unknown FLK/EFL = 1,150,195
4 (Preferred)	**MSST = 75% of SSB_{MSY}**	**0.179**	**GA-NC = unknown** **FLK/EFL = 1,725,293**

4.3.1 Biological Effects

The minimum stock size threshold (MSST) corresponds to the level of biomass below which a stock is considered overfished. If it is determined that a stock's biomass is below the MSST, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires a rebuilding plan, which could result in harvest reductions.

Alternative 1 (No Action) would retain the MSST definition established in Amendment 11 to the Snapper Grouper FMP (SAFMC 1998b) for the entire stock of hogfish in the South Atlantic. **Alternative 2** would impart the same definition of MSST to each of the two stocks of hogfish being defined in this amendment. Hence, in terms of biological effects, **Alternatives 1 (No Action)** and **2** are identical. The current definition of MSST under **Alternatives 1 (No Action)** and **2** requires that MSST be at least one half of SSB_{MSY}, but allows for it to be greater than this value if natural mortality (M) is suitably low. If (1-M) is equal to 0.5, then the value obtained from this alternative would be the same as that obtained from **Alternative 3,** which sets the MSST at 50% of the Spawning Stock Biomass at MSY (SSB_{MSY}). **Preferred Alternative 4** would establish MSST at 75% of SSB_{MSY} for the GA-NC (**Preferred Sub-alternative 4a**) and FLK/EFL (**Preferred Sub-alternative 4b**) stocks of hogfish.

SEDAR 37 (2014) estimated natural mortality for hogfish at 0.179. However, because the stock assessment was not deemed applicable to the Georgia through North Carolina (GA-NC) stock, this estimate is valid for the Florida Keys/East Florida (FLK/EFL) stock only. For species with such low natural mortality, such as hogfish, the biomass threshold for determining if the stock is overfished (MSST) under the current definition (**Alternatives 1 (No Action)** and **2**) is very close to the biomass level when the stock is not considered overfished (SSB_{MSY}). Since **Alternative 1 (No Action)** nearly eliminates the buffer between MSST and SSB_{MSY} for stocks with low natural mortality rates, a stock would never be permitted to fall below SSB_{MSY} without triggering an "overfished" determination and mandatory development of a rebuilding plan. The most biologically conservative alternatives are **Alternatives 1 (No Action)** and **2** because they would ensure that a rebuilding plan is developed for hogfish; however, under these alternatives a rebuilding plan may also be required when it is not biologically necessary. The biological benefits of **Alternative 1 (No Action)** would take the form of increased harvest restrictions that would be implemented with the intent to rebuild the stock according to the current MSST threshold criterion. **Alternative 3** and its sub-alternatives would be the least biologically beneficial since it would allow biomass to decrease by 50% before triggering the rebuilding plan requirement. **Preferred Alternative 4** and its sub-alternatives would still require the development of a rebuilding plan if hogfish was deemed overfished, but would reduce the risk of requiring a rebuilding plan when decreased biomass was due to natural variations in recruitment.

Additionally, if the same management measures are used to rebuild a stock under all the alternatives considered, the stock would be expected to rebuild fastest under **Alternative 1 (No Action)** and **Alternative 2** because the overfished threshold (MSST) would be closest to the rebuilt threshold SSB_{MSY}. Therefore, **Alternative 1 (No Action)** could be considered to have the greatest biological benefit among alternatives considered in this action. The tradeoff associated with the assurance provided by this conservative definition of MSST is that natural variation in recruitment could cause stock biomass to frequently alternate between an overfished and rebuilt condition (biomass at SSB_{MSY}), even if the fishing mortality rate applied to the stock was within the limits specified by the maximum fishing mortality threshold (MFMT). If realized, this situation could result in administrative and socio-economic burdens related to developing and implementing multiple rebuilding plans that may not be biologically necessary. However, simulations on a wide variety of species by Restrepo et al. (1998) indicated that stocks at

biomass levels approximating 75%SSB_{MSY} can rebuild to SSB_{MSY} fairly quickly with little constraint on fishing mortality. Therefore, it is not biologically necessary to have extremely small buffers between overfished and rebuilt thresholds.

Preferred Alternative 4 and its sub-alternatives, which would set MSST equal to 75%SSB_{MSY}, is consistent with how the South Atlantic Council has approached defining MSST for other snapper grouper stocks with low natural mortality estimates. The South Atlantic Council changed the MSST definition to 75%SSB_{MSY} for snowy grouper (SAFMC 2008a), golden tilefish (SAFMC 2008b), red grouper (SAFMC 2011d) and, more recently, other snapper grouper species (red snapper, blueline tilefish, gag, black grouper, yellowtail snapper, vermilion snapper, red porgy, and greater amberjack) (SAFMC 2014). These species have low estimates of natural mortality, and the overfished threshold from the status quo MSST definition is very close to the biomass threshold when stocks are not considered overfished. The biological benefits of **Preferred Alternative 4** and its sub-alternatives, which would trigger a rebuilding plan when biomass is at 75% of SSB_{MSY}, would be expected to be greater than **Alternative 3**, which would have a lower biomass threshold for an overfished determination (50%SSB_{MSY}) because biomass would not be allowed to decrease as much as it would under **Alternative 3** before triggering implementation of a rebuilding plan. At their October 2013 meeting, the South Atlantic Council's SSC acknowledged that the 75%SSB_{MSY} approach is an acceptable choice for MSST, and they voiced no concern regarding the adoption of this management reference point for South Atlantic Council managed species. Bycatch and discards would not increase or decrease as a result of this action. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.3.2 Economic Effects

Like MSY, MSST does not alter the current harvest or use of the resource, and thus would have no direct economic effects on fishery participants and associated industries or communities. Unlike MSY, however, MSST is directly related to actions for rebuilding the stock, actions that would have economic implications.

In general, a high MSST level is susceptible to triggering rebuilding actions that could limit harvest or fishing opportunities, thereby affecting the economic status of fishery participants. A low MSST level would be associated with lower probability of enacting rebuilding actions that would alter the economic environment. To the extent that rebuilding actions necessitated by a chosen MSST would tend to have economic effects, it is possible to provide some general implications of the MSST alternatives.

Alternatives 2-4 each have **Sub-alternatives a** and **b** pertaining to the GA-NC and FLK/EFL stocks, respectively. **Action 3** assumes that **Action 1** would result in the decision to create separate management stocks for the Georgia to North Carolina fish and for the Florida Keys/East Florida. The expected economic effects for the **Sub-alternatives a** and **b** for each alternative are similar.

Assuming **Action 1** results in defining two separate hogfish stocks, **Alternative 2** is functionally equivalent to **Alternative 1 (No Action)** except that **Alternative 2** allows MSST to be set to SSB_{MSY} ((1-M) or 0.5, whichever is greater) for each of the stocks separately.

With rebuilding taking place over a number of years, management actions and their economic consequences could change over time depending on a variety of factors, including the status of the stock and fishing conditions. **Alternative 3** would appear to be best from an economic standpoint, because it is unlikely to trigger restrictive rebuilding actions in the short term. One possible downside of this alternative is that once the stock is considered overfished, the required rebuilding actions could be very restrictive and potentially remain for quite some time. **Alternatives 1 (No Action)** and **2** lie on one end of the continuum for potential negative economic effects because they have the highest probability of triggering restrictive rebuilding actions. A possible mitigating factor with **Alternatives 1 (No Action)** and **2** is the possibility that the required management actions would have adverse economic effects which would not last long. But a frequently varying regulatory regime would tend to de-stabilize business planning and fishing decisions which could have potentially worse economic consequences. The economic implications of the **Preferred Alternative 4** may be characterized as falling between **Alternatives 1 (No Action)/2** and **Alternative 3**.

4.3.3 Social Effects

Social effects of revised biological parameters such as MSST for a stock would be associated with both the biological and economic effects of the modified MSST value. The estimated spawning stock biomass (SSB) as compared to MSST serves as a proxy for designating a stock as overfished or not. If the proxy is not accurately representing the stock status, the outcomes of the 'overfished' designation when a stock is not overfished can have negative long- and short-term social effects associated with restricted or no access to the fish. Conversely, if an inaccurate proxy results in a stock designated as not overfished when it *is* overfished, the fishing fleets, associated businesses and communities could be negatively impacted in the long term due to decline in the stock and negative broader biological impacts of overfishing. Lastly, an inaccurate proxy that causes a stock to fluctuate between overfished and not overfished would likely have negative effects on fishermen by requiring changes in regulations on harvest too often. This could negatively affect stability and planning for fishing businesses, in addition to fishing opportunities for recreational anglers, due to inconsistent access to the resource. Although for some fishermen, any access to a stock would be beneficial, the positive effects of consistency in regulations (even if access is restricted) and stability of the fishery would also be expected from a more fixed designation as overfished or not overfished.

Under all alternatives, fishermen could be affected by future restricted access to a specific species due to an overfished designation, which could have negative effects on associated fishing businesses and communities. Although **Preferred Alternative 4** and its sub-alternatives is the more restrictive approach to set the MSST than under **Alternatives 1 (No Action)-3**, it would also be the most likely to trigger a rebuilding plan sooner, which may avoid more severe biological impacts to the stock (as noted in **Section 4.3.1**).

If the FMU were modified in **Action 1** to align with the approach used in the stock assessment for the stock boundary, **Alternative 1 (No Action)** would not be consistent with the most recent scientific information as in **Sub-alternatives 2a/b, 3a/b**, and **4a/b (Preferred)**.

4.3.4 Administrative Effects

The MSST is the level of biomass below which a species would be considered overfished and is thus tied to implementation of management measures. Those management measures would directly impact the administrative environment according to the level of conservativeness associated with the chosen MSST and subsequent restrictions placed on the species to constrain harvest levels. The current MSST definition under **Alternative 1 (No Action)** could cause hogfish to fluctuate between an overfished and rebuilt condition (constantly triggering rebuilding plans). **Alternative 2** and its sub-alternatives are identical to **Alternative 1 (No Action)** but would apply to each individual stock of hogfish. Hence, both alternatives would be the most administratively burdensome of the MSST alternatives under consideration. The larger the buffer between MSST and SSB_{MSY}, the lower the probability that hogfish would be considered overfished and require a rebuilding plan. Therefore, **Alternative 3** and its sub-alternatives are the least administratively burdensome of the alternatives considered since under **Alternative 3** and its sub-alternatives, hogfish would be least likely to be considered overfished and least likely to require a rebuilding plan. Potential administrative impacts increase as the distance between the MSST value and SSB_{MSY} decreases, therefore, **Alternatives 3** and **4 (Preferred)**, and their respective sub-alternatives, would result in increasingly greater administrative impacts, respectively. However, **Sub-alternatives 3a** and **4a (Preferred)**, would not result in any changes to the administrative burden relative to **Alternative 1 (No Action)** as the MSST value for the GA-NC stock of hogfish would remain unknown.

Action 4. Establish Annual Catch Limits (ACLs) for the Georgia through North Carolina (GA-NC) stock of hogfish

Alternative 1 (No action). The current acceptable biological catch (ABC) for the entire stock of hogfish is 134,824 lbs ww and ACL = optimum yield (OY) = ABC. The commercial ACL = 49,469 lbs ww (36.69%) and the recreational ACL = 85,355 lbs ww (63.31%).

Preferred Alternative 2. Establish an ACL for the GA-NC stock. Specify commercial and recreational ACLs using re-calculated sector allocations based on proposed modifications to the management unit (69.13% commercial and 30.87% recreational). The ABC for the GA-NC stock = 35,716 pounds whole weight (lbs ww).

Sub-alternative 2a. ACL = OY = ABC

Preferred Sub-alternative 2b. ACL = OY = 95% ABC

Sub-alternative 2c. ACL = OY = 90% ABC

4.4.1 Biological Effects

Genetic evidence (Seyoum et al. 2015) indicates that hogfish within the South Atlantic Council's area of jurisdiction belong to two distinct stocks. The SEDAR 37 (2014) assessment, however, was not deemed applicable to the Georgia through North Carolina (GA-NC) stock due to lack of data; hence, the status of the GA-NC stock is currently unknown. Based on methodology in *Calculating Acceptable Biological Catch for Stocks That Have Reliable Catch Data Only* (Only Reliable Catch Stocks – ORCS) (Berkson et al. 2011), the South Atlantic Council's Scientific and Statistical Committee (SSC) recommended an approach to compute the acceptable biological catch (ABC) for unassessed stocks with only reliable catch data. The approach involves selection of a "catch statistic", a scalar to denote the risk of overexploitation for the stock, and a scalar to denote the management risk level. The SSC provides the first two criteria for each stock, and the South Atlantic Council specifies their risk tolerance level for each stock.

Catch Statistic: The median was considered inadequate to represent the high fluctuation in landings—i.e., to appropriately capture the range of occasional high landings—therefore, the maximum catch over the period 1999-2007 was chosen instead. This time period was chosen to (1) be consistent with the period of landings used in the South Atlantic Council's Comprehensive ACL Amendment (SAFMC 2011c), and (2) to minimize the impact of recent regulations and the economic downturn on the landings time series. For the GA-NC stock of hogfish, 1999 was the year of highest landings over the 1999-2007 time period and was selected as the "catch statistic."

Risk of Overexploitation: Based on SSC consensus and expert judgment each stock was assigned to a final risk of exploitation category based on a suite of attributes used to assess the level of risk. For hogfish, the SSC assigned a risk of overexploitation of 1.25, indicating the species is at moderately high risk of overexploitation.

Risk Tolerance: The next step in the process involves multiplying the "catch statistic x scalar" metric by a range of scalar values that reflects the South Atlantic Council's risk tolerance level. For instance, the South Atlantic Council may choose to be more risk-averse in computing the ABC for a stock that exhibits a moderately high risk of overexploitation. As such, the South Atlantic Council may use a scalar of 0.50 for such stocks to specify a more conservative ABC. On the other hand, stocks with low risk of overexploitation, and thus able to tolerate a higher level of management risk, may be assigned a less conservative scalar, such as 0.90. For hogfish, the South Atlantic Council selected a risk tolerance scalar of 0.7.

Table 4.4.1 below summarizes the ORCS approach to arrive at the ABC for the GA-NC stock of hogfish.

Table 4.4.1. The South Atlantic's SSC ABC recommendation for the GA-NC stock of hogfish.

Statistic	Value
Risk of Overexploitation	Moderately High
Associated Scalar	1.25
Range of Years	1999-2007
Year of Max Landings	2006
Catch Statistic	40,818 lbs ww
Council Risk Scalar (Preferred from Am 29)	0.7
Proposed ABC	**35,716 lbs ww**

The allocation formula from the Comprehensive ACL Amendment (SAFMC 2011) was used to specify commercial and recreational allocations for the GA-NC hogfish stock: (0.5 * catch history) + (0.5 * current trend) where catch history = average landings 1986-2008, current trend = average landings 2006-2008. The formula was applied to the Southeast Fishery Science Center (SEFSC) commercial ACL data, accessed in July 2014, and post-stratified SEFSC recreational data accessed in February 2015. Recreational data were post-stratified to include MRIP landings from Monroe County in the FLK/EFL sub-region, consistent with the SEDAR 37 stock assessment. Commercial and recreational landings used to recalculate sector allocations are shown in **Table 4.4.2**.

Table 4.4.2. Commercial and recreational landings (lbs ww) for the GA-NC stock of hogfish, 1986-2008.

Year	Rec	Comm	Total
1986	20,625	8,040	28,665
1987	8,733	9,295	18,028
1988	942	10,186	11,128
1989	3,193	15,177	18,370
1990	1,848	27,862	29,710
1991	814	23,886	24,700
1992	3,309	32,274	35,583
1993	6,272	31,739	38,011
1994	688	23,063	23,751
1995	83,580	36,903	120,483
1996	262	17,471	17,733
1997	977	25,394	26,371
1998	1,338	21,959	23,297
1999	1,215	29,186	30,401
2000	2,417	24,104	26,521
2001	1,471	14,193	15,664
2002	11,796	20,557	32,353
2003	2,343	9,307	11,650
2004	3,888	19,295	23,183
2005	15,082	19,255	34,337
2006	17,385	23,433	40,818
2007	8,782	20,754	29,536
2008	9,044	30,437	39,481

Source: NMFS SERO

Alternative 1 (No Action) would not establish an ACL for the GA-NC stock of hogfish, which would not adhere to the best scientific information available (SEDAR 37) and therefore, is not a viable alternative. To set the ACL and optimum yield (OY) for the GA-NC stock of hogfish, the South Atlantic Council may exercise varying degrees of precaution to account for management uncertainty: **Sub-alternative 2a** would set the ACL and OY at the same level as ABC, whereas **Preferred Sub-alternative 2b** and **Sub-alternative 2c** would each provide a management uncertainty buffer of 5% and 10%, respectively.

Sub-alternatives 2a-2c would set OY equal to the ACL. National Standard 1 (NS1) establishes the relationship between conservation and management measures, preventing overfishing, and achieving OY from each stock, stock complex, or fishery. The NS1 guidelines discuss the relationship of OFL to the MSY and ACL to OY. The OFL is an annual amount of catch that corresponds to the estimate of maximum fishing mortality threshold applied to a stock; MSY is the long-term average of such catches. The ACL is the limit that triggers AMs and is the management target for the species. Management measures for a fishery should, on an annual basis, prevent the ACL from being exceeded. The long-term objective is to achieve OY through

annual achievement of an ACL. The NS1 guidelines state that if OY is set close to MSY, the conservation and management measures in the fishery must have very good control of the amount of catch in order to achieve the OY without overfishing.

The South Atlantic Council and their SSC have established an ABC control rule that takes into consideration scientific and management uncertainty to ensure catches are maintained below OFL. Setting the ACL equal to the ABC (**Sub-alternative 2a**) leaves no buffer between the two harvest parameters, which may increase risk that harvest could exceed the ABC. The South Atlantic Council considered alternatives in the Comprehensive ACL Amendment (SAFMC 2011a) and Amendment 24 to the Snapper Grouper FMP (SAFMC 2011b) that would set the ACL below the ABC but selected ACL=OY=ABC as their preferred alternative. More recently, the South Atlantic Council has frequently set ACLs for snapper grouper species at the same level as the ABC. However, AMs and ACLs are in place to ensure overfishing of hogfish does not occur. The NS1 Guidelines recommend a performance standard by which the system of ACLs and AMs can be measured and evaluated. If the ACL is exceeded more than once over the course of four years, the South Atlantic Council would reassess the system of ACLs and AMs for the species. The South Atlantic Council has taken action in Amendment 34 (SAFMC 2015) to enhance the effectiveness of the AMs for hogfish. Amendment 37 would clarify the AMs for the two South Atlantic stocks of hogfish in Action 12.

Sub-alternatives 2b (Preferred) and **2c** would have a greater positive biological effect than **Sub-alternative 2a** because they would create a buffer between the ACL/OY and ABC, with **Sub-alternative 2c** setting the most conservative ACL at 90% of the ABC (**Table 4.4.3**), while **Alternative 1 (No Action)** would not represent the best scientific information available. Creating a buffer between the ACL/OY and ABC would provide greater assurance that overfishing is prevented, and the long-term average biomass is near or above SSB_{MSY}. However, the South Atlantic Council's ABC control rule takes into account scientific uncertainty. The Magnuson-Stevens Act NS 1 guidelines indicate an ACL may typically be set very close to the ABC. Setting a buffer between the ACL and ABC would be appropriate in situations where there is uncertainty in whether or not management measures are constraining fishing mortality to target levels. An annual catch target (ACT), which is not required, can also be set below the ACL to account for management uncertainty and provide greater assurance overfishing does not occur.

The Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. Their rationale is that the recreational ACL is monitored in numbers of fish while the commercial ACL is tracked in pounds. Because this amendment also considers changing the minimum size limit for the GA-NC stock of hogfish, specifying the recreational ACL in pounds could potentially increase the risk of exceeding the ABC in pounds because larger fish are heavier. However, if the recreational ABC and ACL were specified in numbers, there would be a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The Council also discussed the high percent standard error (PSE) associated with the recreational data and the fact that there were very few intercepts for recreational effort using spear.

Table 4.4.3. Commercial and recreational ACLs for the GA-NC stock per the SSC's recommendation using the ORCS approach in the ABC Control Rule under **Sub-alternatives 2a-2c**.

Sub-alternative	Total ACL (lbs)	Rec ACL (lbs)	Rec ACL (numbers)	Comm ACL (lbs)
2a	35,716	11,026	1,040	24,690
2b (Preferred)	**33,930**	**10,474**	**988**	**23,456**
2c	32,144	9,923	936	22,221

Note: The Council prefers to specify recreational ACL in numbers and commercial ACL in pounds. Recreational ACL converted from pounds to numbers using an average weight of 10.60 lbs ww per fish

With vastly improved commercial monitoring mechanisms recently implemented, it is unlikely that repeated commercial ACL overages would occur. The Commercial Landings Monitoring System (CLM) came online in June 2012 and is now being used to track commercial landings of federally managed fish species. This system is able to track individual dealer reports, track compliance with reporting requirements, project harvest closures using five different methods, and analyze why ACLs are exceeded. The CLM performs these tasks by taking into account: (1) spatial boundaries for each stock based on fishing area; (2) variable quota periods such as overlapping years or multiple quota periods in one year; and (3) overlapping species groups for single species as well as aggregated species. Data sources for the CLM system include the Standard Atlantic Fisheries Information System for Georgia and South Carolina, and the Bluefin Data file upload system for Florida and North Carolina. The CLM system is also able to track dealer reporting compliance with a direct link to the permits database in NMFS Southeast Regional Office (SERO).

Additionally, the SEFSC worked with SERO, the Gulf Council, and South Atlantic Council to develop a Joint Dealer Reporting Amendment (GMFMC & SAFMC 2013b), which became effective on August 7, 2014. The Joint Dealer Reporting Amendment requires electronic reporting, increases required reporting frequency for dealers to once per week, and requires a single dealer permit for all finfish dealers in the Southeast Region. The CLM and the new dealer reporting requirements constitute major improvements to how commercial fisheries are monitored, and go beyond monitoring efforts that were in place when the NS1 guidelines were developed. The new CLM quota monitoring system and actions in the Joint Generic Dealer Reporting amendment are expected to provide more timely and accurate data reporting and would thus reduce the incidence of quota overages.

Harvest monitoring efforts in the recreational sector have also been improved. On January 27, 2014, regulations became effective requiring headboats to report their landings electronically once per week (Generic Headboat Amendment, GMFMC & SAFMC 2013a). The SEFSC is also developing an electronic reporting system for charter boats operating in the Southeast Region and the Gulf of Mexico and South Atlantic Councils are developing amendments that would require electronic reporting for charterboats with a set reporting frequency. These recreational harvest monitoring efforts could substantially increase the accuracy and timeliness of in-season reporting and reduce the risk of recreational ACL overages, which would be biologically beneficial for hogfish. Therefore, there is a low risk of exceeding the commercial and recreational ACLs and **Preferred Alternative 2** and its sub-alternatives can be used as part of a

successful harvest management system for hogfish with little risk of overfishing. This in turn, would help reduce discards and bycatch. Bycatch of other species is incidental in the hook-and-line portion of the snapper grouper fishery for hogfish, with no bycatch of other co-occurring species expected in the spear fishery for hogfish (see **Appendix D**, BPA, for more information).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.4.2 Economic Effects

Alternative 1 (No Action) is not a viable alternative for this action because establishing an ACL for a stock is a statutory requirement. Based on history, the landings for this stock are not expected to exceed the ACL under any of the proposed alternatives. The recreational sector is expected to land 431 fish with a CS of $5,331 (in 2014 dollars). The commercial sector is expected to land 20,534 lbs ww with an ex-vessel value of $76,797. **Table 4.4.2** shows the maximum expected economic effects for the sub-alternatives of **Alternative 2**. However, based on past behavior, neither commercial fishers, nor recreational anglers are expected to meet their sector ACL for this stock. Therefore, the values shown in **Table 4.4.4** represent potential maximum values, assuming each sector would land its respective ACL. If the stock was not split, there would not be any expected recreational sector landings from Georgia to North Caroling. Because of the historically low recreational landings from Georgia to North Carolina in the early part of the year, the Florida East Coast/Florida Keys portion of the fishery would catch the entire ACL. Therefore, the status quo for the recreational sector under Alternative 1 (No Action) would be no expected recreational landings for Georgia to North Carolina during the year. The splitting of the stock into two separate management units ensures that there will be recreational landings from Georgia to North Carolina.

Table 4.4.4. Recreational and commercial sector ACLs with recreational consumer surplus (CS) and commercial ex-vessel expected values (in 2014 $) for the Georgia through North Carolina stock of hogfish.

	Recreational ACL (numbers)	Recreational CS	Commercial ACL (lbs)	Commercial ex-vessel
Sub-alternative 2a	1,040	$12,865	24,690	$89,224
Sub-alternative 2b	**988**	**$12,222**	**23,456**	**$84,761**
Sub-alternative 2c	936	$11,578	22,221	$80,302

Based on actual landings history, there are no expected differences in terms of economic effects among **Alternative 1 (No Action), Sub-alternative 2a**, **Preferred Sub-alternative 2b**, and **Sub-alternative 2c**. The commercial sector is expected to land 20,534 lbs ww with an

expected ex-vessel value of $76,792 (in 2014 dollars). The recreational sector is expected to land 431 fish with an expected CS of $5,331 (in 2014 dollars).

In general, assuming a sector is able to catch its entire ACL, the higher the ACL, the greater the positive direct economic effects for all sectors, as long as the ACL is not exceeded. Therefore, **Sub-alternative 2a** represents the highest potential positive direct economic effects, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**. Based on past landings history, the neither sector ACL is expected to be met under any of the alternatives of **Action 4**, therefore it is expected that there will be no differences in economic effects between any of the alternatives.

4.4.3 Social Effects

Compared to other snapper grouper species such as black sea bass, vermilion snapper, and gray triggerfish; hogfish is not as economically and socially important in Georgia, South Carolina, and North Carolina. However, there are some communities that may have fishermen, fishing businesses, and recreational anglers who would be affected by management changes for the GA-NC stock of hogfish. Commercial landings are relatively high in the South Carolina communities of Little River and Georgetown, and North Carolina communities around the Cape Fear River including Southport, Carolina Beach, and Oak Island (**Figure 3.4.3**). These are also communities that have high levels of engagement and reliance on commercial and recreational fishing (**Figures 3.4.5** and **3.4.7**).

The ACL for any stock does not directly affect resource users unless the ACL is met or exceeded, in which case AMs that restrict or close harvest could negatively impact the commercial fleet, for-hire fleet, and private anglers. AMs can have significant direct and indirect social effects because, when triggered, can restrict harvest in the current season or subsequent seasons. While the negative effects are usually short-term, they may at times induce other indirect effects through changes in fishing behavior or business operations that could have long-term social effects, such as increased pressure on another species, or fishermen having to stop fishing all together due to regulatory closures. However, restrictions on harvest contribute to sustainable management goals, and are expected to be beneficial to fishermen and communities in the long term.

Under **Alternative 2**, the ACL for the GA-NC would be based on the most recent stock assessment, but could also set ACLs lower than recent recreational and commercial landings. This could result in early closures, paybacks, or other management measures. **Table 4.4.5** shows hogfish landings for Georgia, South Carolina, and Florida from 2000 through 2014.

Table 4.4.5. Commercial and recreational landings (lbs ww) for the GA-NC stock of hogfish, 2000-2014.

Year	Rec Landings	Commercial Landings	TOTAL Landings
2000	2,417	24,104	26,521
2001	1,471	14,193	15,664
2002	11,796	20,557	32,353
2003	2,343	9,307	11,650
2004	3,888	19,295	23,183
2005	15,082	19,255	34,337
2006	17,385	23,433	40,818
2007	8,782	20,754	29,536
2008	9,044	30,437	39,481
2009	2,083	34,242	36,325
2010	15,539	41,898	57,437
2011	1,977	35,959	37,936
2012	14,093	20,630	34,723
2013	3,146	19,731	22,877
2014	95	21,242	21,337

Source: SERO and SEFSC

Because recreational landings are estimated to vary year by year (**Figure 4.4.1**), there would likely be some years in which recreational landings would reach the recreational ACL and recreational AMs would be triggered. If an in-season closure and payback measure are implemented as recreational AMs in **Action 12**, there would likely be some negative effects on recreational fishermen and for-hire businesses that target hogfish. In general, a higher ACL would lower the chance of triggering a recreational AM (if implemented) and result in the lowest level of negative effects on the recreational sector. **Sub-alternative 2a** would be the most beneficial for recreational fishermen, followed by **Preferred Sub-alternative 2b**, and **Sub-alternative 2c.**

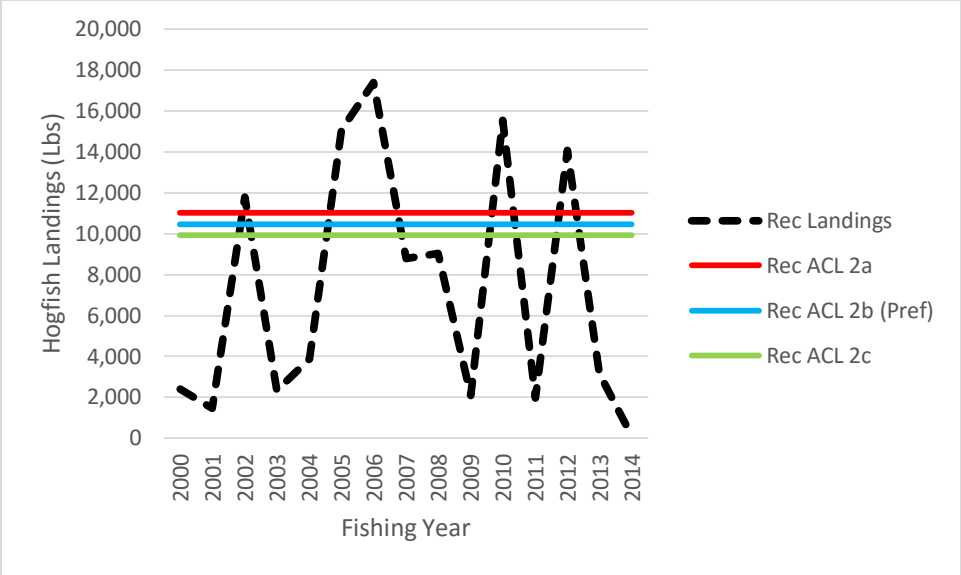


Figure 4.4.1. Annual recreational landings of hogfish (lbs ww) for Georgia, South Carolina, and North Carolina compared to the potential recreational ACLs under **Preferred Alternative 2.**

Similarly, commercial landings in GA-NC have shown years in which landings would have been under the proposed commercial ACLs, and years in which landings would have reached or exceeded the potential commercial ACLs (**Figure 4.4.2**). The potential commercial AMs in Action 12 would mirror current commercial AMs for each stock, and there would be a possibility of an in-season closure for a year with high landings, or a payback if triggered. In general, a higher ACL would lower the chance of triggering a closure, resulting in in the lowest level of negative effects on the commercial sector. **Sub-alternative 2a** would be the most beneficial for commercial fishing businesses who may harvest hogfish, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c.**

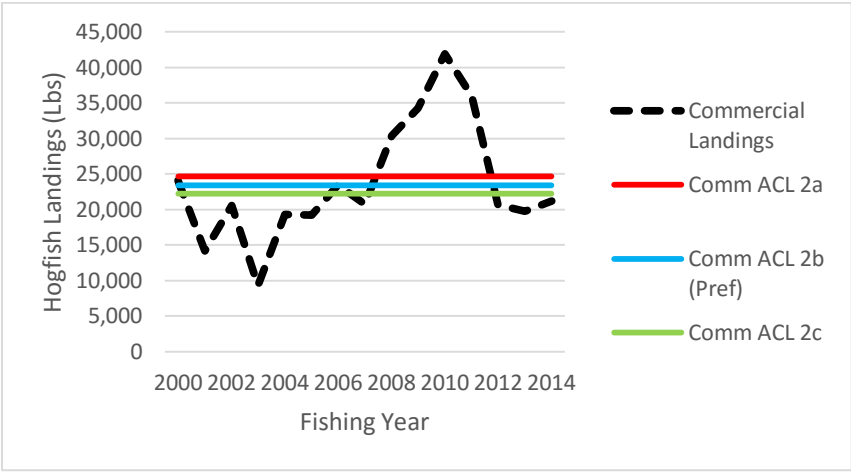


Figure 4.4.2. Annual commercial landings of hogfish (lbs ww) for Georgia, South Carolina, and North Carolina compared to the potential commercial ACLs under **Preferred Alternative 2**.

4.4.4 Administrative Effects

Negative administrative impacts of this action are likely to be minimal. **Alternative 1 (No Action)**, **Sub-Alternatives 2a, 2b (Preferred)** and **2c** would not result in significant administrative cost or time burdens other than notifying fishery participants of the change in the sector ACLs and continued monitoring of the sector ACLs. The burden on law enforcement would not change under either alternative since commercial quota closures and bag limits implemented are currently enforced.

Action 5. Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternative 1 (No Action). The current ABC for the entire stock of hogfish is 134,824 lbs ww. There is no rebuilding plan in place for hogfish in the South Atlantic.

Alternative 2. Define a rebuilding plan where the rebuilding strategy for the Florida Keys/East Florida (FLK/EFL) stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 50% probability of rebuilding success. The overfishing limit (OFL) is the yield at F_{MSY}. The spawning stock biomass (SSB_{MSY}) is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (lbs)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.087	466,101	0	35,986	22,457	283
2018	0.087	615,078	0	41,810	26,929	349
2019	0.087	780,517	0	47,335	31,367	412
2020	0.087	958,225	0.001	53,574	36,477	483
2021	0.087	1,145,995	0.01	60,324	42,153	561
2022	0.087	1,341,203	0.049	67,119	48,052	642
2023	0.087	1,540,211	0.125	73,662	53,910	722
2024	0.087	1,739,110	0.224	79,808	59,601	771
2025	0.087	1,934,221	0.327	85,486	65,008	814
2026	0.087	2,122,134	0.421	90,657	70,070	852
2027	0.087	2,300,212	0.5	95,311	74,752	885

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (**Appendix K**).

Preferred Alternative 3. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (lbs)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.07	466,101	0	35,986	17,930	283
2018	0.069	623,334	0	41,810	21,421	351
2019	0.068	801,673	0	47,335	24,996	418
2020	0.068	997,357	0.001	53,574	29,200	494
2021	0.068	1,208,116	0.014	60,324	33,965	577
2022	0.067	1,430,997	0.067	67,119	39,027	664
2023	0.067	1,661,827	0.167	73,662	44,162	751
2024	0.067	1,896,011	0.293	79,808	49,254	806
2025	0.067	2,129,079	0.417	85,486	54,183	855
2026	0.068	2,356,761	0.525	90,657	58,878	898
2027	0.068	2,575,569	0.613	95,311	63,295	936

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (**Appendix K**).
Note: Projections for various F scenarios were completed using Stock Synthesis (SS3). Under a constant F scenario, the F values vary over the span of the projection due to changes in the stock's vulnerable biomass and age composition.

Alternative 4. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 7 years with a 50% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.027	466,101	0	35,986	6,695	283
2018	0.027	643,910	0	41,810	8,320	357
2019	0.027	853,516	0	47,335	10,015	433
2020	0.027	1,092,682	0.002	53,574	12,023	520
2021	0.027	1,359,505	0.03	60,324	14,329	616
2022	0.027	1,650,910	0.133	67,119	16,823	718
2023	0.027	1,962,295	0.306	73,662	19,402	820
2024	0.027	2,288,307	0.494	79,808	22,028	889

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (Appendix K).

Alternative 5. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate that rebuilds the stock in 7 years with a 72.5% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.022	466,101	0	35,986	5,530	283
2018	0.022	646,051	0	41,810	6,780	358
2019	0.022	859,315	0	47,335	8,136	434
2020	0.022	1,103,904	0.002	53,574	9,787	523
2021	0.022	1,378,000	0.031	60,324	11,725	621
2022	0.022	1,678,512	0.145	67,119	13,861	724
2023	0.022	2,000,728	0.329	73,662	16,110	829
2024	0.022	2,339,124	0.523	79,808	18,441	899

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (Appendix K).

4.5.1 Biological Effects

The hogfish population in the South Atlantic had not been assessed until SEDAR 37 (2014). The assessment showed the Florida Keys/East Florida (FLK/EFL) stock of hogfish is overfished and undergoing overfishing. Hence, the South Atlantic Council must establish a rebuilding plan for that stock within two years of receiving notification of its status. **Action 5** presents options for the rebuilding strategy and schedule that would govern the rebuilding plan for the FLK/EFL stock of hogfish and the resulting acceptable biological catch (ABC).

Alternatives 2-5 would establish a rebuilding strategy based on the results of the most recent stock assessment (SEDAR 37 2014). The recreational sector for hogfish was closed in August 2015 due to an increase in landings during Wave 2 of the MRIP survey. As a result, preliminary landings for 2015 were above the landings level assumed in the original set of stock projections from the SEDAR 37 (2014) assessment raising concerns that the projections might no longer represent the best scientific information available. Hence, the South Atlantic Council requested updated projections for the FLK/EFL hogfish stock using the most recent landings estimates. The request was for the same suite of scenarios provided in the original projections, modified with the most recent landings estimates and changing year 1 to 2017 to reflect the likely implementation date of the management actions.

The South Atlantic Council's SSC recommended a rebuilding scenario that would set the ABC at the yield under a constant fishing mortality rate that rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. This rebuilding scenario corresponds to **Preferred Alternative 3** (**Table 4.5.1**). Under **Alternatives 2-5** the total ABC would increase over time until the Spawning Stock Biomass (SSB) reaches the level at which the stock is considered to be rebuilt (~ 2.3 million pounds). Under **Preferred Alternative 3**, this level would be reached in 2027.

Table 4.5.1. ABC under rebuilding plan Alternatives 2-5. Preferred alternative indicated in bold.

		Alt 2	Preferred Alt 3	Alt 4	Alt 5
Year	**OFL (Numbers)**	**ABC (Numbers)**	**ABC (Numbers)**	**ABC (Numbers)**	**ABC (Numbers)**
2017	35,986	22,457	**17,930**	6,695	5,530
2018	41,810	26,929	**21,421**	8,320	6,780
2019	47,335	31,367	**24,996**	10,015	8,136
2020	53,574	36,477	**29,200**	12,023	9,787
2021	60,324	42,153	**33,965**	14,329	11,725
2022	67,119	48,052	**39,027**	16,823	13,861
2023	73,662	53,910	**44,162**	19,402	16,110
2024	79,808	59,601	**49,254**	22,028	18,441
2025	85,486	65,008	**54,183**	---	---
2026	90,657	70,070	**58,878**	---	---
2027	95,311	74,752	**63,295**	---	---

Alternative 2 yields higher ABCs than **Preferred Alternative 3** at a probability of rebuilding of 50%. This level of harvest is higher than that recommended by the South Atlantic Council's SSC. **Alternatives 4** and **5** both result in lower ABCs than those under **Preferred Alternative 3** and rebuild the FLK/EFL stock of hogfish in 7 years instead of 10. In general, lower levels of harvest and less time to rebuild translate into higher biological benefits for the stock, hence the biological benefits of **Alternatives 4** and **5** would be higher than those under **Preferred Alternative 3**. However, the SSC has indicated that harvest levels proposed under **Preferred Alternative 3** are sustainable and would achieve the goal of rebuilding the FLK/EFL stock of hogfish within a reasonable timeframe. Therefore, there is no biological need to constrain harvest below this level. Compared to **Alternative 1 (No Action)**, the biological effects of **Alternatives 2-5** would be beneficial since management would be responding to the best scientific information available and results of the SEDAR 37 (2014) stock assessment have indicated that the FLK/EFL stock of hogfish is overfished and undergoing overfishing.

Preferred Alternative 3 in **Action 5** is more conservative than **Alternative 2**, and could result in more discards in the short term. However, with a higher probability of success of rebuilding the stock in 10 years, there would be less discards in the long term after the stock has been rebuilt. Furthermore, bycatch and discards are not expected to increase because the majority of the fishing gear used to harvest hogfish is spear, which is very selective. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no

impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.5.2 Economic Effects

Rebuilding plans in general impose negative direct economic effects in the short term in favor of more direct positive economic effects in the long term as the stock recovers. The difficulty is in balancing those long term and short-term economic effects. Being overly restrictive in the short term could rebuild the stock faster, but perhaps at the expense of pushing some fishermen out of the fishery because they are unable to survive financially under the restrictions. Being too lenient in the short term could jeopardize the probability of rebuilding the stock as needed.

Alternative 1 (No Action) is not a viable alternative to consider, as there are statutory requirements to rebuild all fishery stocks that are overfished or undergoing overfishing. The rebuilding plan has indirect economic effects in that it frames the ACL decision (**Action 6**). The level of the ABC in and of itself does not have direct economic effects.

4.5.3 Social Effects

Although establishment of a rebuilding strategy for the FLK/EFL stock of hogfish is primarily an administrative action, the selected level of fishing mortality and associated ABCs determine the level of restrictiveness in management that is needed to rebuild the resource within the specified timeframe. The level to which access to the resource is limited or non-existent would determine the magnitude of the associated social and economic effects expected to accrue during the recovery period. The rebuilding strategies and associated ABCs in this action are trade-offs of long-term and short-term biological benefits, which are directly tied to long-term and short-term social benefits. A more conservative rebuilding strategy would likely result in short-term negative social impacts such as loss of income and decreased fishing opportunities due to lower target fishing mortality. However, the resulting larger sustainable biomass once the FLK/EFL hogfish stock is rebuilt is expected to produce long-term social benefits, including stable and sustainable livelihoods for commercial fishermen and the for-hire sector; consistent product for fish houses and restaurants; and private recreational fishing opportunities.

Section 3.4 describes Florida communities that could be affected by changes to the FLK/EFL hogfish rebuilding plan, particularly in the Florida Keys. Additionally, hogfish is an important part of the tourism and culinary scene in the Florida Keys, as a signature dish of the area. Changes to access to hogfish could also affect fish houses and restaurants that depend on a steady supply of hogfish.

Because the recent assessment update determined that FLK/EFL hogfish is overfished and experiencing overfishing, **Alternative 1 (No Action)** would be expected to result in negative long-term effects on fishermen associated with negative biological effects on the stock, even if this alternative may provide some short-term benefits by not restricting harvest. The level of

negative short-term effects on fishermen and communities due to restrictions would depend on the length of the rebuilding plan and the severity of restrictions. Overall, the most benefits to fishermen and communities would come from a balance between minimal harvest restrictions for a minimal time period, but still achieve rebuilding goals to ensure long-term sustainability of the hogfish stock.

Because higher ABC levels (and associated ACLs) would be expected to result in less short-term negative effects on fishermen by allowing more access to hogfish, **Alternative 2** would likely have the least effects associated with catch limits, followed by **Preferred Alternative 3**, **Alternative 4**, and then **Alternative 5**. However, a longer rebuilding plan (**Alternative 2** and **Preferred Alternative 3**) would extend any negative effects on fishermen due to harvest restrictions more than under the shorter (7-year) rebuilding plans in **Alternatives 4** and **5**. Additionally, lower probability of rebuilding could result in long-term negative effects on the stock, which would affect future fishing opportunities. Overall, **Preferred Alternative 3** would be a longer period (10 years) for rebuilding, but may result in a lower level of negative short-term effects than under **Alternatives 4** and **5** due to higher ABCs/ACLs.

4.5.4 Administrative Effects

In general, the shorter the rebuilding schedule the more restrictive the harvest limitations needed to rebuild the stock within the specified timeframe. Greater restrictions can result in increased impacts on the administrative environment due to an increased need to closely track landings; enforce bag, trip, and size limits; or implement in-season and post-season AMs.

Alternative 1 (No Action) would not establish a rebuilding schedule for the FLK/EFL stock of hogfish and would therefore, not comply with Magnuson-Stevens Act requirements for developing rebuilding plans. **Alternative 2** would rebuild the FLK/EFL stock of hogfish in 10 years, but with only a 50% probability of success. **Alternative 3 (Preferred)** would rebuild the FLK/EFL stock of hogfish in 10 years with a 72.5% probability of rebuilding success. **Alternatives 4** and **5** have the shortest rebuilding schedule considered and would require implementation of additional harvest restrictions to meet the goal of rebuilding the stock within 7 years. Therefore, of all the rebuilding schedule alternatives that specify a timeframe, **Alternatives 4** and **5** would be most likely to impact the administrative environment in the form of developing, implementing, and monitoring more restrictive harvest regulations for hogfish. Of all the alternatives considered, **Alternative 3 (Preferred)** would be the most efficient rebuilding strategy and least likely to impact the administrative environment.

Action 6. Establish Annual Catch Limits (ACLs) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternative 1 (No action). The current acceptable biological catch (ABC) for the entire stock of hogfish is 134,824 lbs ww and ACL = optimum yield (OY) = ABC. The commercial ACL = 49,469 lbs ww (36.69%) and the recreational ACL = 85,355 lbs ww (63.31%).

Preferred Alternative 2. Establish ACLs for the FLK/EFL stock of hogfish. Specify commercial and recreational ACLs for 2017-2027. ACLs will not increase automatically in a subsequent year if present year projected catch has exceeded the total ACL. Specify commercial and recreational ACLs using re-calculated sector allocations based on proposed modifications to the management unit (9.63% commercial and 90.37% recreational).

Sub-alternative 2a. ACL = OY = ABC

Preferred Sub-alternative 2b. ACL = OY = 95% ABC

Sub-alternative 2c. ACL = OY = 90% ABC

4.6.1 Biological Effects

The allocation formula from the Comprehensive ACL Amendment (SAFMC 2011) was used to specify commercial and recreational allocations for the Florida Keys/East Florida (FLK/EFL) hogfish stock: (0.5 * catch history) + (0.5 * current trend) where catch history = average landings 1986-2008, current trend = average landings 2006-2008. The formula was applied to Southeast Fisheries Science Center (SEFSC) commercial ACL data, accessed in July 2014, and post-stratified SEFSC recreational data accessed in February 2015). Recreational data were post-stratified to include Marine Recreational Information Program (MRIP) landings from Monroe County in the FLK/EFL sub-region, consistent with the SEDAR 37 stock assessment. Commercial and recreational landings data used to re-calculate sector allocations are shown in **Table 4.6.1**.

Alternative 1 (No Action) would not establish an ACL for the FLK/EFL stock of hogfish, which would not adhere to the best scientific information available (SEDAR 37) and therefore, is not a viable alternative. To set the annual catch limit (ACL) and optimum yield (OY) for the FLK/EFL stock of hogfish, the South Atlantic Council may exercise varying degrees of precaution to account for management uncertainty. **Sub-alternative 2a** would set the ACL and OY at the same level as ABC, whereas **Sub-alternatives 2b** (**Preferred**) and **2c** would each provide a management uncertainty buffer of 5% and 10%, respectively.

Table 4.6.1. Commercial and recreational landings (lbs ww) used to re-calculate hogfish sector allocations for FLK/EFL hogfish stock, 1986-2008.

Year	Recreational	Commercial	Total
1986	173,489	28,878	202,367
1987	340,881	44,300	385,181
1988	247,203	48,362	295,565
1989	151,578	54,155	205,733
1990	307,831	53,914	361,745
1991	196,098	53,590	249,688
1992	309,536	54,495	364,031
1993	266,249	42,646	308,895
1994	224,732	34,716	259,448
1995	285,983	39,433	325,416
1996	159,365	40,136	199,501
1997	168,822	42,573	211,395
1998	57,160	31,211	88,371
1999	115,575	24,155	139,730
2000	40,295	28,015	68,310
2001	79,266	18,455	97,721
2002	99,499	19,525	119,024
2003	123,767	20,623	144,390
2004	190,292	23,299	213,591
2005	189,126	12,380	201,506
2006	120,381	11,337	131,718
2007	271,031	14,402	285,433
2008	361,301	17,882	379,183

Source: NMFS SERO

Sub-alternative 2a, **Preferred Sub-alternative 2b**, and **Sub-alternative 2c** would set OY equal to the ACL. NS1 establishes the relationship between conservation and management measures, preventing overfishing, and achieving OY from each stock, stock complex, or fishery. The NS1 guidelines discuss the relationship of the overfishing limit (OFL) to the maximum sustainable yield (MSY) and ACL to OY. The OFL is an annual amount of catch that corresponds to the estimate of maximum fishing mortality threshold applied to a stock; MSY is the long-term average of such catches. The ACL is the limit that triggers AMs and is the management target for the species. Management measures for a fishery should, on an annual basis, prevent the ACL from being exceeded. The long-term objective is to achieve OY through annual achievement of an ACL. The NS1 guidelines state that if OY is set close to MSY, the conservation and management measures in the fishery must have very good control of the amount of catch to achieve the OY without overfishing.

The South Atlantic Council and their Scientific and Statistical Committee (SSC) have established an ABC control rule that takes into consideration scientific and management uncertainty to ensure catches are maintained below OFL. Setting the ACL equal to the ABC

(**Sub-alternative 2a**) leaves no buffer between the two harvest parameters, which may increase risk that harvest could exceed the ABC. The South Atlantic Council considered alternatives in the Comprehensive ACL Amendment (SAFMC 2011a) and Amendment 24 to the Snapper Grouper FMP (SAFMC 2011b) that would set the ACL below the ABC but selected ACL=OY=ABC as their preferred alternative. More recently, the South Atlantic Council has frequently set ACLs for snapper grouper species at the same level as the ABC. However, accountability measures (AMs) and ACLs are in place to ensure overfishing of hogfish does not occur. The NS1 Guidelines recommend a performance standard by which the system of ACLs and AMs can be measured and evaluated. If the ACL is exceeded more than once over the course of four years, the South Atlantic Council would reassess the system of ACLs and AMs for the species. The South Atlantic Council took action in Amendment 34 (SAFMC 2015) to enhance the effectiveness of the AMs for hogfish. Action 12 in Amendment 37 includes alternatives that would clarify the AMs for the two South Atlantic stocks of hogfish.

Sub-alternatives 2b (Preferred) and **2c** would have a greater positive biological effect than **Sub-alternative 2a** because they would create a buffer between the ACL/OY and ABC, with **Sub-alternative 2c** setting the most conservative ACL at 90% of the ABC (**Table 4.6.2**). **Alternative 1 (No Action)** would not establish an ACL for the GA-NC stock of hogfish, which would not adhere to the best scientific information available (SEDAR 37) and therefore, is not a viable alternative. Creating a buffer between the ACL/OY and ABC would provide greater assurance that overfishing is prevented, and the long-term average biomass is near or above SSB_{MSY}. However, the South Atlantic Council's ABC control rule takes into account scientific uncertainty. The Magnuson-Stevens Act NS 1 guidelines indicate an ACL may typically be set very close to the ABC. Setting a buffer between the ACL and ABC would be appropriate in situations where there is uncertainty in whether or not management measures are constraining fishing mortality to target levels. An ACT, which is not required, can also be set below the ACL to account for management uncertainty and provide greater assurance overfishing does not occur.

The Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. Their rationale is that the recreational ACL is monitored in numbers of fish while the commercial ACL is tracked in pounds. Because this amendment also considers changing the minimum size limit for the GA-NC stock of hogfish, specifying the recreational ACL in pounds could potentially increase the risk of exceeding the ABC in pounds because larger fish are heavier. However, if the recreational ABC and ACL were specified in numbers, there would be a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The Council also discussed the high percent standard error (PSE) associated with the recreational data and the fact that there were very few intercepts for recreational effort using spear.

Table 4.6.2. Sector ACLs for the FLK/EFL stock for **Sub-alternatives 2a-2c** in **Action 6** and based on ABC projections from **Preferred Alternative 3** in **Action 5** where ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success.

Year	ABC (numbers)	Total ACL (numbers)	Rec ACL (numbers)	Commercial ACL (lbs)	Commercial ACL (numbers)
Sub-alternative 2a (ACL = OY = ABC)					
2017	17,930	17,930	16,514	3,695	1,416
2018	21,421	21,421	19,597	4,762	1,824
2019	24,996	24,996	22,709	5,969	2,287
2020	29,200	29,200	26,407	7,291	2,793
2021	33,965	33,965	30,627	8,712	3,338
2022	39,027	39,027	35,114	10,213	3,913
2023	44,162	44,162	39,653	11,768	4,509
2024	49,254	49,254	44,141	13,344	5,113
2025	54,183	54,183	48,470	14,912	5,713
2026	58,878	58,878	52,578	16,443	6,300
2027	63,295	63,295	56,432	17,914	6,863
Preferred Sub-alternative 2b (ACL = OY = 95%ABC)					
2017	**17,930**	**17,034**	**15,689**	**3,510**	**1,345**
2018	**21,421**	**20,350**	**18,617**	**4,524**	**1,733**
2019	**24,996**	**23,746**	**21,574**	**5,670**	**2,173**
2020	**29,200**	**27,740**	**25,086**	**6,926**	**2,654**
2021	**33,965**	**32,267**	**29,096**	**8,277**	**3,171**
2022	**39,027**	**37,076**	**33,358**	**9,703**	**3,718**
2023	**44,162**	**41,954**	**37,671**	**11,179**	**4,283**
2024	**49,254**	**46,791**	**41,934**	**12,677**	**4,857**
2025	**54,183**	**51,474**	**46,046**	**14,167**	**5,428**
2026	**58,878**	**55,934**	**49,949**	**15,621**	**5,985**
2027	**63,295**	**60,130**	**53,610**	**17,018**	**6,520**
Sub-alternative 2c (ACL = OY = 90%ABC)					
2017	17,930	16,137	14,863	3,325	1,274
2018	21,421	19,279	17,637	4,286	1,642
2019	24,996	22,496	20,438	5,372	2,058
2020	29,200	26,280	23,766	6,562	2,514
2021	33,965	30,569	27,564	7,841	3,004
2022	39,027	35,124	31,602	9,192	3,522
2023	44,162	39,746	35,688	10,591	4,058
2024	49,254	44,329	39,727	12,010	4,601
2025	54,183	48,765	43,623	13,421	5,142
2026	58,878	52,990	47,320	14,799	5,670
2027	63,295	56,966	50,788	16,122	6,177

Note: The Council prefers to specify the recreational ACL in numbers of fish and the commercial ACL in pounds. See **Appendix X** for methodology used to derive the recreational ACL in numbers.

With vastly improved commercial monitoring mechanisms recently implemented, it is unlikely that repeated commercial ACL overages would occur. The Commercial Landings Monitoring System (CLM) came online in June 2012 and is now being used to track commercial landings of federally managed fish species (see **Section 4.4.1**). The CLM system is can track dealer reporting compliance with a direct link to the permits database at SERO. Additionally, the Joint Dealer Reporting Amendment (GMFMC & SAFMC 2013b), which became effective on August 7, 2014 requires electronic reporting, increases required reporting frequency for dealers to once per week, and requires a single dealer permit for all finfish dealers in the Southeast Region. The new CLM quota monitoring system and actions in the Joint Generic Dealer Reporting amendment are expected to provide more timely and accurate data reporting and would thus reduce the incidence of quota overages.

Harvest monitoring efforts in the recreational sector have also been improved. On January 27, 2014, regulations became effective requiring headboats to report their landings electronically once per week (Generic Headboat Amendment, GMFMC & SAFMC 2013a). The SEFSC is also developing an electronic reporting system for charter boats operating the Southeast Region and the Gulf of Mexico and South Atlantic Councils are developing a joint amendment that would require electronic reporting for charterboats with a set reporting frequency. **Preferred Alternative 2** and its sub-alternatives would also act as an AM in that, if the combined commercial and recreational ACL (total ACL), as estimated by the SRD, is exceeded in a fishing year, then during the following fishing year, an automatic increase will not be applied to the commercial and recreational ACLs. The RA will evaluate the landings data, using the best scientific information available, to determine whether or not an increase in the commercial and recreational ACLs will be applied. Therefore, there is a low risk of exceeding the commercial and recreational ACLs and **Preferred Alternative 2** and its sub-alternatives can be used as part of a successful harvest management system for hogfish with little risk of overfishing. This in turn, would help decrease discards and bycatch. Furthermore, as mentioned in **Appendix D** (BPA), discards are inherently low for the gear used to harvest hogfish (primarily spear), and other actions are considered in this amendment that could help prevent this ACL from exceeding (**Actions 7** through **12**).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.6.2 Economic Effects

Alternative 1 (No Action) is not a viable alternative for this action because establishing an ACL for a stock is a statutory requirement. Based on ACL values specified in **Table 4.6.2**, **Table 4.6.3** shows short-term (2017) sector ACLs and expected economic returns (in 2014 dollars) for the alternatives/sub-alternatives for **Action 6**.

Table 4.6.3. Recreational and commercial sector ACLs with recreational consumer surplus (CS) and commercial ex-vessel expected values (in 2014 $) for the FLK/EFL stock of hogfish.

	Recreational ACL (numbers)	Recreational CS	Commercial ACL (lbs)	Commercial ex-vessel
Sub-alternative 2a	16,514	$204,281	3,695	$13,353
Sub-alternative 2b	**15,689**	**$194,076**	**3,510**	**$12,684**
Sub-alternative 2c	14,863	$813,858	3,325	$12,016

Source: NMFS SERO Recreational Decision Tool, Appendix X

The sub-alternatives under **Preferred Alternative 2** represent a large reduction from the estimated baseline landings under **Alternative 1 (No Action)**. For the recreational sector, **Sub-alternatives 2a – 2c** represent 14-15% of the baseline landings CS value. In the commercial sector, **Sub-alternatives 2a-2c** represent approximately 12% of the baseline ex-vessel landings value. Among the **Alternative 2** sub-alternatives, **Sub-alternative 2a** would result in the highest positive direct economic effects, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**.

4.6.3 Social Effects

As noted in **Section 4.4.3**, social effects of ACLs are associated with changes to access through associated AMs triggered by reaching the ACL. In general, the higher the ACL, the greater the short-term social and economic benefits that would be expected to accrue, assuming long-term recovery and rebuilding goals are met. Adhering to stock recovery and rebuilding goals is assumed to result in net long-term positive social and economic benefits. Additionally, adjustments in an ACL based on updated information from a stock assessment would be the most beneficial in the long term to fishermen and coastal communities because ACLs would be based on the current conditions, even if the updated information indicates that a lower ACL is appropriate to sustain the stock.

Under **Preferred Alternative 2**, the ACL for the FLK/EFL stock would be based on the most recent stock assessment, but could also set ACLs lower than recent recreational and commercial landings in the area. This could result in early closures, paybacks, or other management measures. **Table 4.6.4** shows hogfish landings for Georgia, South Carolina, and Florida from 2000 through 2014.

Table 4.6.4. Commercial and recreational landings (lbs ww) for the FLK/EFL stock of hogfish, 2000-2014.

Year	Rec Landings	Commercial Landings	TOTAL Landings
2000	40,295	28,015	68,310
2001	79,266	18,455	97,721
2002	99,499	19,525	119,024
2003	123,767	20,623	144,390
2004	190,292	23,299	213,591
2005	189,126	12,380	201,506
2006	120,381	11,337	131,718
2007	271,031	14,402	285,433
2008	361,301	17,882	379,183
2009	239,327	12,014	251,341
2010	137,731	10,554	148,285
2011	66,475	10,384	76,859
2012	300,550	12,145	312,695
2013	142,687	13,950	156,637
2014	239,403	15,833	255,236

Source: SERO and SEFSC

Recreational landings of hogfish in the FLK/EFL are much higher than the proposed recreational ACLs under **Preferred Alternative 2** (**Table 4.6.2**). For the potential recreational ACLs in the first five years of a proposed rebuilding plan, FLK/EFL recreational landings are substantially higher than any proposed recreational ACLs (**Figure 4.6.1**). If an in-season closure and payback measure are implemented as recreational AMs in **Action 12**, there would likely be some negative effects on recreational fishermen and for-hire businesses that target hogfish, as access would be greatly restricted. In general, a higher ACL would lower the chance of triggering a recreational AM (if implemented) and result in the lowest level of negative effects on the recreational sector. After **Alternative 1 (No Action)**, **Sub-alternative 2a** would be the most beneficial for recreational fishermen, followed by **Preferred Sub-alternative 2b** and then **Sub-alternative 2c**. However, because the proposed ACLs in **Preferred Alternative 2** would all be much lower than recreational landings in recent years, all sub-alternatives would likely result in negative effects on recreational anglers, for-hire businesses and for-hire clients who harvest or would harvest hogfish.

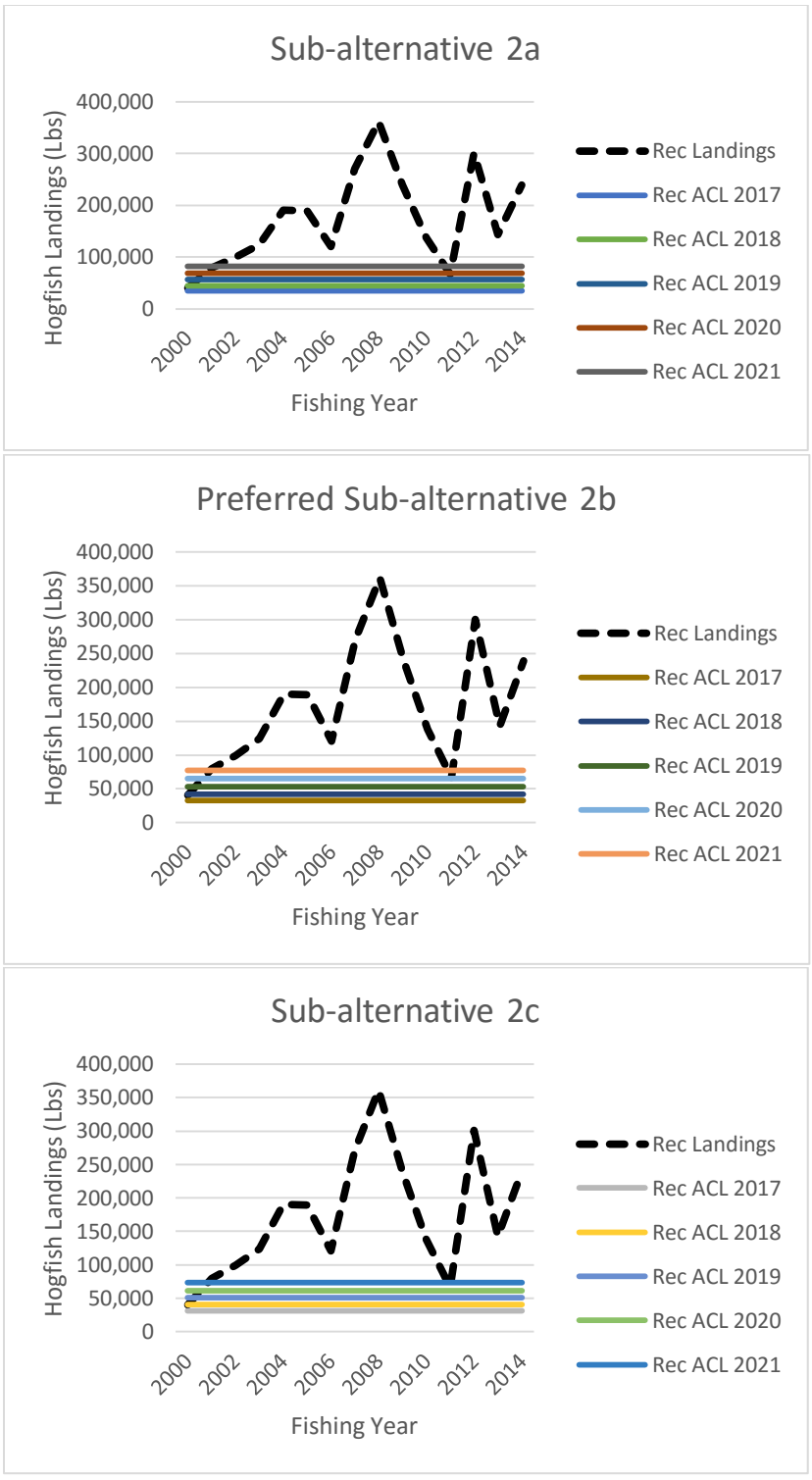
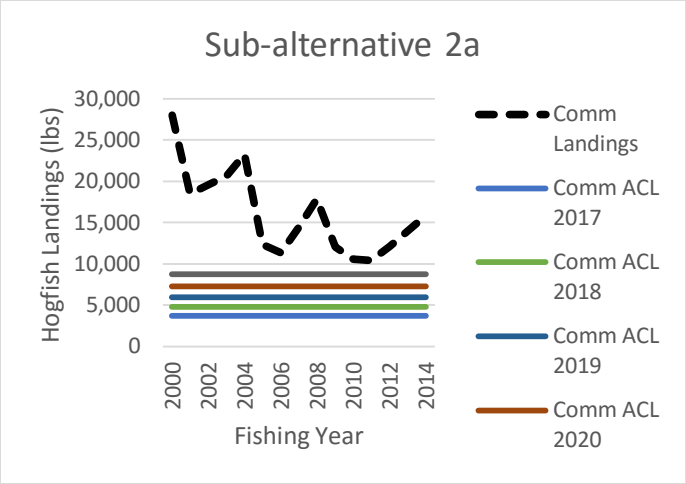
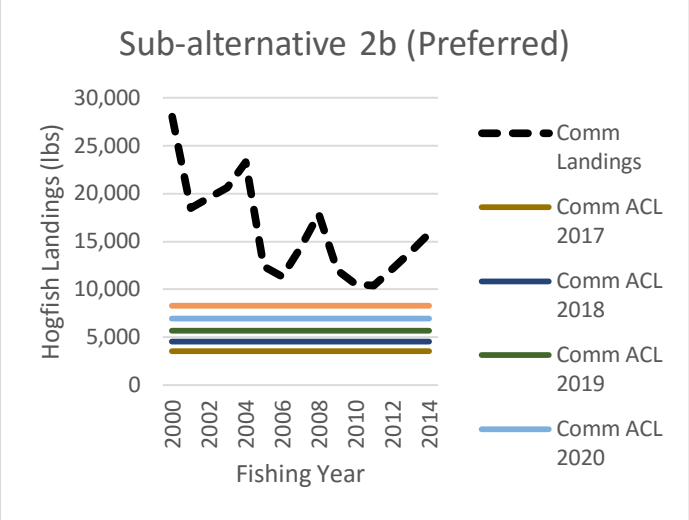


Figure 4.6.1. Annual recreational landings of FLK/EFL hogfish (lbs ww) for compared to the potential recreational ACLs under each sub-alternative under **Preferred Alternative 2**.

Although commercial landings of FLK/EFL hogfish are much lower compared to recreational landings, the proposed commercial ACLs under **Preferred Alternative 2** are much lower than commercial landings in recent years (**Figure 4.6.2**). The potential commercial AMs in **Action 12** would mirror current commercial AMs for each stock, and there would be a possibility of an in-season closure for a year with high landings, or a payback if triggered. In general, a higher ACL would lower the chance of triggering a closure, resulting in in the lowest level of negative effects on the commercial sector. After **Alternative 1 (No Action)**, **Sub-alternative 2a** would be the most beneficial for commercial fishing businesses who may harvest hogfish, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c.**





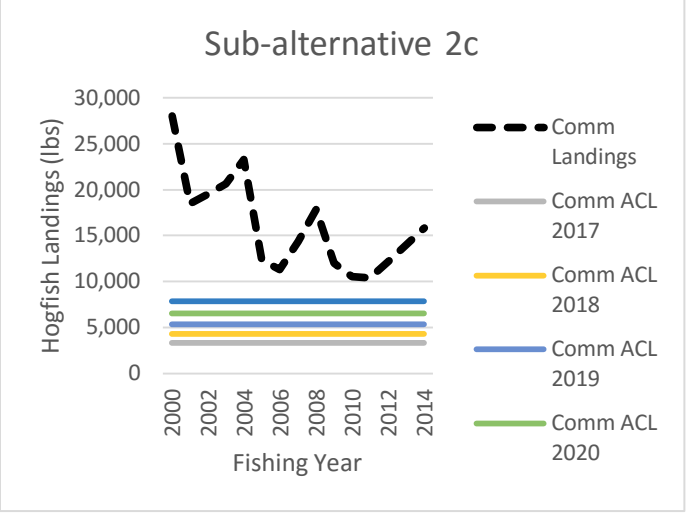


Figure 4.6.2. Annual commercial landings of FLK/EFL hogfish (lbs ww) for compared to the potential commercial ACLs under each sub-alternative under **Preferred Alternative 2**.

4.6.4 Administrative Effects

Negative administrative impacts of this action are likely to be minimal. **Alternative 1 (No Action),** Sub-**alternatives 2a, 2b (Preferred),** and **2c** would not result in significant administrative cost or time burdens other than notifying fishery participants of the change in the sector ACLs and continued monitoring of the sector ACLs. The burden on law enforcement would not change under either alternative since commercial quota closures and bag limits implemented are currently enforced.

Action 7. Establish a recreational Annual Catch Target (ACT) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). The current annual catch target (ACT) is 59,390 lbs ww and applies to hogfish throughout the South Atlantic Council's jurisdiction. The ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater, and where Percent Standard Error (PSE) = average PSE 2005-2009.

Year	Hogfish PSE
2005	28.7
2006	34.3
2007	23.9
2008	30.9
2009	29.5
Average	29.5

Source: NMFS Office of Science and Technology MRIP Domain Catch Totals (2015)

Preferred Alternative 2. Establish an ACT for the GA-NC stock of hogfish for the recreational sector.

Sub-alternative 2a. ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater.

Preferred Sub-alternative 2b. ACT =85% recreational ACL.

Sub-alternative 2c. ACT = 75% recreational ACL.

Year	Hogfish PSE (GA-NC)
2010	61.9
2011	67.3
2012	63.1
2013	56.1
2014	n/a
Average	62.1%

Source: NMFS Office of Science and Technology MRIP Domain Catch Totals (2015)

Preferred Alternative 3. Establish an ACT for the FLK/EFL stock of hogfish for the recreational sector.

Sub-alternative 3a. ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater.

Preferred Sub-alternative 3b. ACT =85% recreational ACL.

Sub-alternative 3c. ACT = 75% recreational ACL.

Year	Hogfish PSE East FL-FL Keys
2010	30.5
2011	22.0
2012	24.7
2013	14.7
2014	10.7
Average	20.5

Source: NMFS Office of Science and Technology MRIP Domain Catch Totals (2015)

4.7.1 Biological Effects

As explained in **Section 2.7.1**, ACTs can be used to prevent ACLs from being exceeded. For species without in-season management control to prevent the ACL from being exceeded, managers may utilize ACTs that are set below annual catch limits (ACLs) so that catches do not exceed the ACLs. In managing the snapper grouper fishery; however, the South Atlantic Council has chosen not to use ACTs to trigger accountability measures (AMs) because it is anticipated that improvements in reporting will significantly reduce management uncertainty.

Since the ACT is typically set lower and would be reached sooner than the ACL, using an ACT rather than the ACL as a trigger for AMs in the recreational sector may prevent an ACL overage. This more conservative approach, would likely help to ensure that recreational data uncertainties do not cause or contribute to excessive ACL overages for vulnerable species. Using recreational ACTs rather than the ACLs to trigger recreational AMs may not eliminate ACL overages completely; however, using such a strategy for the recreational sector may reduce the need to compensate for very large overages. Because the South Atlantic Council has not employed ACTs in its management strategy for the snapper grouper fishery, the biological effects of **Preferred Alternatives 2** and **3** (and their respective sub-alternatives) would be neutral. Compared to **Alternative 1 (No Action)**, **Preferred Alternatives 2** and **3** (and their respective sub-alternatives) would be biologically beneficial in that management would be adjusted to apply to two separate stocks of hogfish and; therefore, be responding to the best scientific information available about the target species.

The Percent Standard Error (PSE) for the GA-NC stock of hogfish is above 50%. The South Atlantic Council has consistently chosen to specify recreational ACTs using a formula that incorporates the PSE in order to account for uncertainty in recreational landings estimates. However, recreational landings estimates for the GA-NC stock of hogfish are imprecise (and therefore have high PSEs) due to low MRIP intercepts that may result from low intercept rates of recreational divers. Hogfish are primarily harvested with spearfishing gear. Using the South Atlantic Council's existing ACT formula (Rec ACT = rec ACL*(1-PSE) or 0.5, whichever is greater), would have resulted in setting the recreational ACT at 50% of the recreational ACL. Given that the proposed recreational ACLs for the GA-NC stock of hogfish are low compared to status quo, the South Atlantic Council chose instead to establish the recreational ACT at 85% of

the recreational ACL (**Preferred Sub-alternative 2b**). For the FLK/EFL stock of hogfish, the South Atlantic Council selected **Preferred Sub-alternative 3b** to maintain consistency.

Table 4.7.1 shows recreational ACTs for the GA-NC stock of hogfish based on the proposed recreational ACL alternatives in **Action 4**.

Table 4.7.1. Recreational ACTs (in pounds and numbers) for the GA-NC stock of hogfish for each of the Recreational ACL sub-alternatives in Action 4.

	ACL=ABC		ACL=95%ABC		ACL=90%ABC	
	Lbs	num	lbs	num	lbs	num
ACT=rec ACL (1-PSE) or rec ACL*0.5, whichever is greater	5,513	520	5,237	494	4,961	468
ACT=85%rec ACL (Preferred)	**9,372**	**884**	**8,903**	**840**	**8,435**	**796**
ACT=75%recACT	8,269	780	7,856	741	7,442	702

Table 4.7.2 shows recreational ACTs for the FLK/EFK stock for the **Alternative 3** sub-alternatives, including **Preferred Sub-alternative 3b**. Recreational ACTs are specified in numbers of fish based on **Preferred Sub-alternative 2a** under **Action 6**.

This action would not be expected to affect discards and/or bycatch, since the only consequence of reaching the ACT would be to monitor the landings, which MRIP does anyway. For more information on bycatch and discards, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

Table 4.7.2. Recreational ACTs (numbers of fish) under consideration for the FLK/EFL stock of hogfish based on **Preferred Sub-alternative 2b** under **Action 6**.

Year	Rec ACL	Sub-alt 2a	Pref Sub-alt 2b	Sub-alt 2c
2017	15,689	12,472	**13,335**	11,767
2018	18,617	14,800	**15,824**	13,963
2019	21,574	17,151	**18,338**	16,180
2020	25,086	19,944	**21,323**	18,815
2021	29,096	23,131	**24,731**	21,822
2022	33,358	26,520	**28,354**	25,019
2023	37,671	29,948	**32,020**	28,253
2024	41,934	33,338	**35,644**	31,451
2025	46,046	36,607	**39,139**	34,535
2026	49,949	39,709	**42,457**	37,462
2027	53,610	42,620	**45,568**	40,207

4.7.2 Economic Effects

The purpose of establishing ACTs is to help prevent a sector from exceeding its ACLs due to management uncertainty. Exceeding an ACL would have direct negative economic effects on a all sectors potentially due to a reduced stock size and to a sector that would have its future ACL reduced by the size of the overage. Without being able to predict exactly how much precaution is needed in setting the ACL, it is difficult to compare alternatives. However, if a fishery were closed too early for a sector based on the ACT, there would be direct negative economic effects as well because the sector was prohibited from harvesting fish. The ACTs being established by this action only apply to the recreational sector. There are no commercial ACTs being proposed as commercial landing reporting requirements allow for the commercial sector to be closed comparatively more quickly when the commercial sector ACL is met or projected to be met.

Table 4.7.3 shows the expected ACT and CS (in 2014 dollars) for the sub-alternatives of **Alternatives 2** and **3**. The ACTs and CS for **Alternative 2** sub-alternatives do not change over time. The ACTs and CS for **Alternative 3** sub-alternatives increase over time (**Table 4.7.2**). For **Alternative 3**, the ACTs and CS values shown in **Table 4.7.3** are only for 2017. As the ACTs for the FK/EFL stock increases, the expected CS will increase accordingly.

Table 4.7.3. The numbers of fish and consumer surplus values for the recreational ACTs proposed by the sub-alternatives of **Alternatives 2** and **3** based on preferred alternatives from Actions 4 and 6. Preferred sub-alternatives indicated in bold.

Alternative 2: Georgia - North Carolina Stock		
	Recreational ACT (numbers)	**Recreational CS**
Sub-alternative 2a	494	$6,111
Sub-alternative 2b	**840**	**$10,391**
Sub-alternative 2c	741	$9,166
Alternative 3: Florida Keys/East Coast Florida		
	Recreational ACT (numbers)	**Recreational CS**
Sub-alternative 3a	12,472	$154,279
Sub-alternative 3b	**13,335**	**$164,954**
Sub-alternative 3c	11,767	$145,556

Source: Hogfish Recreational Decision Tool, **Appendix ??**

Alternative 1 (No Action) is not a viable alternative for management as the previous single stock of hogfish has been separated into two separate stocks and the current ACT set for the recreational sector is no longer valid. As stated in **Section 4.4.2**, based on past behavior, recreational anglers are not expected to meet their sector ACT for the Georgia to North Carolina stock. The recreational sector is expected to land 431 fish with an expected CS of $5,331 (in 2014 dollars). Assuming hypothetically that the recreational sector for the Georgia to North Carolina stock (**Preferred Alternative 2**) could reach its ACT, **Preferred Alternative 2, Preferred Sub-alternative 2b** and **Preferred Alternative 3, Preferred Sub-alternative 3b** would allow for the highest catches (and highest positive direct economic effects) before the ACT could be used to trigger a closure for the recreational sector. **Alternative 2, Sub-alternative 2c** and **Alternative 3, Sub-alternative 3a** which results in the second highest ACT would be expected to result in the next highest amount of positive direct economic effects, followed lastly by **Alternative 2, Sub-alternative 2a** and **Alternative 3, Sub-alternative 3c**.

4.7.3 Social Effects

Establishment of a recreational ACT for each stock of hogfish would likely have little effects on recreational fishermen targeting hogfish, unless the South Atlantic Council decides to set the ACT as a trigger for AMs at a later time. A higher ACT could be more beneficial for fishermen, depending on the levels specified in **Preferred Alternative 2** and **Preferred Alternative 3.** Because the ACT is used for monitoring only, it is expected that the social effects of **Alternative 1 (No Action)**, **Preferred Alternative 2**, and **Preferred Alternative 3** would be the similar.

As noted in **Section 4.7.1**, the PSE for hogfish is 50% and that could result in the ACT under **Sub-alternatives 2a/ 3a** being set lower than under **Preferred Sub-alternatives 2b/ 3b,** or **Sub-**

alternatives 2c/ 3c. **Preferred Sub-alternatives 2b/ 3b** would ensure that the ACT was not associated with the PSE and would likely be more beneficial to fishermen if the South Atlantic Council chooses to use ACT for management and monitoring purposes.

4.7.4 Administrative Effects

Under this action, it is important to note that recreational data collection can be more administratively burdensome due to time delays and lengthy reviews. Specifying an ACT alone would not increase the administrative burden over the status quo, other than adding an additional layer of precautionary monitoring to the system of AMs. In-season monitoring needed for tracking how much of the ACT has been harvested throughout a particular fishing season can potentially result in a need for additional cost and personnel resources if a monitoring mechanism is not already in place. However, because the ACT alternatives as they are presented here, do not trigger any corrective or preventative action, no additional in-season monitoring is required regardless of where the ACT level is set. Therefore, there is no difference in the potential administrative impacts associated with **Alternatives 2a, 2b (Preferred), 2c, 3a, 3b (Preferred),** and **3c** when compared with **Alternative 1 (No Action)**.

Action 8. Increase the commercial and recreational minimum size limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). The current minimum size limit for hogfish is 12 inches fork length (FL) for both the commercial and recreational sectors in federal waters of the South Atlantic Region, and state waters of South Carolina, North Carolina, and Florida. There is no minimum size limit for hogfish in state waters of Georgia.

Preferred Alternative 2. Increase the commercial and recreational minimum size limit for the GA-NC stock of hogfish in the South Atlantic Region.

Sub-alternative 2a. 16 inches FL

Preferred Sub-alternative 2b. 17 inches FL

Sub-alternative 2c. 18 inches FL

Sub-alternative 2d. 19 inches FL

Sub-alternative 2e. 20 inches FL

Sub-alternative 2f. Increase the minimum size limit from 12 inches FL to 15 inches FL in year 1, to 18 inches FL in year 2, and to 20 inches FL in year 3.

Preferred Alternative 3. Increase the commercial and recreational minimum size limit for the FLK/EFL stock of hogfish in the South Atlantic Region.

Sub-alternative 3a. 14 inches FL

Sub-alternative 3b. 15 inches FL

Preferred Sub-alternative 3c. 16 inches FL

Sub-alternative 3d. 17 inches FL

Sub-alternative 3e. Increase the minimum size limit from 12 inches FL to 14 inches FL in year 1 and to 16 inches FL in year 3.

4.8.1 Biological Effects

Hogfish are protogynous; fish mature as females first, and are expected to eventually become male if they live long enough. Research conducted on hogfish that would belong to the FLK/EFL stock, indicate that a single male maintains harems of 5 to 15 females (Colin 1982, Munoz et al. 2010) during extended spawning seasons that last for months. Hogfish are pair spawners (Davis 1976, Colin 1982), and spawning occurs daily during spawning season (McBride and Johnson 2007, Collins and McBride 2008, Munoz et al. 2010). The size (7.8-28.6 inches fork length [FL]) and age (1-11 years) range at which sexual transition occurs indicates that transition is socially mediated (Collins and McBride 2011).

For hogfish in the GA-NC stock, the size at which 50% of females transition to males was estimated to be 24 inches FL (**Figure 4.8.1**). The size at transition was calculated based on macroscopic investigation of gonad samples collected in 2013 through 2015 from vessels fishing off North Carolina (Scott Van Sant, SEFSC, unpublished data) using binary logistic regression

implemented in SAS 9.1. The smallest male observed was 15 inches FL. No female hogfish were observed greater than 30 inches FL. These data are preliminary and will likely change when a complete historical analysis is completed; however, they provide a general estimate of the transition size for hogfish off North Carolina that can be considered in the management of the GA-NC stock.

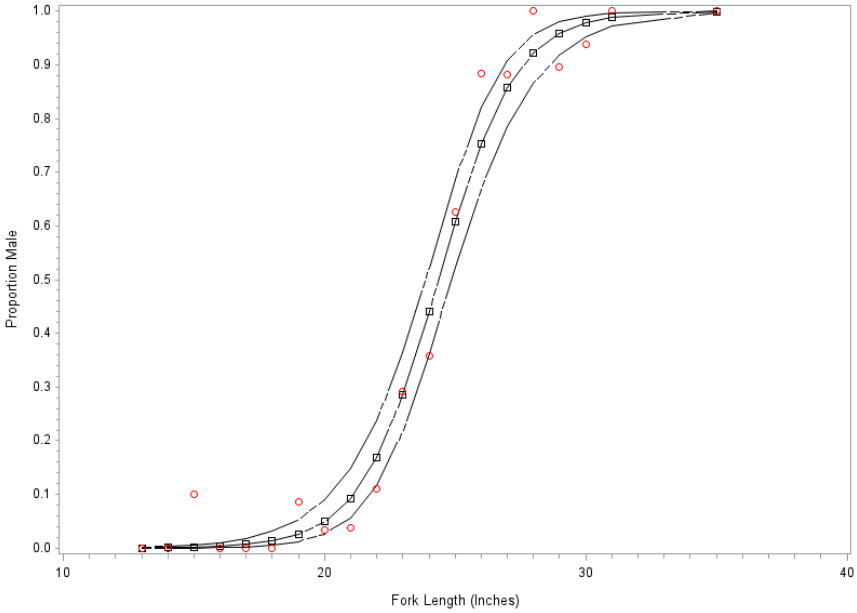


Figure 4.8.1. Size at transition (female to male) for hogfish in North Carolina (preliminary data). Source: Scott Van Sant, SEFSC.

Studies on Florida hogfish have estimated that 50% of females between 6 and 7.6 inches FL and between 0.9 and 1.6 years are sexually mature (McBride et al. 2008, Collins and McBride 2011). Males may occur as small as 7.8 inches FL, but 50% of males in the Florida Keys that are 16.4 inches FL and 7 years old are sexually mature (McBride et al. 2008; **Figure 4.8.2**). Sex change in hogfish can take several months (McBride and Johnson 2007), so removal of the dominant male has the potential to significantly affect harem stability and decrease reproductive potential (Munoz et al. 2010). Size limits above 16 inches FL (**Sub-alternatives 3c, 3d** and **3e**) may provide hogfish the opportunity to form harems and transition to males. McBride et al. (2008) state: "…the size of 50% male maturation, approximately 415 to 425 mm (16.3-16.7 inches) FL, is well above the current minimum size limit. Evidently, to reduce disruption to spawning harems and avoid recruitment overfishing, the minimum size limit should be increased."

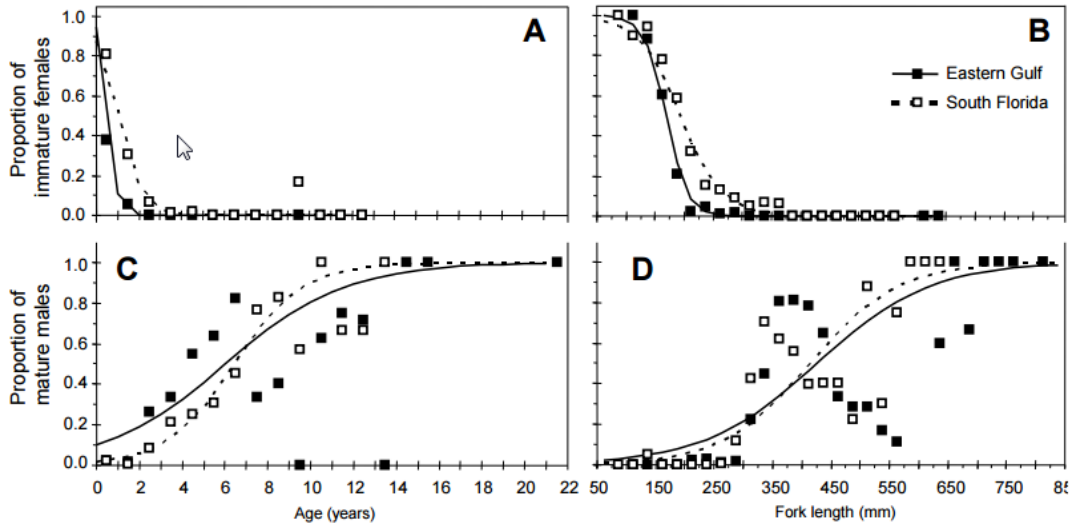
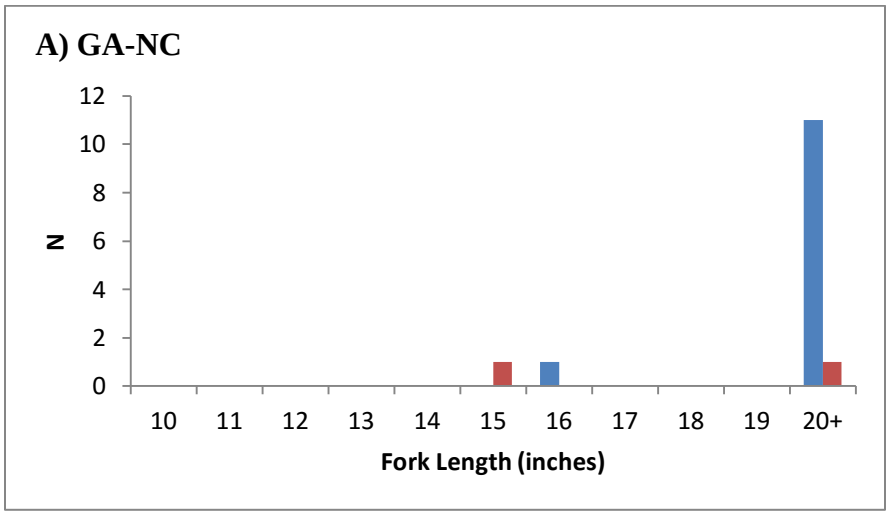


Figure 4.8.2. Maturation of hogfish (*Lachnolaimus maximus*) from the eastern Gulf of Mexico and south Florida for (A) females by age, (B) females by size, (C) males by age, and (D) males by size. Source: Figure 4 in McBride et al. 2008.

Size distributions (in inches fork length) of recreationally harvested hogfish for the GA-NC and FLK/EFL stocks are shown in **Figure 4.8.3**. Hogfish harvested recreationally in the GA-NC sub-region are well above the current minimum size limit of 12 inches FL; whereas, the size distribution of hogfish harvested recreationally in Florida peaks at the current minimum size limit and ranges from 10 inches FL to over 20 inches FL.

Assuming no change in recreational management measures (**Alternative 1 (No Action)**) recreational harvest of hogfish in the GA-NC sub-region in 2017 would not be expected to reach the proposed recreational ACL of 988 fish (**Preferred Sub-alternative 2b, Action 4)** based on mean 2012-2015 observed landings (**Table 4.8.1A**). The various minimum size limit alternatives have no affect on predicted landings (**Table 4.8.2**).

For the FLK/EFL stock, under existing management measures (**Alternative 1 (No Action)**), recreational landings in 2017 are projected to exceed the proposed recreational ACL of 15,689 fish around the beginning of February based on mean 2012-2015 observed landings (**Table 4.8.1B**). In such a scenario, the NMFS would have to project the duration of the fishing season before the start of the year because the recreational ACL would be landed well before the Wave 1 landings were available. Moreover, the likelihood of the recreational ACL not going up the following year would increase (as **Preferred Alternative 2** under **Action 6** indicates that ACLs would not increase automatically in a subsequent year if present year projected catch exceeds the total ACL).



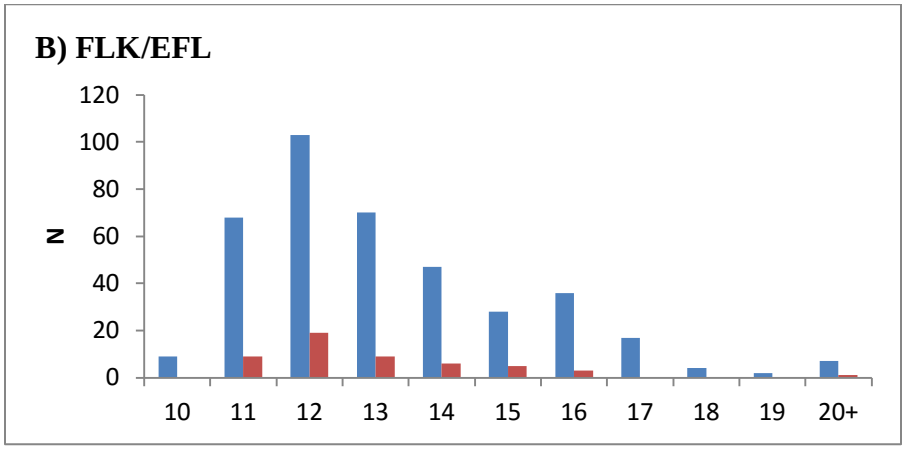


Figure 4.8.3. Size distribution (fork lengths in inches) of landed hogfish reported by the Southeast Headboat Survey (2011-2013; red) and MRIP (2012-2014; blue) for (A) GA-NC and (B) FLK/EFL stocks of hogfish.
Sources: NMFS SERO. MRIP (NMFS OST, accessed May 2015) and Southeast Headboat Survey (HBS bp72_13 file).

Table 4.8.1. Projected 2017 baseline monthly recreational landings in numbers of fish for A) GA-NC and B) FLK/EFL hogfish under status quo management measures with no seasonal or quota closures. Assumes MRIP landings uniformly distributed within waves. Projection based on mean 2012-2015 observed landings.

A) GA-NC

LANDINGS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SRHS	0	0	0	0	1	2	24	1	2	2	0	0
MRIP CHARTER	0	0	0	0	7	7	7	7	4	4	0	0
MRIP PRIVATE	0	0	0	0	152	147	32	32	0	0	0	0
Total	**0**	**0**	**0**	**0**	**160**	**156**	**64**	**40**	**6**	**6**	**0**	**0**

B) FLK/EFL

LANDINGS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SRHS	29	23	25	16	13	16	10	7	5	6	9	19
MRIP CHARTER	283	256	108	104	354	343	16	16	174	180	324	335
MRIP PRIVATE	12,604	11,384	27,813	26,916	9,228	8,930	17,961	17,961	4,994	5,161	2,743	2,835
Total	**12,915**	**11,663**	**27,946**	**27,036**	**9,595**	**9,289**	**17,988**	**17,984**	**5,173**	**5,346**	**3,077**	**3,188**

Source: NMFS SERO

Table 4.8.2. Projected hogfish recreational landings, length of season and percent of ACL expected to be landed for the GA-NC stock under various minimum size limit alternatives for the ACLs proposed under Action 4.

ACL Alternative	Size Limit	Open Days	Landings (N)	Percent of ACL landed
Alt 2a	12	365	431	41
Pref Alt 2b		365	431	44
Alt 2c		365	431	46
Alt 2a	15	365	431	41
Pref Alt 2b		365	431	44
Alt 2c		365	431	46
Alt 2a	16	365	417	40
Pref Alt 2b		365	417	42
Alt 2c		365	417	45
Alt 2a	**17**	365	411	40
Pref Alt 2b		**365**	**411**	**42**
Alt 2c		365	411	44
Alt 2a	18	365	411	40
Pref Alt 2b		365	411	42
Alt 2c		365	411	44
Alt 2a	19	365	411	40
Pref Alt 2b		365	411	42
Alt 2c		365	411	44
Alt 2a	20	365	411	40
Pref Alt 2b		365	411	42
Alt 2c		365	411	44

Source: NMFS SERO Recreational Decision Tool. See Appendix X.

Under the preferred minimum size limit of 16 inches FL (**Preferred Sub-alternative 3b, this action**) and assuming no other changes to recreational management measures for the FLK/EFL stock, the proposed recreational ACL for 2017 of 15,689 hogfish (**Preferred Sub-alternative 2b, Action 6**), would be landed in 95 days (**Table 4.8.3**). Under the current calendar fishing year, unless a recreational season were implemented through Action 11, the recreational ACL would be met in early April.

Projected reductions in harvest under different minimum size limits for the recreational sector are shown in **Tables 4.8.4** and **4.8.5** for the GA-NC and FLK/EFL stocks of hogfish, respectively. For the GA-NC region, minimum size limits of 16 inches FL and above would result in some reduction in harvest for the for-hire mode (headboat and charter; **Table 4.8.3**). However, the projected reductions in harvest are based on limited available data and are, therefore, highly uncertain. In the FLK/EFL region, minimum size limits, especially at 15 inches FL (**Sub-alternative 3b**) and above, would constrain harvest across all modes, with projected reductions in recreational harvest across all modes ranging from 59% to 84% (**Table 4.8.5**).

Table 4.8.3. Projected recreational harvest (in numbers of fish) and season length for the FLK/EFL stock under various proposed minimum size limit and ACL alternatives. Preferreds shown in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Removals (N)
2a	14	5 Fish	12-Mar	71	16,425	22,377
Pref 2b			**10-Mar**	**69**	**15,524**	**21,501**
2c			8-Mar	67	14,623	20,625
2a	15	5 Fish	22-Mar	81	16,433	22,385
Pref 2b			**19-Mar**	**78**	**15,386**	**21,367**
2c			17-Mar	76	14,688	20,688
2a	**16**	5 Fish	8-Apr	98	16,477	22,428
Pref 2b			**5-Apr**	**95**	**15,669**	**21,641**
2c			2-Apr	92	14,860	20,855
2a	17	5 Fish	8-Jun	159	16,474	22,425
Pref 2b			**23-May**	**143**	**15,677**	**21,649**
2c			6-May	126	14,830	20,825

Source: NMFS SERO Recreational Decision Tool. See Appendix X.

Table 4.8.4. Projected reductions in recreational hogfish landings (in numbers of fish) for the GA-NC stock, by month, for headboat (HB), charter, and private modes, under proposed minimum size limits. Preferred alternative indicated in bold.
Note: data have been pooled to achieve a minimum sample size of 30 fish per estimate.

	HB (NUMBERS; 2011-2013)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
17	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**
18	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
19	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
20	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
	CHARTER (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**
18	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
19	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
20	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
	PRIVATE (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
18	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Sources: Headboat CRNF file (mean 2011-2013), MRIP Catch-Effort Files (mean 2012-2014).
Note: There were insufficient samples to model monthly impacts of proposed size limits for headboat; headboat catch effort file for 2014 not available.

Table 4.8.5. Projected reductions in recreational hogfish landings (in numbers of fish) for the FLK/EFL stock, by month, for headboat (HB), charter, and private modes, under proposed minimum size limits. Preferred alternative indicated in bold.
Note: data have been pooled to achieve a minimum sample size of 30 fish per estimate.

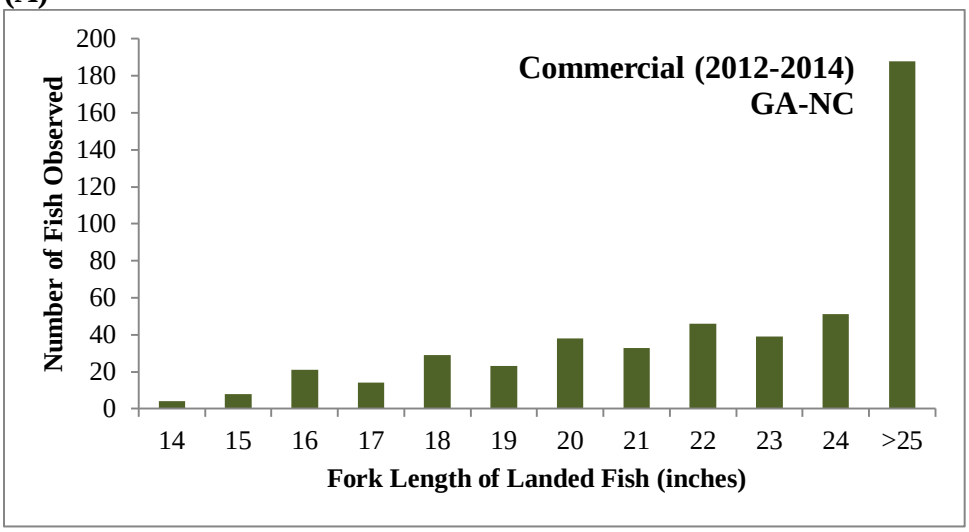
	HB (NUMBERS; 2011-2013)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%
15	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%
16	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**
17	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
	CHARTER (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	33%	33%
15	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	70%	70%
16	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**76%**	**76%**
17	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%

	PRIVATE (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	54%	54%	50%	50%	30%	30%	53%	53%	54%	54%	56%	56%
15	63%	63%	61%	61%	71%	71%	54%	54%	60%	60%	63%	63%
16	**75%**	**75%**	**70%**	**70%**	**73%**	**73%**	**59%**	**59%**	**63%**	**63%**	**71%**	**71%**
17	82%	82%	81%	81%	84%	84%	69%	69%	77%	77%	80%	80%

Sources: Headboat CRNF file (mean 2011-2013), MRIP Catch-Effort Files (mean 2012-2014).
Note: There were insufficient samples to model monthly impacts of proposed size limits for headboat; headboat catch effort file for 2014 not available.

The size distributions (inches FL) of commercially harvested hogfish for the GA-NC and FLK/EFL stocks are shown in **Figure 4.8.4**. The majority of commercially harvested hogfish in the GA-NC portion of the stock are 25 inches FL and greater whereas in Florida, the majority of commercially harvested hogfish are at the 12-inch FL minimum size limit. **Tables 4.8.6** and **4.8.7** present the projected reduction in commercial harvest, by month, under the various proposed minimum size limits for the GA-NC and FLK/EFL stocks, respectively.

(A)



(B)

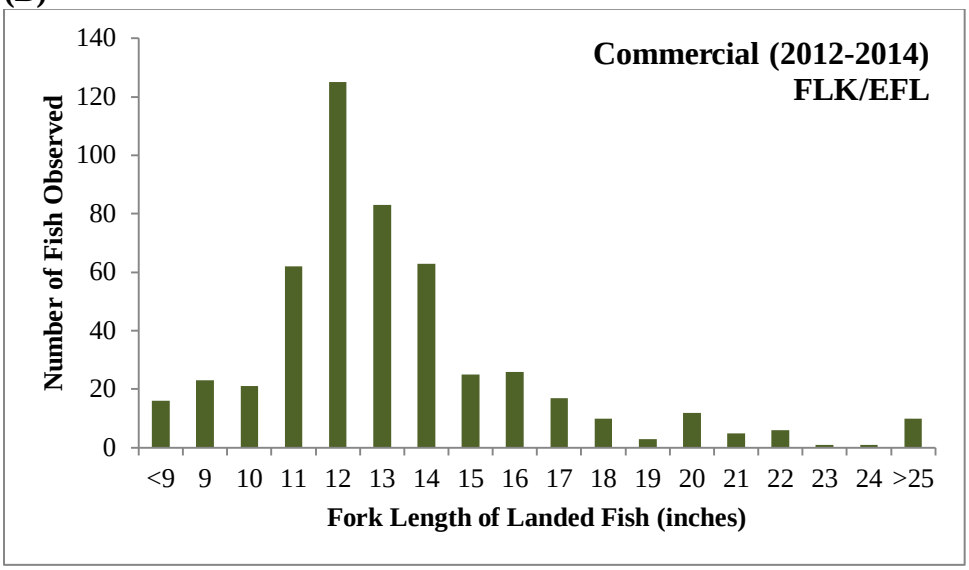


Figure 4.8.4. Size distribution in inches FL of hogfish landed commercially in: (A) GA-NC and (B) Florida Keys/East Florida, 2012-2014.
Source: NMFS SERO. Commercial TIP data (L. Beerkircher, SEFSC, pers. comm.)

For the GA-NC region, the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b**) would result in an average reduction in commercial landings of only 2%. At a minimum size limit of 20 inches FL, average commercial harvest would be reduced by only 8% (**Table 4.8.6**). In Florida, the a minimum size limit of 15 inches FL (**Preferred Sub-alternative 3b**) and above would constrain harvest with average reductions of 41% or more (**Table 4.8.6**).

Table 4.8.6. Percent reductions in commercial landings (in pounds whole weight) for GA-NC, by month, at under proposed minimum size limits. Preferred alternative indicated in bold.

	Month												
Size Limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Mean 2012-2014**
12	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	1	1	1	0	1	0	0	0	0	0	0	1
17	**1**	**3**	**3**	**4**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**2**
18	3	4	4	5	3	4	3	2	2	1	2	2	3
19	7	7	9	7	4	6	5	5	2	2	5	6	6
20	9	12	11	8	5	8	8	7	3	4	7	9	8

Sources: SEFSC TIP data (accessed May 2015).
Note: Some months were pooled with surrounding months to achieve a sample size >30.

Table 4.8.7. Percent reductions in commercial landings (in pounds whole weight) for FLK/EFL, by month, under proposed minimum size limits. Preferred alternative indicated in bold.

	Month												
Size Limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Mean 2012-2014**
12	0	0	0	0	0	0	0	0	0	0	0	0	0
14	58	64	66	12	3	9	12	24	45	68	48	61	29
15	71	71	73	18	9	15	17	59	61	68	58	76	41
16	**76**	**77**	**77**	**19**	**9**	**66**	**22**	**61**	**64**	**68**	**66**	**80**	**47**
17	81	77	77	21	13	70	36	62	72	90	76	85	54

Sources: SEFSC TIP data (accessed May 2015).
Note: Some months were pooled with surrounding months to achieve a sample size >30.

Alternative 1 (No Action) would continue a minimum size limit of 12 inches FL for both the commercial and recreational sectors off North Carolina, South Carolina, and Florida, with no minimum size limit off Georgia. **Sub-alternatives 2a-2e** propose minimum size limits ranging from 16 inches FL to 20 inches FL, for the GA-NC stock of hogfish. **Sub-alternative 2f** would increase the minimum size limit from 12 inches FL to 15 inches FL in the first year, 18 inches FL in the second year, and 20 inches FL in the third year. Off North Carolina, 50% of hogfish transition to males at 24.5 inches FL (**Figure 4.8.1**); hence, the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b**) would continue to allow removal of the most reproductively successful individuals with potentially negative biological effects on the population.

On average, **Sub-alternative 2e** would result in a 45% reduction in harvest from mean landings from 2012 through 2014 for the headboat sector and 15% and 0% for the charter and private sectors, respectively (**Table 4.8.4**). Of all the sub-alternatives under **Preferred Alternative 2**, **Sub-alternative 2f** would be the least conservative and expected to have the least biological benefits. **Sub-alternative 2e** would be the most biologically conservative of the alternatives considered and, presumably result in the greatest biological benefit. Although annual catch limits (ACLs) and accountability measures (AMs) are in place to constrain harvest and ensure overfishing does not occur, larger minimum size limits would provide more spawning opportunities, a greater percentage of males in the stock, and more spawning opportunities for the stock.

For the FLK/EFL stock of hogfish, **Preferred Alternative 3** and its sub-alternatives would increase the minimum size limits from 14 inches FL (**Sub-alternative 3a**) to 17 inches FL (**Sub-alternative 3d**). **Sub-alternative 3e** would increase the minimum size limit from 12 inches FL to 14 inches FL in the first year, and 16 inches FL in the third year. As mentioned previously, studies on reproductive biology of hogfish in Florida suggest that minimum size limits above 16 inches FL would allow more females to transition to males thus promoting spawning harems and benefiting the hogfish population. Hence, **Sub-alternatives 3c (Preferred)**, **3d** and **3e** would increase the minimum size limit for the FLK/EFL stock of hogfish to a level that would impart the most biological benefits to the stock. Of these, **Preferred Sub-alternative 3c** would be the most biologically beneficial, followed by **Sub-alternatives 3c** and **3e**. Assuming the socially-mediated size at transition (Collins & McBride 2011) has remained around 16 inches FL in the FLK/EFL sub-region since the study by McBride et al. (2008), **Sub-alternative 3b** would impart less biological benefits to the FLK/EFL hogfish stock than **Sub-alternatives 3c (Preferred)-3e**, because it would continue to allow removal of the most reproductively productive individuals and possibly disrupt formation of harems since individuals would be harvested before transition from female to male could take place. Because size at transition is socially-mediated and the FLK/EFL stock is overfished, there is a strong possibility the size at transition is currently lower than 16 inches FL; however, it should also be noted that in a non-overfished stock, the size at transition might be above 16 inches FL. SEDAR 37 (2014) indicates that hogfish have been overfished since 1986, well before the McBride et al. (2008) study. Per SEDAR 37 (2014): "…the base model predicted the [FLK/EFL] population as being overfished and experiencing overfishing for nearly the entire time frame of the model runs [1986-2012]."

In general, biological effects would increase with larger size limits. **Sub-alternative 3a** would result in negative biological effects compared to the other alternatives considered. Compared to **Alternative 1 (No Action)**, **Sub-alternatives 3a-3e** would be expected to benefit the FLK/EFL stock of hogfish to varying degrees. On average, **Sub-alternative 3b** would reduce harvest from mean 2012-2014 landings by 72% for the headboat sector, and by 77% and 62% for the charter and private sectors, respectively (**Table 4.8.5**). While **Sub-alternatives 3c (Preferred)-3e** would result in greater potential reductions in recreational harvest, they would be more biologically beneficial (**Table 4.8.5**). **Preferred Sub-alternative 3c** would result in average annual reductions in recreational harvest of 80% for the headboat sector, 82.6% for the charter sector, and 68.5% for the private sector. Similar effects are expected for the commercial sector, with **Preferred Sub-alternative 3c** reducing commercial harvest by a mean of 47%, compared to a mean of 29% for **Sub-alternative 3a**, 41% under **Sub-alternative 3b** and 54% under **Sub-alternative 3d** (**Table 4.8.7**). **Sub-alternative 3e** would be expected to result in percent reductions of commercial harvest similar to **Sub-alternative 3a** in year 1 and similar to **Sub-alternative 3c (Preferred)** in year 3 (**Table 4.8.7**). However, ACLs and AMs are in place to constrain harvest.

Changes in size limits can lead to regulatory discards; however, extensive scientific evidence from life history studies, spawning, and social structure (Davis 1976; Colin 1982; McBride and Johnson 2007; McBride et al. 2008, Munoz et al. 2010; and Collins and McBride 2011) listed in SEDAR 37 (2014) recommend an increase in the size limit, which would be beneficial to the hogfish stocks and aid in rebuilding. Bycatch and discards would not be expected to increase as a result of an increase in the minimum size limit, since the dominant mode of harvest is by spearfishing, which is highly selective, and fishers using this gear would be expected to target larger fish. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.8.2 Economic Effects

In general, increasing the size limit for a species has little long-term economic effect unless the larger size limit results in greater numbers of fish reaching spawning size and/or fish have higher fecundity prior to being harvested. Size limits that result in more spawning and/or higher fecundity would result on more direct, long-term, positive economic effects presumably through the availability of increased numbers of fish in the future. However, there could be some direct, short-term, negative economic effects as fewer fish would be available to harvest until the current population grows into the new minimum size and/or the biomass of harvestable fish increases. The greater the increase in size limit from **Alternative 1 (No Action)**, the probability increases for longer short-term negative economic effects, but could also eventually result in

greater long-tern positive economic effects as long as increased size limits would result in a larger spawning biomass and overall biomass increasing above the minimum limit.

There were very little data available to estimate the economic effects for the consumer surplus (CS) estimates for the recreational sector for the GA-NC stock. Hence, a number of the size limits proposed by the **Alternative 2 (Preferred)** sub-alternatives resulted in indistinguishable CS values for the recreational sector **(Table 4.8.5)**. **Alternative 1 (No Action)** affords the highest positive, direct, short-term economic effects compared to the **Preferred Alternative 2** sub-alternatives. There were no distinguishable differences between **Preferred Alternative 2, Sub-alternative 2f** for the first year and **Alternative 1 (No Action)**. However, the long-term direct economic effects for **Alternative 1 (No Action)** would result in a more compressed stock size and presumably lower fecundity leading to fewer fish available to harvest when compared to other **Preferred Alternative 2** sub-alternatives. However, it should be noted that the differences in estimated consumer surplus for all the **Preferred Alternative 2** sub-alternatives is rather small. The economic benefit of establishing a larger minimum size limit would be an increased stock size with a larger range in sizes of fish. Overall, in the short-term, there are negligible differences among the **Preferred Alternative 2** sub-alternatives. From least to most long-term, direct, positive economic effects for the recreational sector for **Preferred Alternative 2** would be **Preferred Sub-alternative 2b** – **Sub-alternative 2e**, and then **2a**. It is not clear where **Sub-alternative 2f** would fit in the rankings, however; in the long-term, it would be expected to fall between **Sub-alternative 2e** and **Alternative 1 (No Action**

For the commercial sector of the GA-NC stock, except for **Alternative 1 (No Action)**, **Preferred Alternative 2, Sub-alternative 2f** affords the highest probability of first year positive economic effects. In terms of least to most long-term, direct, positive economic effects for the commercial sector, the sub-alternatives for **Preferred Alternative 2** would be **2e**, **2d**, **2c**, **Preferred 2b**, and then **Sub-alternative 2a**. It is not clear where **Sub-alternative 2f** would fit in the rankings, however; in the long-term, it would be expected to fall between **Sub-alternative 2a** and **Sub-alternative 2e**.

Table 4.8.5. **Preferred Alternative 2** expected recreational CS and commercial ex-vessel revenue (2014 $) for hogfish landed from the GA-NC stock in the first year of implementation.

Sub-alternative	Size Limit	Recreational Numbers	Recreational CS	Commercial Pounds	Commercial Ex-vessel
Alternative 1	12" FL	431	$5,331	20,534	$74,129
Sub-alt. 2a	16" FL	417	$5,158	20,406	$73,666
Preferred 2b	**17" FL**	**411**	**$5,084**	**20,128**	**$72,662**
Sub-alt. 2c	18" FL	411	$5,084	19,918	$71,902
Sub-alt. 2d	19" FL	411	$5,084	19,398	$70,025
Sub-alt. 2e	20" FL	411	$5,084	18,921	$68,305
Sub-alt. 2f	15"/18"/20" FL	431	$5,331	20,498	$73,998

Note: Sub-alternative 2f uses a stepped approach to increasing the size limit with an increase to 15" in year 1, 18" in year 2, and 20" in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 15" size limit increase. Source: Hogfish Recreational Decision Tool, **Appendix ??**

Preferred Alternative 3 sub-alternatives indicate that an increase in minimum size limit for both the recreational and commercial sectors of the FLK/EFL stock would result in reduced short-term economic benefit when compared to **Alternative 1 (No Action)**. For the recreational sector, the expected economic effects of **Preferred Alternative 3** sub-alternatives and **Alternative 1 (No Action)** are relatively small range from $190,325 (15"; **Sub-alternative 3b**) $194,073 (12" FL; **Alternative 1 – No Action**). The differences in expected economic effects among the **Preferred Alternative 3** sub-alternatives are small in the short-term.

Commercial sector landings for the FLK/EFL stock are relatively low with an **Alternative 1 (No Action)** expected ex-vessel value of just $12,565 (**Table 4.8.6**). The differences between **Alternative 1 (No Action)** and the **Preferred Alternative 3** sub-alternatives for the commercial sector are small, ranging from $12,532 (17" FL; **Sub-alternative 3d**) to $12,590 (15" FL; **Sub-alternative 3b).** However, in the long-term a larger minimum size limit could result in larger stock size, as well as a broader range of sizes of hogfish available to be caught. In that sense, in the long-term, a larger minimum stock size could result in greater long-term economic benefit. In terms of least to most long-term, direct, positive economic effects for the commercial sector, the sub-alternatives for **Preferred Alternative 3** would be **3d**, Alternative 1 (No Action), 3a, ,**Preferred 3c**, and **3d**. It is not clear where **Sub-alternative 3e** would fit in the rankings, however the in the long-term, it would be expected to fall between **Sub-alternative 3a** and **Sub-alternative 3c (Preferred)**.

Table 4.8.6. Preferred Alternative 3 expected recreational CS and commercial ex-vessel revenue (2014 $) for hogfish landed from Florida Keys/Florida East Coast stock in the first year of implementation using the ACL from **Action 6, Preferred Sub-alternative 2b** .

Sub-alternative	Size Limit	Recreational Numbers	Recreational CS	Commercial Pounds	Commercial Ex-vessel
Alternative 1	12" FL	15,415	$190,684	3,477	$12,565
Sub-alt. 3a	14" FL	15,524	$192,032	3,477	$12,565
Sub-alt. 3b	15" FL	15,386	$190,325	3,484	$12,590
Preferred 3c	**16" FL**	**15,669**	**$193,826**	**3,477**	**$12,565**
Sub-alt. 3d	17" FL	15,677	$193,924	3,468	$12,532
Sub-alt. 3e	14"/16" FL	15,524	$192,032	3,477	$12,565

Note: Sub-alternative 3e uses a stepped approach to increasing the size limit with an increase to 14" in year 1, 16" in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 14" size limit increase.
Source: Hogfish Recreational Decision Tool, **Appendix ??**

4.8.3 Social Effects

As discussed in **Section 4.5.3**, hogfish is an important commercial and recreational species in the Florida Keys. Additionally, as discussed in **Section 4.4.3**, there are communities in South Carolina and North Carolina that may be affected by management changes for GA-NC hogfish.

Some social effects of minimum size limits would be associated with the positive and negative biological effects of minimum size limits on the hogfish stocks (**Section 4.8.1**). Positive effects of allowing only fish of a certain size that are caught in the South Atlantic EEZ to be landed could help maintain sustainability of harvest and the health of each hogfish stock, which would be beneficial to recreational and commercial fishermen in the long term. Negative effects of potential increase in discard mortality due to higher minimum size limit could affect the stock and in turn, commercial and recreational fishing opportunities.

Because recreational harvest would be reduced as the minimum size limit increases (see **Table 4.8.2**), there would be expected negative short-term effects on recreational fishermen targeting hogfish in North Carolina, South Carolina, and Georgia under an increased minimum size limit for the GA-NC stock (**Preferred Alternative 2**). However, there would be more expected negative effects on private recreational anglers than on recreational fishermen on for-hire vessels. Fishing opportunities for hogfish on headboat trips would be expected to be negatively affected under higher minimum size limits, although any minimum size limit of 16 inches or higher would likely result in the same effects on headboat businesses and clients (**Table 4.8.2**). It is likely that headboat businesses and clients would be the most affected by the

largest minimum size limit and at the same level under all sub-alternatives in **Preferred Alternative 2**, including **Preferred Sub-alternative 2b**. For the charter businesses, a 16-inch FL minimum size limit (**Sub-alternative 2a**) would likely have fewer negative effects on fishing opportunities than other sub-alternatives under **Preferred Alternative 2**, including **Preferred Sub-alternative 2b**. There would be few or short-term effects on headboats and charter boats expected under **Alternative 1 (No Action**).

Private recreational anglers may target smaller sizes of hogfish, and an increase under **Preferred Alternative 2** would likely have some negative effects on fishing opportunities (**Table 4.8.2**). In general, as the minimum size limit increases, the higher of the expected reduction in recreational landings that could occur. The most negative effects would be expected under **Sub-alternative 2e** and year 3 under **Sub-alternative 2f**, followed in order by **Sub-alternative 2d**, **Sub-alternative 2c** and year 2 under **Sub-alternative 2f**, **Preferred Sub-alternative 2b**, **Sub-alternative 2a**, year 1 under **Sub-alternative 2f**, and then **Alternative 1 (No Action)**.

There would be minimal or no expected effects on the commercial sector by any minimum size limit in **Sub-alternatives 2a-2f** (**Figure 4.8.4**), including **Preferred Sub-alternative 2b**, because in general the commercial fleet is harvesting larger hogfish.

Similar to the minimum size limit change for GA-NC hogfish, there would be expected negative short-term effects on recreational fishermen targeting hogfish in Florida under an increased minimum size limit for the FLK/EFL stock (**Preferred Alternative 3**). Fishing opportunities for hogfish on headboat trips and for private recreational anglers would be expected to be negatively affected under higher minimum size limits other than **Alternative 1 (No Action)** (**Table 4.8.5**). Even the smallest proposed increase (**Sub-alternative 3a**) would likely decrease recreational landings for headboats, charter boats, and private anglers by about 50% or more. The reduction in landings increases as the minimum size limit increases, and it is likely that any proposed increase in minimum size limit under **Preferred Alternative 3** will have substantial negative short-term effects on recreational fishing opportunities for FLK/EFL hogfish, and fishermen and for-hire businesses will switch target species. Although catch-and-release for hook and line fishermen may continue to allow some opportunities, hogfish is usually targeted as a fish to take home and eat.

In general, larger minimum size limits would have more negative effects on recreational fishing opportunities in the immediate future. The most short-term negative effects on the recreational sector would be expected under **Sub-alternative 3d**, followed in order by **Preferred Sub-alternative 3c** and year 3 under **Sub-alternative 3e**; **Sub-alternative 3b**; and **Sub-alternative 3a** and year 1 under **Sub-alternative 3f**; and then **Alternative 1 (No Action)**.

Similar to the recreational sector, an increase in the minimum size limit will likely result in negative short-term effects on commercial vessels harvesting FLK/EFL hogfish by limiting access to the available hogfish. Because most commercially harvested FLK/EFL hogfish are at the current minimum size limit (**Figure 4.8.3**), it can be expected that commercial vessels will

target other species instead of trying to catch hogfish of a larger size, as proposed in **Sub-alternatives 3a-3e** including **Preferred Alternative 3c**. Because hogfish are a popular menu item in local restaurants in the Florida Keys, there may be some negative effects on restaurants that focus on regional fare.

It should be noted that although expected short-term negative social effects would be the least under **Alternative 1 (No Action)**, there would likely be long-term negative biological effects that would limit recreational and commercial fishing opportunities for FLK/EFL hogfish in the future and for a longer period of time. In order to meet the rebuilding goals in **Action 5**, reducing harvest through a higher minimum size limit is expected to be more beneficial to recreational fishermen, commercial fishermen, and for-hire businesses in the long term.

4.8.4 Administrative Effects

Beneficial administrative effects would be expected from **Sub-alternatives 2a, 2b (Preferred), 2c, 2d, 2e, 2f, 3a, 3b, 3c (Preferred), 3d, and 3e** compared to **Alternative 1 (No Action),** which would continue to have a minimum size limit for three out of the four states in the South Atlantic region. Alternatives that specify a consistent minimum size limit throughout the South Atlantic Council's jurisdiction would help the public avoid confusion with regulations and aid law enforcement. Administrative impacts on the agency associated with the action alternatives would be incurred by rulemaking, outreach, education and enforcement.

Action 9. Establish a commercial trip limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). There is no commercial trip limit for hogfish in the South Atlantic region.

Preferred Alternative 2. Establish a commercial trip limit for the GA-NC stock of hogfish in the South Atlantic region.

Sub-alternative 2a. 100 lbs ww per trip.
Sub-alternative 2b. 250 lbs ww per trip.
Preferred Sub-alternative 2c. 500 lbs ww per trip.
Sub-alternative 2d. 750 lbs ww per trip.
Sub-alternative 2e. No trip limit

Preferred Alternative 3. Establish a commercial trip limit for the FLK/EFL stock of hogfish in the South Atlantic region.

Preferred Sub-alternative 3a. 25 lbs ww per trip.
Sub-alternative 3b. 50 lbs ww per trip.
Sub-alternative 3c. 100 lbs ww per trip.
Sub-alternative 3d. 150 lbs ww per trip.
Sub-alternative 3e. 200 lbs ww per trip.
Sub-alternative 3f. No trip limit

4.9.1 Biological Effects

Preferred Alternatives 2 and **3** (including their respective sub-alternatives) would propose commercial trip limit options for the GA-NC and FLK/EFL stocks of hogfish, respectively. **Sub-alternatives 2e**, and **3f** would not establish a commercial trip limit for either stock.

Commercial logbook data were explored to determine harvest of hogfish per trip and to analyze trip limit options. During 2012-2014 (the most recent years of complete data), 2,008 commercial trips landed hogfish in the South Atlantic (**Figure 4.9.1**). During 2012-2014, 64% of the commercial trips landed 25 lbs ww or less, 14% landed 50 lbs ww, 9% landed 75 lbs ww, 5% landed 200 lbs ww, 2% landed 300 lbs ww, 1% landed 400 lbs ww, and <1% landed 500 lbs ww or more (**Figure 4.9.1**).

Hogfish are commercially harvested primarily by spear and hook-and-line gear. **Figure 4.9.2** shows the distribution of hogfish landings per trip by gear type. The majority of the trips that landed hogfish during 2012-2014 used spear (47%, 950 trips) and hook and line gear (42%, 842 trips). **Figure 4.9.3** shows hogfish harvested commercially per trip (lbs ww) in two areas of the South Atlantic, GA-NC and FLK/EFL, during 2012-2014.

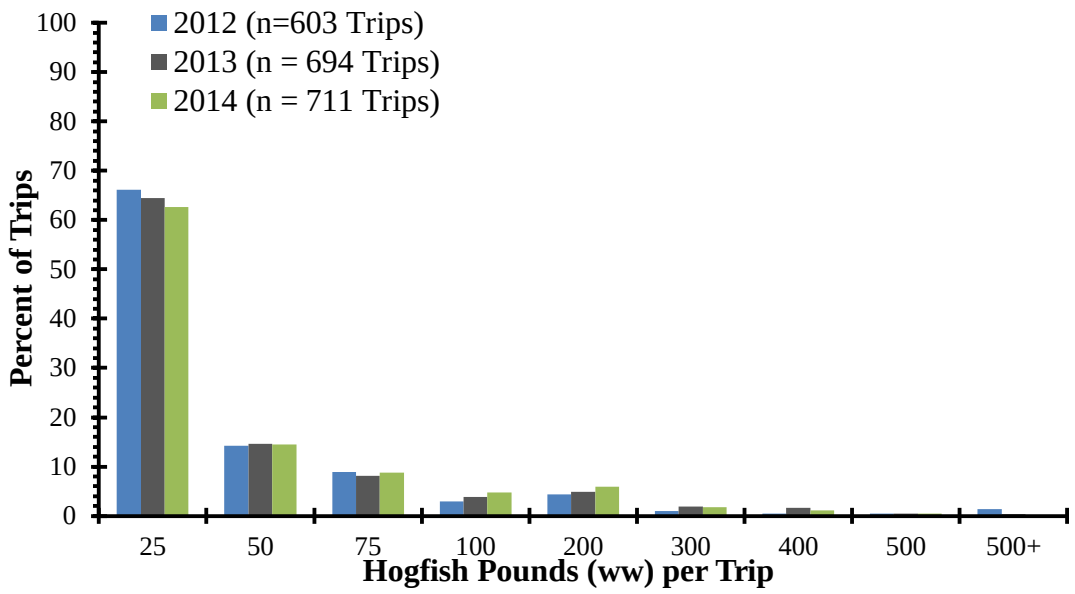


Figure 4.9.1. Distribution of commercially harvested hogfish per trip (lbs ww) by year, from 2012 through 2014, in the South Atlantic. Source: Commercial logbook dataset accessed April 2, 2015.

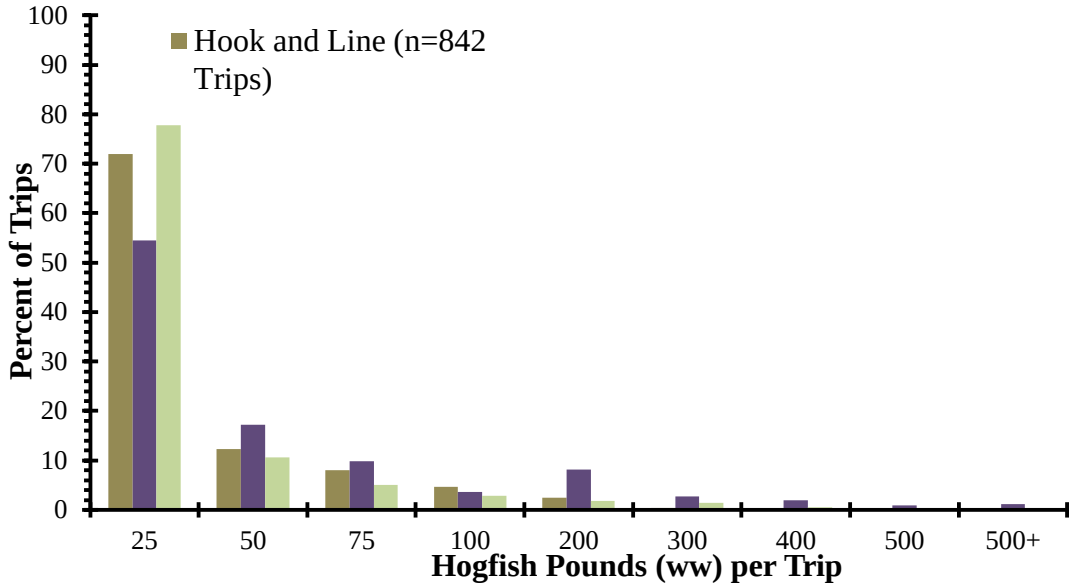


Figure 4.9.2. Distribution of commercially harvested hogfish per trip (lbs ww) by gear, from 2012 through 2014, in the South Atlantic. Note: The "Other" gear type consists of hogfish landings from gill nets, traps, and if the gear type was not provided in the commercial logbook dataset.
Source: Commercial logbook dataset accessed April 2, 2015.

More commercial trips (1,238) were observed for the FLK/EFL stock than in GA-NC (770) during 2012-2014, but GA-NC had higher pounds per trip (**Figure 4.9.3**). For GA-NC, 53% of the commercial trips landed 25 lbs ww or less per trip, 13% landed 50 lbs ww, 11% landed 75 lbs ww, 6% landed 100 lbs ww, 9% landed 200 lbs ww, 3% each landed 300 and 400 lbs ww, and 1% landed 500 lbs ww or more (**Figure 4.9.3**). In the FLK/EFL area, 72% of the commercial trips landed 25 lbs ww or less per trip, 15% landed 50 lbs ww, 7% landed 75 lbs ww, 3% (each) landed 100 and 200 lbs ww, and less than 1% landed 300 lbs ww or more (**Figure 4.9.3**).

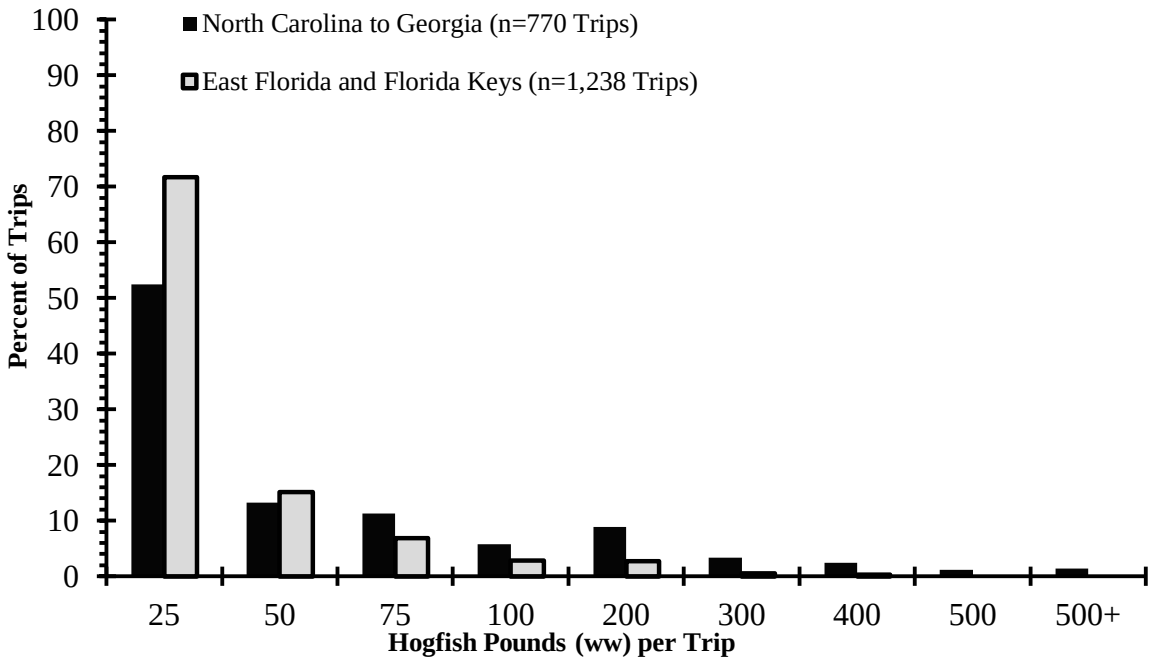


Figure 4.9.3. Distribution of commercially harvested hogfish per trip (lbs ww) by area (GA-NC and FLK/EFL) from 2012 through 2014.
Source: Commercial logbook dataset accessed April 2, 2015.

Percent decrease in landings by gear and for all gear types were calculated for the different trip limits considered under **Preferred Alternatives 2** and **3**. The results for GA-NC are shown in **Table 4.9.1** and the results for FLK/EFL are shown in **Table 4.9.2**.

Table 4.9.1. Percent decrease in landings by gear and for all gear, for various commercial hogfish trip limits for GA-NC.

Alternative 2; Trip Limit (lbs ww)	Hook and Line	Spear	All Gears (incl. hook-and-line, spear, gill nets, traps, etc.)
Sub-alternative 2a - 100	1.7%	38.5%	40.8%
Sub-alternative 2b - 250	0.1%	17.0%	17.4%
Sub-alternative 2c - 500	**0.0%**	**5.0%**	**5.0%**
Sub-alternative 2d - 750	0.0%	2.3%	2.3%
Sub-alternative 2e – No trip limit	0.0%	0.0%	0.0%

Source: South Atlantic commercial logbook data, 2012-2014.

Table 4.9.2. Percent decrease in landings by gear and for all gear, for various commercial hogfish trip limits for FLK/EFL.

Alternative 3; Trip Limit (lbs ww)	Hook-and-Line	Spear	All Gears (incl. hook-and-line, spear, gill nets, traps, etc.)
Sub-alternative 3a - 25	**7.7%**	**27.1%**	**42.1%**
Sub-alternative 3b - 50	4.3%	13.1%	21.9%
Sub-alternative 3c - 100	2.0%	3.8%	8.1%
Sub-alternative 3d - 150	1.4%	1.6%	4.3%
Sub-alternative 3e - 200	0.8%	1.1%	2.6%
Sub-alternative 3f – No trip limit	0.0%	0.0%	0.0%

Source: South Atlantic commercial logbook data, 2012-2014.

Sub-alternative 2a (100 lbs ww trip limit) would have the largest percent decrease in commercial landings for the GA-NC stock of hogfish, followed by **Sub-alternatives 2b** (250 lbs ww trip limit), and **Preferred Sub-alternative 2c** (500 lbs ww trip limit) (**Table 4.9.1**). This is expected, given that only 6% of the commercial trips during 2012-2014 landed 100 lbs ww, 9% landed 200 lbs ww, and only 1% landed 500 lbs ww or more (**Figure 4.9.3**).

Preferred Sub-alternative 3a (25 lbs ww trip limit) would result in the largest percent decrease in commercial landings for the FLK-EFL stock of hogfish, followed by **Sub-alternatives 3b** (50 lbs ww trip limit), **3c** (100 lbs ww trip limit), **3d** (150 lbs ww trip limit), and **3e** (200 lbs ww trip limit) (**Table 4.9.2**). This reflects **Figure 4.9.3**, which shows that most (72%) of the commercial trips landed 25 lbs ww or less per trip. **Sub-alternatives 2e** and **3f** propose no commercial trip limit for the GA-NC stock and the FLK/EFL stock, respectively. Since these two alternatives would not constrain and reduce harvest the percent decrease in commercial landings is zero.

A SARIMA model was fit to the average daily hogfish landings by month (1997 through 2014) to capture seasonal and non-seasonal trends in the data, especially the recent increasing

trend from 2011 through 2014 (**Figure 4.9.4**). This approach was deemed more appropriate than using an average of recent landings (see **Appendix X** for more details).

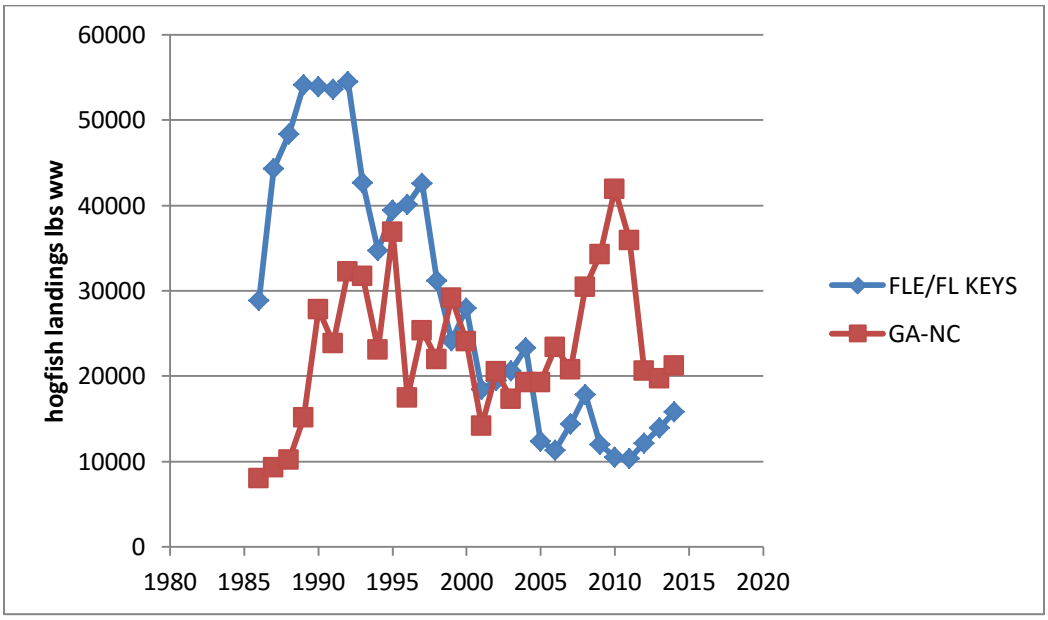


Figure 4.9.4. Annual commercial hogfish landings (lbs ww) by year and region.

The baseline landings used for the Georgia through North Carolina region were the average annual landings from 2012 through 2014. **Table 4.9.3** shows estimated commercial landings for the GA-NC stock in 2017 under all ACL alternatives (**Action 4**) using a combination of the minimum size limits (**Action 8**) and trip limits (**Action 9**).

The proposed (**Preferred Sub-alternative 2b** under **Action 4**) commercial ACL in 2017 for the GA-NC stock is 23,456 lbs ww (**Table 4.4.1** in **Action 4**). The landings under all size limit alternatives (**Action 8**) as well as trip limit alternatives in **Action 9** are estimated to be under this ACL (**Table 4.9.3**). Therefore, it is expected that none of the ACL alternatives would result in an in-season closure for the commercial sector of the GA-NC stock. The commercial season length under all combinations of alternatives is expected to be 365 (plus one if leap year) days. For **Preferred Alternative 2** and its sub-alternatives in **Action 9**, there would be little difference in estimated landings between **Sub-alternatives 2a** through **2e**.

Table 4.9.3. Estimated landings (lbs ww) in first year of implementation (2017) for GA-NC under the various minimum size limit (Action 8) and trip limit (Action 9) combinations*.

	Action 9 Trip Limit (lbs ww)				
Action 8 Size Limit (inches FL)	**100 (Alt 2a)**	**250 (Alt 2b)**	**500 (Alt 2c)**	**750 (Alt 2d)**	**No trip limit (Alt 2e)**
12 (Alt 1 – No Action)	11,745	16,554	**19,339**	19,951	20,534
16 (Alt2a)	11,672	16,450	**19,218**	19,826	20,406
17 (Pref Alt 2b)	11,513	16,226	**18,956**	19,556	20,128
18 (Alt 2c)	11,392	16,057	**18,758**	19,351	19,918
19 (Alt 2d)	11,095	15,637	**18,268**	18,846	19,398
20 (Alt 2e)	10,822	15,253	**17,820**	18,383	18,921
15/18/20 (Alt 2f**)	11,724	16,525	**19,305**	19,915	20,498

* This assumes that effort and catch rates will not change in response to management measures, only landings will change.

Note 1: Season length here will be 365 days +1 if leap year. Because season length will not be affected, and because there was minimal variability in monthly average prices, changes in landings and econ effects were modeled at the annual level only.

Note 2: Because the estimated landings are not expected to exceed even the most conservative ACL alternative, each trip limit/size limit combination is expected to have the same effect for all ACL alternatives.

Note 3: Trip limit and size limit alternatives will not be considered separately from action to form two management areas, NC to GA and East FL/FL Keys.

**Alt 2f in Action 8 uses a stepped approach to increasing the size limit with an increase to 15 inches in year 1, 18 inches in year 2, and 20 inches in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 15 inches size limit increase that would occur in year 1.

The estimated commercial fishing season length (days open) for the FLK/EFL stock of hogfish under the preferred ACL alternative in **Action 6**, combined with the size limits in **Action 8** and trip limits in **Action 9**, is shown in **Table 4.9.4**. Estimated landings are shown in similar fashion in **Table 4.9.5**. The alternatives with smaller trip limits obviously extend the commercial fishing season longer than the ones with larger trip limits, with no difference between **Alternative 1 (No Action)** and **Sub-alternative 3f** (**Table 4.9.4**). A commercial ACL of 3,510 lbs ww (**Preferred Sub-alternative 2b** in **Action 6**), size limit of 16 inches FL (**Preferred Sub-alternative 3c** in **Action 8**), and a trip limit of 25 lbs ww (**Preferred Sub-alternative 3a** in **Action 9)** would result in 181 commercial fishing days for the FLK-EFL stock. Biological effects under all the alternatives considered in **Action 9** would not differ significantly because there are ACLs and in-season AMs in place. The only difference between the alternatives in **Action 9** is the number of commercial fishing days.

Table 4.9.4. Estimated commercial season length (days open) for the FLK/EFL stock of hogfish under ACL **Preferred Alt 2b (3,510 lbs ww)** in Action 6 and different minimum size limit (Action 8) and trip limit (Action 9) alternatives in first year of implementation (2017). Preferreds indicated in bold.

Size Limit (FL inches)	No limit (Alt 1)	25 (Pref Alt 3a)	50 (Alt 3b)	100 (Alt 3c)	150 (Alt 3d)	200 (Alt 3e)
12 (Alt 1 - Status Quo)	58	92	71	62	59	59
14 (Alt 3a)	118	147	127	121	119	118
15 (Alt 3b)	127	159	136	129	127	127
16 (Pref Alt 3c)	131	**181**	141	133	131	131
17 (Alt 3d)	133	187	144	135	134	133
14/16 (Alt 3e*)	118	147	127	121	119	118

* Alt 3e in Action 8 is a step increase, with an increase to14 inches in year 1 and an increase to16 inches in year 3. Model uncertainty is such that year 3 predictions would be highly uncertain. As such, estimates are for year 1 only and match those associated with Alt 3a in Action 8.

Table 4.9.5. Estimated commercial landings (lbs ww) for the FLK/EFL stock of hogfish under ACL **Preferred Alt 2b (3,510 lbs ww)** in Action 6 and different minimum size limit (Action 8) and trip limit (Action 9) alternatives in first year of implementation (2017). Preferreds indicated in bold.

Size Limit (FL inches)	No limit (Alt 1 - Status Quo)	25 (Alt 3a)	50 (Alt 3b)	100 (Alt 3c)	150 (Alt 3d)	200 (Alt 3e)
12 (Alt 1 - Status Quo)	3,477	3,472	3,498	3,476	3,451	3,509
14 (Alt 3a)	3,477	3,504	3,482	3,476	3,490	3,463
15 (Alt 3b)	3,484	3,504	3,470	3,473	3,452	3,473
16 (Pref Alt 3c)	3,477	**3,501**	3,498	3,462	3,447	3,469
17 (Alt 3d)	3,468	3,506	3,504	3,444	3,509	3,459
14/16 (Alt 3e*)	3,477	3,504	3,482	3,476	3,490	3,463

* Alt 3e in Action 8 is a step increase, with an increase to14 inches in year 1 and an increase to16 inches in year 3. Model uncertainty is such that year 3 predictions would be highly uncertain. As such, estimates are for year 1 only and match those associated with Alt 3a in Action 8.

None of the preferred sub-alternatives in this action would result in a year-long commercial fishing season. Therefore, with an early closure, discards could be expected. However, as mentioned in **Appendix D** (BPA), the snapper grouper fishery represents many species occupying the same location at the same time. Thompson and Switzer (2015) reported on habitat selection and overlap in terms of location, abiotic, and habitat variables of six co-occurring species including gag, lane snapper, gray snapper, black sea bass, white grunt, and hogfish. Results showed that hogfish were the least sympatric with the co-occurring species, with gag and the snappers co-occurring much more commonly (Thompson and Switzer 2015). Bycatch of other snapper grouper species is incidental to hook-and-line fishing for hogfish, with no bycatch of other co-occurring species expected when spear is used to target hogfish. Therefore, detrimental effects of discards and bycatch are not expected from this action.

None of the alternatives under consideration for this action are expected to adversely impact species or critical habitat listed under the ESA. Establishing commercial trip limits for hogfish as addressed in this action would not alter the way in which the snapper grouper fishery is prosecuted in terms of gear types used or areas fished; nor would any of the alternatives substantially increase or decrease fishing effort. Therefore, no impacts on ESA-listed species or designated critical habitat thereof are anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area).

The proposed alternatives under this action would not alter the way the commercial portion of the snapper grouper fishery for hogfish is prosecuted. Furthermore, the gear predominantly used by hogfish commercial fishermen (spear and hook-and-line gear) are known to have minimal to no bycatch issues, and do little damage to physical or biogenic habitats (Blue Ocean 2010; Seafood Watch 2010). Therefore, no adverse effects on EFH, EFH-HAPCs, or Coral HAPCs are anticipated (see **Section 3.1** and **Appendix H** for a detailed description of EFH in the South Atlantic region).

4.9.2 Economic Effects

Generally, trip limits are not considered to be economically efficient because they require an increase in the number of trips and associated trip costs to land the same amount of fish. The fewer the number of trips that have to stop targeting hogfish because the trip limit has been reached would result in the least amount of direct negative economic effect. There are no specific trip costs available for average trip costs associated with either stock, therefore specific values associated with trip costs cannot be estimated.

The entire commercial sector ACL for the GA-NC stock is not expected to be landed under all of the sub-alternatives of **Preferred Alternative 2**. **Table 4.9.7** shows what percent of the ACL is expected to be landed and the expected ex-vessel revenue for each commercial trip limit. The ranking of **Sub-alternatives 2a** through **2e** in terms of least to most direct positive economic effect are **2a**, **2b**, **Preferred Sub-alternative 2c**, **2d**, and **2e/(Alternative 1-No Action)**.

Table 4.9.7. Expected percent of the ACL landed (**Action 2, Preferred Alternative 2b**) and commercial ex-vessel value (in 2014 $) of the trip limits proposed for the GA-NC stock.

	Trip Limit	Expected % of ACL Landed	Commercial Ex-vessel
Sub-alt. 2a	100 lbs	50%	$43,926
Sub-alt. 2b	250 lbs	71%	$61,912
Preferred 2c	**500 lbs**	**82%**	**$72,328**
Sub-alt. 2d	750 lbs	85%	$74,617
Sub-alt. 2e	No limit	88%	$76,797

The entire commercial sector ACL for the Florida Keys/Florida East Coast stock is expected to be caught under all of the sub-alternatives of **Preferred Alternative 3**. The only difference is the number of trips it is expected to take to catch the entire commercial sector ACL; therefore, there are no estimated differences in aggregate expected ex-vessel revenue among the sub-alternatives of **Preferred Alternative 3**. The lower the trip limit, the more likely some commercial vessels will be negatively affected. Lower trip limits may reduce profits through a reduction in efficiency and the severity of such impacts will be based on the overall dependence a vessel has on hogfish and the vessel's ability to substitute other species revenue.

4.9.3 Social Effects

Commercial fishermen in the communities identified in **Section 3.4** would likely be those affected by a change in the hogfish commercial trip limit. However, it is likely that fishermen who have targeted hogfish in recent years also target other species, and would be able to adjust their businesses to adapt to regulatory changes. In general, a commercial trip limit may help slow the rate of harvest, lengthen a season, and prevent the ACL from being exceeded, but trip limits that are too low may make fishing trips inefficient and too costly if fishing grounds are too far away. Additionally, if the trip limit is too low, the commercial ACL may not be met.

The magnitude of hogfish commercial landings in the South Atlantic is small (**Figures 4.9.1-4.9.3**), with a large majority of trips landing 25 lbs ww or less. While a trip limit may help to slow the rate of harvest by restricting landings for larger vessels, it is likely that establishing a trip limit under **Preferred Alternatives 2** and **3** would have minimal effects on commercial fishermen and associated communities. The social benefits of potentially extending the fishing season by slowing the rate of harvest and contributing to rebuilding goals for FLK/EFL hogfish would be most likely under the lower trip limits (**Sub-alternative 2a** and **Preferred Sub-alternative 3a**), and would be reduced as the trip limit increased. For the GA-NC stock, a higher trip limit as under **Sub-alternative 2b**, **Preferred Sub-alternative 2c**, followed by **Sub-alternative 2d** would allow flexibility for larger vessels or on trips with higher catches of hogfish. For the FLK/EFL stock, the higher trip limits in **Sub-alternatives 3b-3e** may provide the same flexibility to larger vessels but would likely have little effect on the commercial fleet because of the low catches of commercial hogfish per trip. The absence of a trip limit

(**Alternative 1 (No Action)**, **Sub-alternatives 2e** and **3f**) would likely have little effect on commercial fishermen in the short-term, but could result in negative effects in the future if some commercial vessels began targeting hogfish at higher levels.

4.9.4 Administrative Effects

Currently, there is no trip limit for the hogfish commercial sector (**Alternative 1, No Action**). **Sub-alternatives 2a, 2b, 2c (Preferred), 2d, 2e, 3a (Preferred), 3b, 3c, 3d, 3e,** and **3f** could add to the administrative burden in the form of cost, time, or law enforcement efforts because new commercial trip limits for the GA-NC and the FLK/EFL stocks would need to be monitored and enforced. However, even if the commercial ACLs are met under each of the proposed commercial trip limits under **Sub-alternatives 2a, 2b, 2c (Preferred), 2d, 2e, 3a (Preferred), 3b, 3c, 3d, 3e, and 3f**, the administrative resources required to implement in-season closures would not be much different from what is currently in place under **Alternative 1 (No Action)**. Higher trip limits could have slightly greater administrative effects because they increase the likelihood that the commercial ACL or quota would be met and a commercial closure would occur. **Sub-alternatives 2a, 2b, 2c (Preferred), 2d, 2e, 3a (Preferred), 3b, 3c, 3d, 3e, and 3f** would require notifying the commercial snapper grouper fishery and law enforcement personnel of an impending trip limit change for hogfish. Therefore, **Alternative 1 (No Action)** would be the least burdensome alternative compared to **Sub-alternatives 2a, 2b, 2c (Preferred), 2d, 2e, 3a (Preferred), 3b, 3c, 3d, 3e, and 3f**.

Action 10. Modify and/or establish recreational bag limits for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). The recreational bag limit is 5 fish per person per day in federal waters off east Florida and there is no recreational bag limit in federal waters off Georgia, South Carolina, and North Carolina.

Preferred Alternative 2. Establish a recreational bag limit for the GA-NC stock of hogfish.
Preferred Sub-alternative 2a. 2 fish per person per day.
Sub-alternative 2b. 1 fish per person per day.
Sub-alternative 2c. 1 fish per vessel per day.

Preferred Alternative 3. Modify the recreational bag limit for the FLK/EFL stock of hogfish.
Sub-alternative 3a. 3 fish per person per day.
Sub-alternative 3b. 2 fish per person per day.
Preferred Sub-alternative 3c. 1 fish per person per day.
Sub-alternative 3d. 1 fish per vessel per day.

4.10.1 Biological Effects

During 2012-2014, recreational landings (lbs ww) of hogfish were predominantly from Monroe County, Florida and East Florida, followed by North Carolina, Georgia/East Florida, and South Carolina (**Table 4.10.1**).

Alternative 1 (No Action) would maintain the 5 fish per person per day recreational bag limit for hogfish off Florida, with no recreational bag limit off Georgia, South Carolina, and North Carolina. Under **Preferred Alternative 2**, for the GA-NC stock of hogfish, **Sub-alternatives 2a (Preferred)** and **2b** would consider a 2 fish per person per day and 1 fish per person per day recreational bag limit, respectively, whereas **Sub-alternative 2c** would consider a 1 fish per vessel per day recreational bag limit.

Under **Preferred Alternative 3**, for the FLK/EFL stock of hogfish, **Sub-alternatives 3a**, **3b**, and **3c (Preferred)** would consider 3, 2, and 1 fish per person per day recreational bag limits, respectively, whereas **Sub-alternative 3d** would consider a 1 fish per vessel per day recreational bag limit.

Table 4.10.1. Recreational landings (lbs ww) of hogfish by state in the South Atlantic during 2012-2014.

Year	North Carolina	South Carolina	Georgia/East FL	East Florida	Monroe County	Total
2012	4,178	3	178	84,042	281,172	369,573
2013	825	5	255	63,998	92,768	157,852
2014	8	16	368	111,410	154,087	265,889
Average 2012-2014	**1,670**	**8**	**267**	**86,483**	**176,009**	**264,438**

Source: MRIP ACL dataset generated from the SEFSC on July 20, 2015.

MRIP catch and effort files from 2012 to 2014 were explored to determine recreational trips that harvested hogfish in the South Atlantic. Five hundred fifty-five recreational trips (194 MRIP and 361 Headboat trips) from North Carolina through Monroe County, Florida harvested hogfish. None of the headboat trips harvested more than 1 hogfish per person. The MRIP private and charter trips had 78% of the trips harvest 2 hogfish per person or less, 14% of the trips harvested 3-4 hogfish per person, and 8% of the trips harvested 5 hogfish or more per person (**Figure 4.10.1**).

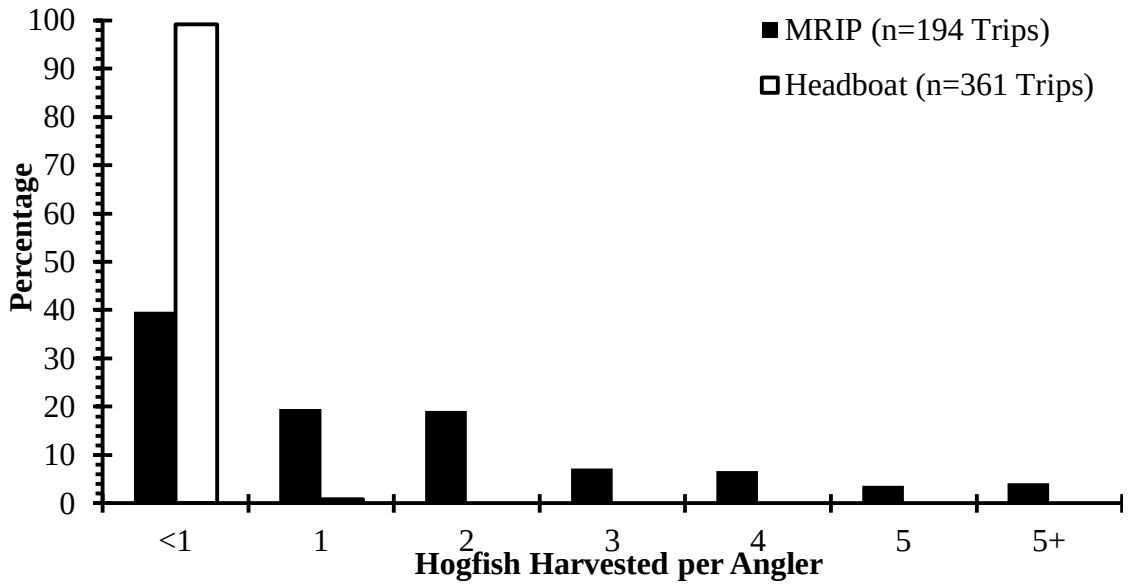


Figure 4.10.1. Distribution of hogfish harvested per person from two recreational datasets (MRIP and Headboat) during 2012-2014, in the South Atlantic.

Figure 4.10.2 shows the distribution of hogfish harvested per vessel during 2012-2014. Among headboats trips, 87% harvested 1 hogfish per vessel, 10% harvested 2 hogfish, 1% harvested 3 hogfish, and 2% harvested more than 5 hogfish per vessel. For the MRIP private and charter recreational trips, 19% harvested 1 hogfish per vessel, 34% harvested 2 hogfish per vessel, 19% harvested 4 hogfish per vessel, and 28% harvested more than 5 hogfish per vessel (**Figure 4.10.2**).

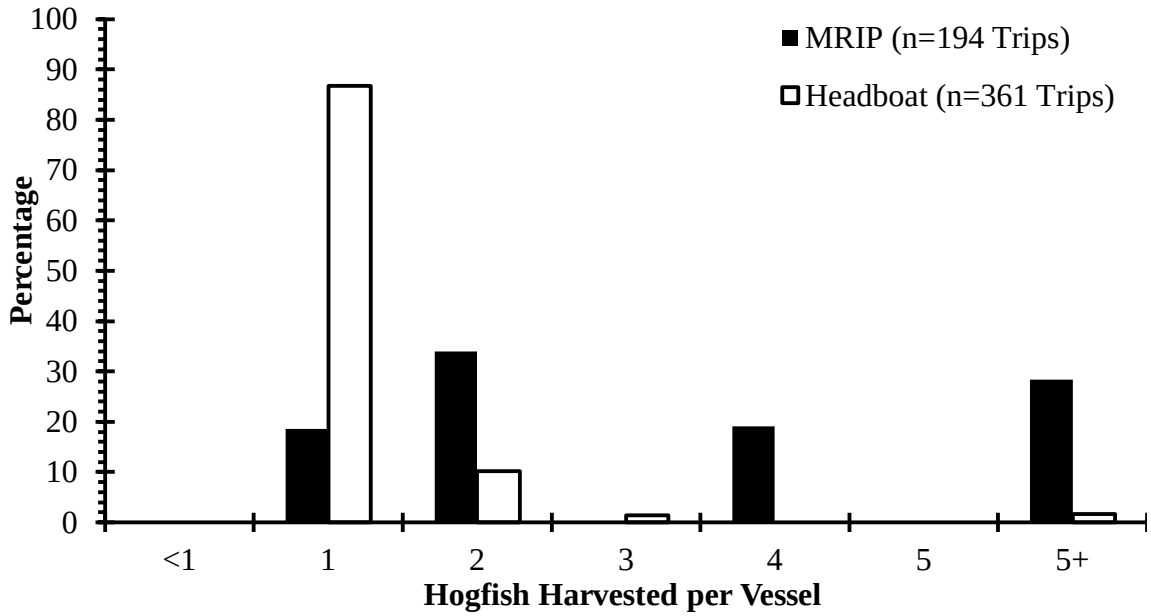


Figure 4.10.2. Distribution of hogfish harvested per vessel from two recreational datasets (MRIP and Headboat) during 2012-2014, in the South Atlantic.

Reductions in landings from the proposed bag limits in **Preferred Alternatives 2** and **3** (and their sub-alternatives) were calculated. A discard mortality of 10% (SEDAR 37 2014) was applied to the bag limit analysis. The majority of the MRIP trips from 2012-2014 harvested hogfish were with spearfishing gear (56%, n=109 trips). Discard mortality for spearfishing trips was assumed to be zero because spearfishing is very selective and any reduction in bag limit would result in the spearing of fewer fish. For example, if the bag limit is reduced from five to three fish, then spear fishermen would focus their efforts to only spear three fish, and it is assumed the spear fishermen would not spear five fish and then release two in the water.

The calculated percent decrease in landings for the bag limits under consideration are shown by mode in **Table 4.10.2**. There were no calculated reductions in landings for headboat bag limits per person because there were no trips in 2012 to 2014 that harvested more than one hogfish per person. The percent decrease in landings from the bag limits per person from North Carolina to Georgia was very small, because only 5% (n=9 trips) of the MRIP trips occurred from North Carolina to Georgia from 2012 to 2014. In both regions, the bag limits per vessel had higher reductions because this would restrict the catch to only one hogfish per trip for the entire vessel.

Table 4.10.2. Estimated percent decrease in recreational landings from decreasing the bag limit in the South Atlantic. Percent decrease in landings is presented by mode for the GA-NC and FLK/EFL stocks were from 2012 through 2014.

Bag Limit	MRIP		Headboat
	Charter	Private	
North Carolina to Georgia Preferred Alternative 2			
2 per Person (Sub-alternative 2a)	**0%**	**0%**	**0%**
1 per Person (Sub-alternative 2b)	0%	0%	0%
1 per Vessel (Sub-alternative 2c)	33%	75%	41%
Florida Keys/East Florida Preferred Alternative 3			
3 per Person (Sub-alternative 3a)	3%	12%	0%
2 per Person (Sub-alternative 3b)	10%	24%	0%
1 per Person (Sub-alternative 3c)	**22%**	**45%**	**0%**
1 per Vessel (Sub-alternative 3d)	93%	98%	32%

Source: NMFS SERO

For the GA-NC stock, there would be no percent decrease in recreational landings under **Preferred Sub-alternative 2a** (2 fish per person) for private, charter, and headboat (**Table 4.10.2**), because most of the recreational harvest of hogfish is from the FLK/EFL stock (**Table 4.10.1**). At the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b** under **Action 8**), a 2 fish per person per day recreational bag limit would result in about 42% the proposed recreational ACL being landed. (**Table 4.10.3**). Projected landings vary only slightly for the proposed bag limit sub-alternatives. In terms of biological effects, there would be no difference among the sub-alternatives under **Preferred Alternative 2** since ACLs and AMs are in place to prevent overfishing.

Table 4.10.3. Projected recreational landings for the GA-NC hogfish stock for various ACL (Action 4), preferred minimum size limit (17 inches FL) and estimated percent of ACL landed under proposed bag limit alternatives. Preferreds indicated in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Percent of ACL landed
Alt 2a	**17**	**2 Fish/Angler**	N/A	365	411	40
Pref Alt 2b			**N/A**	**365**	**411**	**42**
Alt 2c			N/A	365	411	44
Alt 2a	17	1 Fish/Angler	N/A	365	410	39
Pref Alt 2b			N/A	365	410	41
Alt 2c			N/A	365	410	44
Alt 2a	17	1 Fish/Vessel	N/A	365	122	12
Pref Alt 2b			N/A	365	122	12
Alt 2c			N/A	365	122	13

For FLK/EFL stock, there would be no decrease in harvest for headboats under **Preferred Sub-alternative 3c** (1 fish per person) but a 22% decrease in landings for the charter mode and a 45% decrease in private recreational landings (**Table 4.10.2**). For charter and private modes, **Sub-alternative 3d** would have the largest percent decrease, followed by **Sub-alternative 3c (Preferred)**, **3b**, and **3a** (**Table 4.10.2**). The percent reductions in landings are higher for the private mode than the charter mode calculations because private recreational anglers harvest more hogfish per vessel compared to headboats (**Figure 4.10.2**). These data are presented by month in Table 4 of **Appendix X.**

The proposed recreational annual catch limit (ACL) for the FLK/EFL stock would be expected to be met under every sub-alternative for **Preferred Alternative 3** except **Sub-alternative 3d** under the preferred minimum size limit of 16 inches FL **(Table 4.10.4)**. There would be little biological difference in the sub-alternatives because ACLs and accountability measures (AMs) are in place to ensure overfishing does not occur. The effect of the various sub-alternatives would result in variations in the length of time that the recreational sector was open during the fishing year. For the preferred recreational ACL for the FLK/EFL stock of hogfish and at the preferred minimum size limit of 16 inches FL, the recreational season would be expected to close on July 1 under the current calendar fishing year. This combination of size and bag limit alternatives results in the second longest opening for the recreational sector; recreational harvest is projected to remain open 6 day longer under the slightly higher ACL under **Sub-alternative 2a** of **Action 6**. Being the most restrictive at 1 fish per vessel per day, **Sub-alternative 3d** is expected to result in no in-season closure for the recreational sector (**Table 4.10.4**).

Table 4.10.4. Estimated landings and projected closure dates for recreational under proposed bag limit alternatives for the FLK/EFL hogfish stock at the preferred minimum size limit of 16 inches under Action 8 for all ACL alternative (Action 6). Preferreds indicated in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Open Days	Landings (numbers)	Removals (numbers)
Alt 2a	16	5 Fish	8-Apr	98	16,477	22,428
Pref Alt 2b			5-Apr	95	15,669	21,641
Alt 2c			2-Apr	92	14,860	20,855
Alt 2a	16	3 Fish	15-Apr	105	16,293	22,248
Pref Alt 2b			12-Apr	102	15,581	21,556
Alt 2c			8-Apr	98	14,632	20,633
Alt 2a	16	2 Fish	26-Apr	116	16,346	22,300
Pref Alt 2b			22-Apr	112	15,527	21,503
Alt 2c			18-Apr	108	14,707	20,706
Alt 2a	**16**	**1 Fish**	7-Jul	188	16,401	22,353
Pref Alt 2b			**1-Jul**	**182**	**15,625**	**21,599**
Alt 2c			15-Jun	166	14,848	20,843
Alt 2a	16	1 per Vessel	N/A	365	482	6,871
Pref Alt 2b			N/A	365	482	6,871
Alt 2c			N/A	365	482	6,871

Reducing the recreational bag limits would not be expected to increase discards, however, as shown in the analysis presented earlier in this section. Most recreational anglers rarely harvest more than 1-2 hogfish per person; therefore, decreasing the recreational bag limit is not expected to result in an increase in discards and bycatch of hogfish. For more information, see **Appendix D** (BPA).

None of the alternatives under consideration for this action are expected to adversely impact species or critical habitat listed under the ESA. Establishing recreational bag limits for hogfish as addressed in this action would not alter the way in which the snapper grouper fishery is prosecuted in terms of gear types used or areas fished; nor would any of the alternatives substantially increase or decrease fishing effort. Therefore, no impacts on ESA-listed species or designated critical habitat thereof are anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area).

The proposed alternatives under this action would not alter the way the recreational portion of the snapper grouper fishery for hogfish is prosecuted. Furthermore, the gear predominantly used by hogfish recreational fishermen (spear) is known to have minimal to no bycatch issues, and do little damage to physical or biogenic habitats (Blue Ocean 2010; Seafood Watch 2010). Therefore, no adverse effects on EFH, EFH-HAPCs, or Coral HAPCs are anticipated (see **Section 3.1** and **Appendix H** for a detailed description of EFH in the South Atlantic Region).

4.10.2 Economic Effects

Individual recreational anglers who catch hogfish from the GA-NC stock rarely catch more than one fish. This is evident when comparing the expected total consumer surplus **Alternative 1 (No Action)** and **Sub-alternatives 2a** and **2b** as shown in **Table 4.10.4**. However, it appears that if one angler on a vessel catches at least one hogfish, others on the vessel will do the same as there is a large drop in the expected recreational consumer surplus between 1 fish per person per day (**Sub-alternative 2b**) and 1 fish per vessel per day (**Sub-alternative 2c**). In terms of least to highest expected positive direct economic effects for the GA-NC stock are **Sub-alternative 2c** (1 fish/ vessel/day), **2b** (1 fish/person/day), and **Preferred Sub-alternative 2a** (2 fish/person/day)/**Alternative 1 (No Action)** (No bag limit).

Table 4.10.4. Expected recreational consumer surplus (in 2014 $) for **Alternative 2** proposed bag limits.

	Bag Limit	Landings (Numbers)	Recreational CS
Alternative 1	No bag limit	431	$5,331
Preferred 2a	**2 fish/person/day**	**431**	**$5,331**
Sub-alt. 2b	1 fish/person/day	429	$5,307
Sub-alt. 2c	1 fish/vessel/day	134	$1,658

Source: Hogfish Recreational Decision Tool, **Appendix X**

The sub-alternatives of **Alternative 3** (FLK/EFL stock) would establish a recreational trip limit that would be more restrictive than the current five fish per person limit (**Alternative 1 (No Action)**). Under (**Alternative 1 (No Action)**) and each **Alternative 3** sub-alternative except (**Sub-alternative 3d**), the entire recreational sector portion of the ACL is expected to be caught rather quickly. Historically, most recreational hogfish trips in FLK/EFL stock would be affected by the sub-alternatives of **Alternative 3** as shown in **Table 4.10.5**. In terms of least to highest expected positive direct economic effects for the Florida Keys/Florida East Coast stock would be **Sub-alternative 3d** (1 fish/vessel/day), **3a** (3 fish/person/day), **Alternative 1 (No Action)** (5 fish/person/day), **Sub-alternative 3b** (2 fish/person/day), and, **Preferred Sub-alternative 3c** (1 fish/person/day).

Table 4.10.5. Expected recreational consumer surplus (in 2014 $) for **Alternative 3** proposed bag limits.

	Bag Limit	**Landings (Numbers)**	**Recreational CS**
Alternative 1	5 fish/person/day	15,415	$190,684
Sub-alt. 3a	3 fish/person/day	15,395	$190,436
Sub-alt. 3b	2 fish/person/day	15,633	$193,380
Preferred 3c	**1 fish/person/day**	**15,647**	**$193,553**
Sub-alt. 3d	1 fish/vessel/day	1,769	$21,883

Source: Hogfish Recreational Decision Tool, **Appendix X**

4.10.3 Social Effects

In general, the social effects of modifying the recreational bag or vessel limit would be a trade-off between longer seasons under lower bag limits, and the negative effects on recreational fishing opportunities because the bag limit is too low. While **Preferred Alternatives 2** and **3** would limit recreational fishing opportunities for hogfish by changing the recreational fishing experience by restricting the number of hogfish that can be kept, the season will also likely be longer because the rate of harvest would be slower.

Different levels of recreational fishing opportunities under each alternative could affect recreational anglers and for-hire businesses targeting hogfish. The social effects of bag limits can be associated with how many and at what times of year the recreational catch may be retained. Additionally, any long-term negative biological effects on the stock due to recreational landings from higher bag limits, or dead discards due to lower bag limits, would also likely result in negative effects of recreational fishing opportunities in future years.

In general, social benefits from improved recreational fishing opportunities would result from a bag limit that has the largest portion of the year open to recreational harvest, with the highest number of fish per person, as long as the recreational ACL is not exceeded and there is no in-season closure or post-season payback. **Alternative 1 (No Action)** would be the most beneficial to recreational fishermen in the short-term but could detract from measures to rebuild the FLK/EFL stock and sustain the GA-NC stock. For the GA-NC stock, **Sub-alternative 2c** would be the most restrictive by designating a vessel limit of one fish, and would in particular be expected to negatively affect private recreational anglers (**Table 4.10.2**). **Preferred Sub-alternative 2a** and **Sub-alternative 2b** would be expected to have little or no effects on recreational fishing opportunities, similar to **Alternative 1 (No Action)**.

For the FLK/EFL stock, the most restrictive recreational limit (**Sub-alternative 3d**) may eliminate recreational fishing opportunities for charter and private recreational anglers (**Table 4.10.2**). Less restrictive recreational limits in **Sub-alternative 3a, 3b** and **3c (Preferred)** and **Alternative 1 (No Action**) would improve benefits to the recreational sector and associated businesses, but may also shorten the fishing season under the recreational ACL specified in **Action 6**.

4.10.4 Administrative Effects

Under **Alternative 1 (No Action)**, there would be no recreational bag limit in three out of four states in the South Atlantic region for hogfish. **Sub-alternatives 2a (Preferred), 2b, 2c, 3a, 3b, 3c (Preferred), and 3d** would add to the administrative burden in the form of cost, time, law enforcement efforts, and informing the public, when compared with **Alternative 1 (No Action)**. However, consistent regulations help avoid confusion with the public and aid law enforcement, which reduces the administrative burden in the long term.

Action 11. Establish a recreational fishing season for the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). There is no recreational fishing season for hogfish in the South Atlantic. The recreational fishing year for hogfish is January 1 through December 31.

Preferred Alternative 2. Establish a recreational fishing season for the FLK/EFL stock of hogfish in the South Atlantic region.

Sub-alternative 2a. May-June
Sub-alternative 2b. July-August
Sub-alternative 2c. July-September
Preferred Sub-alternative 2d. July-October

4.11.1 Biological Effects

Davis (1976), Colin (1982), Claro et al. (1989), McBride and Johnson (2007), Collins and McBride (2008) and, Munoz et al. (2010) indicated that spawning activity of hogfish occurs predominantly during December through April, and begins (and ends) slightly earlier in the Florida Keys than on the West Florida shelf.

Hogfish are protogynous; all fish mature first as females first, and eventually become male, if they live long enough. A single male maintains harems of 5 to 15 females (Colin 1982, Munoz et al. 2010) during extended spawning seasons that last for months. Hogfish are pair spawners (Davis 1976, Colin 1982), and spawning occurs daily during the spawning season (McBride and Johnson 2007, Collins and McBride 2008, Munoz et al. 2010). Sex change can take several months (McBride and Johnson 2007), so removal of the dominant male has the potential to significantly affect harem stability and decrease reproductive potential (Munoz et al. 2010).

Average recreational landings of hogfish throughout the South Atlantic during 2012-2014 peak in July and August and decrease markedly thereafter (**Figure 4.11.1**).

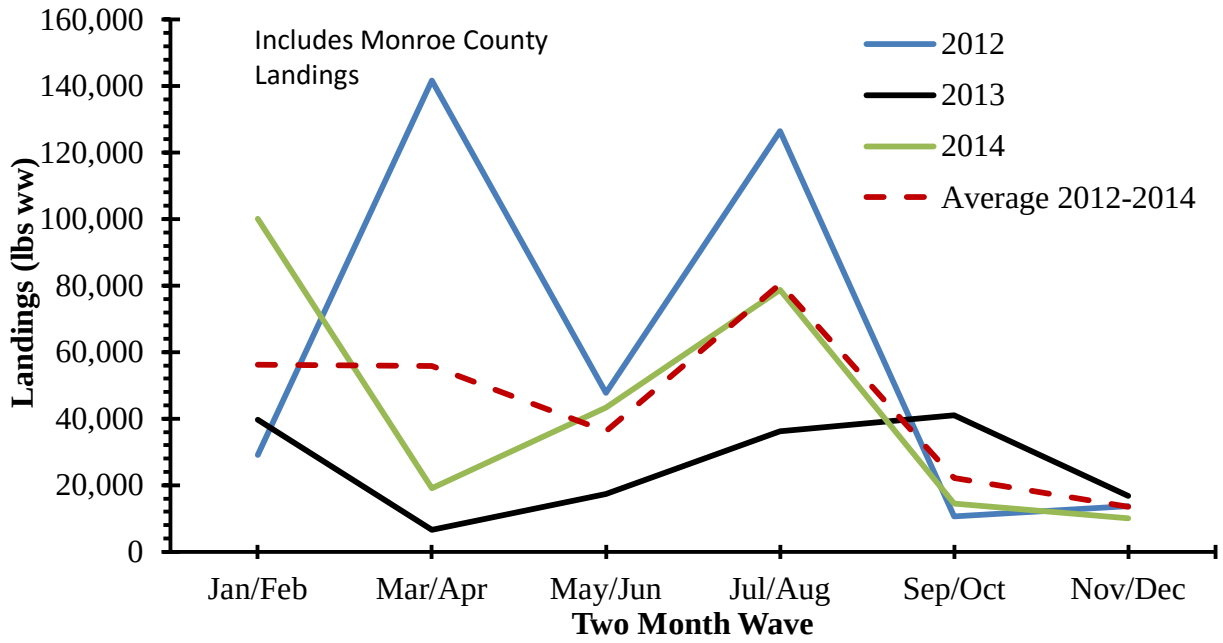


Figure 4.11.1. Recreational landings (lbs ww) by two-month waves during 2012-2014 for the South Atlantic Region, including Monroe County, Florida.

Alternative 1 (No Action) would not establish a recreational fishing season. **Preferred Alternative 2** considers establishing a recreational fishing season of May-June (**Sub-alternative 2a**), July-August (**Sub-alternative 2b**), July-September (**Sub-alternative 2c**) and July-October (**Preferred Sub-alternative 2d**). **Table 4.11.1** shows when the recreational sector would close, how many days would be open, the landings and percent of the recreational ACL that would be expected to be landed at the preferred minimum size and bag limit options: 16 inches FL (**Preferred Sub-alternative 3c** in **Action 8**) and a 1 per person per day recreational bag limit (**Preferred Sub-alternative 3c** in **Action 10**).

Table 4.11.1. Projected landings and percent of recreational ACL that would be landed under preferred ACL, minimum size limit (16 inches FL), and bag limit (1 fish/angler/day) alternatives for the recreational season alternatives in Action 11. Preferreds indicated in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Season	Landings (numbers)	Percent of ACL landed
Alt 2a	16	1 Fish/Angler	No closure	May-Jun	2,634	16
Pref Alt 2b			No closure	May-Jun	2,634	17
Alt 2c			No closure	May-Jun	2,634	18
Alt 2a	16	1 Fish/Angler	No closure	Jul-Aug	8,016	49
Pref Alt 2b			No closure	Jul-Aug	8,016	51
Alt 2c			No closure	Jul-Aug	8,016	54
Alt 2a	16	1 Fish/Angler	No closure	Jul-Sep	8,985	54
Pref Alt 2b			No closure	Jul-Sep	8,985	57
Alt 2c			No closure	Jul-Sep	8,985	60
Alt 2a	**16**	**1 Fish/Angler**	No closure	Jul-Oct	9,987	60
Pref Alt 2b			**No closure**	**Jul-Oct**	**9,987**	**64**
Alt 2c			No closure	Jul-Oct	9,987	67

Source: NMFS SERO

The biological effects of the proposed sub-alternatives would be neutral because fishing would occur outside of the spawning season, and ACLs and accountability measures (AMs) would ensure overfishing does not occur. Compared to **Alternative 1 (No Action)**, all of the proposed sub-alternatives would impart biological benefit because **Alternative 1 (No Action)** would allow fishing to occur during the spawning season.

Preferred Sub-alternative 2d in **Action 11** would reduce the recreational fishing season to four months and could lead to an increase in discards; however, hogfish are primarily targeted with spearfishing gear, which is very selective and results in very low discards. Additionally, hogfish are not caught with co-occurring species, as is the case with other species in the snapper grouper complex. Therefore, an increased level of discards is not expected from this action (see **Appendix D**, BPA, for more details).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.11.2 Economic Effects

The economic effects of establishing a set recreational season for hogfish would depend on several factors. The factors would include whether or not the season was restrictive enough to

keep the recreational ACL from being exceeded or if the season was too restrictive and unnecessarily restricting access to the resource, thus preventing achievement of optimum yield.

Under each of the alternatives/sub-alternatives of **Action 11** the recreational season for hogfish would last less than one two-month MRIP wave based on **Action 6**, **Preferred Alternative 2**, **Preferred Sub-alternative 2b**. **Table 4.11.2** shows what the expected consumer surplus would be for each of the proposed recreational fishing seasons. The differences in consumer surplus as calculated by the Recreational Decision Tool (**Appendix X**) largely depend on heterogeneous wave-level daily catch rates. Additionally, the differences in consumer surplus among the **Alternative 2 (Preferred)** sub-alternatives depend on when the in-season closure is triggered. **Sub-alternative 2b** and **Preferred Sub-alternative 2c** both have the same start date and projected date of reaching the recreational sector ACL at the end of July, hence the same expected consumer surplus values.

Table 4.11.2. Expected recreational consumer surplus (in 2014 $) for season lengths proposed by Action 11, **Preferred Alternative 2** and its sub-alternatives.

	Season	Landings (Numbers)	Recreational CS
Alternative 1	All year season	15,677	$193,924
Sub-alt. 2a	May-June	15,478	$191,463
Sub-alt. 2b	July-August	15,667	$193,801
Preferred 2c	July-September	15,667	$193,801

Source: Hogfish Recreational Decision Tool, **Appendix ??**

In each case, the sub-alternatives of **Alternative 2** are more restrictive than **Alternative 1 (No Action)**. However, depending on how quickly the recreational sector ACL is expected to be caught, it is impossible to know whether setting an exact season is more beneficial to the recreational sector because of the delay related to processing MRIP landings estimates. Too long of a delay in closing the recreational sector could result in very large overages and shortened future seasons. Until there is analysis of the sub-alternatives of **Alternative 2**, it will not be known whether setting a fixed season, or which fixed season is most appropriate for either the GA-NC or FLK/EFL hogfish stocks.

The expected differences in CS between the alternatives/sub-alternatives of **Action 11** are negligible at only 1-2% difference among them. From least to greatest positive direct economic effects are **Sub-alternative 2a**, **Sub-alternative 2b/Preferred Sub-alternative 2c**, and **Alternative 1 (No Action)**.

4.11.3 Social Effects

Hogfish is an important recreational species in some areas of the South Atlantic, particularly in South Florida and the Florida Keys (see **Section 3.4**). Imposing a recreational season on the FLK/EFL stock could change the level of access to hogfish during periods when hogfish are available and when participation in the fishery is highest. However, long-term biological

benefits of maintaining a healthy stock would contribute to future fishing opportunities for both the commercial and recreational sectors.

The social effects of **Sub-alternatives 2a-2d (Preferred)** under **Preferred Alternative 2** compared to **Alternative 1 (No Action)** will depend on when recreational effort is the highest for FLK/EFL hogfish, and how the proposed recreational limits in **Action 10** will work under the proposed ACLs in **Actions 4** and **6**. Because hogfish is an important recreational species for south Florida and particularly the Florida Keys, it is likely that any restriction on time for recreational harvest under **Preferred Alternative 2** may have negative effects on recreational fishing opportunities.

As shown in **Table 4.11.1**, the combination of a bag limit and recreational season would result in the longest expected season under **Sub-alternative 2c** when compared to season length in **Alternative 1 (No Action)** and **Sub-alternatives 2a** and **2b**. It should be noted that specifying only two months during which recreational harvest would be allowed (**Sub-alternatives 2a** and **2b**) could result in recreational landings not reaching the recreational ACL as designated in **Action 6**.

Because the expected closure date under **Sub-alternative 2c** is before the end of September (**Table 4.11.1b**) when incorporating the potential ACLs and bag limits, it can be assumed that the expected closure date under **Preferred Sub-alternative 2d** would be the same. Therefore there would be no major differences in the effects on recreational fishing opportunities between **Sub-alternative 2c** and **Preferred Sub-alternative 2d** under the current expected restrictions and fishery conditions. However, under **Preferred Sub-alternative 2d**, an additional month would be beneficial for recreational fishing opportunities if there is a future increase in the recreational ACL that allowed a longer fishing season.

4.11.4 Administrative Effects

Sub-alternatives 2a, **2b**, **2c**, and **2d** (**Preferred)** could increase administrative costs compared to **Alternative 1 (No Action)** as these alternatives would establish a recreational fishing season with a closure of the recreational sector for the months of January through June, and October through December. However, an in-season closure would also be expected under the **Alternative 1 (No Action)**. Therefore, the administrative effects could be similar between **Alternatives 1 (No Action)** and **Sub-alternatives 2a, 2b, 2c, and 2d (Preferred)**. The administrative effects of **Sub-alternatives 2a, 2b, 2c, and 2d (Preferred)** would be greater than **Alternative 1 (No Action)** since the fishing season is only specified for a specific time of the year versus a year-round fishing season. Changing the fishing season under **Sub-alternatives 2a, 2b, 2c, and 2d (Preferred)** would add to the administrative burden in the form of cost, time, and law enforcement efforts.

Action 12. Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). Current commercial and recreational AMs apply to hogfish throughout the South Atlantic Council's area of jurisdiction.

Preferred Alternative 2. If commercial landings reach or are projected to reach the commercial annual catch limit (ACL), NMFS would close the commercial sector for the remainder of the fishing year. On and after the effective date of such a notification, all sale or purchase is prohibited and harvest or possession of hogfish in or from the EEZ would be limited to the recreational bag and possession limit. Additionally, if the commercial ACL is exceeded, NMFS would reduce the commercial ACL in the following fishing year by the amount of the commercial overage, only if hogfish is overfished **and** the total ACL (commercial ACL and recreational ACL) of the respective stock is exceeded.

Preferred Sub-alternative 2a. For the GA-NC stock of hogfish.

Preferred Sub-alternative 2b. For the FLK/EFL stock of hogfish.

Preferred Alternative 3. If recreational landings reach or are projected to reach the recreational ACL, NMFS would close the recreational sector for the remainder of the fishing year, unless, using the best scientific information available, NMFS determines that a closure is unnecessary.

Sub-alternative 3a. For the GA-NC stock of hogfish if the stock is overfished.

Preferred Sub-alternative 3b. For the GA-NC stock of hogfish regardless of stock status.

Sub-alternative 3c. For the FLK/EFL stock of hogfish if the stock is overfished.

Preferred Sub-alternative 3d. For the FLK/EFL stock of hogfish regardless of stock status.

Preferred Alternative 4. If recreational landings exceed the recreational ~~annual catch limit (~~ACL~~)~~, then during the following fishing year, recreational landings will be monitored for a persistence in increased landings. If necessary, NMFS would reduce the length of fishing season and the recreational ACL in the following fishing year by the amount of the recreational overage, only if the species is overfished **and** the total ACL (commercial ACL and recreational ACL) of the respective stock is exceeded. The length of the recreational season and recreational ACL will not be reduced if NMFS determines, using the best scientific information available, that a reduction is unnecessary.

Preferred Sub-alternative 4a. For the GA-NC stock of hogfish.

Preferred Sub-alternative 4b. For the FLK/EFL stock of hogfish.

4.12.1 Biological Effects

Accountability measures (AMs) for hogfish were revised through Amendment 34 to the Snapper Grouper FMP (effective February 22, 2016). A revision to the AMs for hogfish and

many other snapper grouper species was necessary to create a consistent regulatory environment while preventing unnecessary negative socio-economic impacts, and prevent overfishing. Subsequent to the reauthorization of the Magnuson-Stevens Act in 2007, the South Atlantic Council established AMs for managed species over the next several years through various amendments to the Snapper Grouper FMP. Consequently, inconsistencies in the regulatory language arose creating some confusion. Through implementation of Amendment 34 (SAFMC 2015); however, the South Atlantic Council has brought consistency in the management response to meeting or exceeding established annual catch limits (ACLs) for snapper grouper species.

As Amendment 34 was being developed, however, work was underway to determine the stock structure of hogfish (Seyoum et al. 2015). Since a splitting of the hogfish stock within the South Atlantic Council's area of jurisdiction is being proposed in this amendment (**Action 1**), action must be also taken to specify AMs for each of the two hogfish stocks.

Under **Alternative 1 (No Action)**, the current AMs for both the commercial and recreational sectors of hogfish would continue to apply to the South Atlantic Council's entire jurisdiction area, which does not adhere to the best scientific information available as recommended in SEDAR 37 (2014), and is therefore, not a viable alternative. For the commercial sector, the payback provision under **Preferred Alternative 2** would be triggered infrequently, because the payback would only be required if two criteria are met: (1) hogfish is overfished *and* the total ACL has been exceeded. At this time, the likelihood of both of these scenarios taking place at the same time for the GA-NC stock of hogfish is zero, since the status of the stock is unknown. As such, **Preferred Sub-alternative 2a** is the least biologically advantageous alternative for the GA-NC stock of hogfish because a commercial payback would never be triggered, even when it was biologically needed. For the FLK/EFL stock of hogfish, while the likelihood of both of these scenarios taking place at the same time is small, one of the two criteria to trigger a commercial payback has already been met as the stock is overfished. Hence, **Preferred Sub-alternative 2b** may impart biological benefits to the FLK/EFL stock. However, since **Preferred Alternative 2** would prohibit harvest in-season if the commercial ACLs for the respective hogfish stock was met or was projected to be met, overages of the total ACL (commercial and recreational combined) would be unlikely.

Preferred Alternatives 3 and **4** (and their respective sub-alternatives) would apply to the recreational sector. **Preferred Sub-alternatives 3b** and **3d** would trigger an in-season closure for the GA-NC stock and the FLK/EFL stock, respectively, regardless of stock status. These sub-alternatives have the potential to impart biological benefits to both stocks compared to **Sub-alternatives 3a** and **3c** since an overfished determination would not be needed to trigger a closure and thus ACL overages would be avoided. Under **Preferred Sub-alternatives 4a** and **4b**, if the recreational ACL is exceeded, recreational landings during the following year would be monitored for persistence in increased landings. If necessary, the recreational season *and* the recreational ACL would be reduced the following fishing year but only if the respective hogfish stock is overfished and the total ACL (commercial + recreational) is exceeded. In this respect, **Preferred Sub-alternatives 4a** and **4b** are almost identical to **Preferred Sub-alternatives 2a** and **2b** for the commercial sector; however, the Regional Administrator would determine, based

upon the best scientific information available, whether a payback is actually needed. The Regional Administrator may determine that a payback is not needed in a case where the combined total ACL has been met and the species is overfished, but an ongoing stock assessment indicates the species, or a species in a species group, is no longer overfished; or if ACL overages are shown to be caused by increased rates of harvest due to increasing stock abundance rather than increased fishing effort. Thus, **Preferred Sub-alternatives 4a** and **4b** would maintain the ability of the Regional Administrator to interpret landings data to determine whether a payback is needed. However, these sub-alternatives would all allow the payback to take the form of a recreational ACL reduction *and* a season length reduction, compared to **Alternative 1 (No Action)**, which only allows for a season length reduction as a form of payback for the entire area under the South Atlantic Council's jurisdiction. However, **Preferred Alternative 3** and all its sub-alternatives would allow the Regional Administrator to close the recreational sector when the recreational ACL for the respective hogfish stock is met or projected to be met. Therefore, if in-season closures are implemented when needed to prevent recreational ACLs from being exceeded, the need to initiate an ACL payback the following year would be greatly reduced.

Since **Preferred Alternatives 2** and **3** would prohibit commercial and recreational harvest in-season if the sector ACLs were met or were projected to be met and since overages of the total ACL (commercial and recreational combined) would be unlikely to occur, significant biological impacts, beneficial or adverse, on the GA-NC and FLK/EFL stocks of hogfish are not expected.

The in-season closures if the commercial and recreational ACLs are exceeded as well as payback measures proposed in these preferred sub-alternatives would be expected to prevent ACLs from exceeding, hence helping reduce discards (see **Appendix D**, BPA, for more details on bycatch and discards).

None of the alternatives considered under this action would significantly alter the way in which the hogfish portion of the snapper grouper fishery is prosecuted in the South Atlantic EEZ. No adverse impacts on endangered or threatened species are anticipated because of this action; nor are any adverse impacts on EFH or EFH HAPC including corals, sea grasses, or other habitat types expected because of this action.

4.12.2 Economic Effects

In general, AMs help ensure that ACLs are not exceeded, particularly on a consistent basis. Exceeding an ACL on a consistent basis presents a high likelihood of overfishing which could possibly derail a rebuilding strategy adopted for an overfished stock or even drive an otherwise healthy stock to being overfished. Once overfishing occurs, or a stock become overfished, and more restrictive regulations are adopted, affected fishers could redirect their effort to other species that could also experience overfishing or be overfished over time. This could eventually trigger untoward repercussions on the ecological environment for a stock and other associated species. Incorporating paybacks in AMs may not eliminate the occurrence of overages but it does decrease the likelihood that overages (and overfishing) would occur over time.

Action 12 considers alternatives that would modify AMs for hogfish which had recently been modified in Snapper Grouper Amendment 34 (2015). Under **Alternative 1 (No Action)**, the current AMs in place for these species would not be modified. **Preferred Alternative 2** specifies the same conditions that would require paybacks of overages in the commercial sector, which are the same as **Alternative 1 (No Action)**. **Preferred Sub-alternatives 2a** and **2b** specify that the commercial AMs for the GA-NC and FLK/EFL stocks would close when the commercial ACL is met or projected to be met.

Preferred Alternative 3, Sub-alternatives 3a and **3c** would close the recreational sector for the rest of the fishing year only if the GA-NC or FLK/EFL stocks are overfished. **Preferred Sub-alternatives 3b** and **3d** would close the recreational sector for the rest of the fishing year regardless of the stock status.

Preferred Alternative 4 considers an in-season closure for the recreational sector. **Preferred Sub-alternatives 4a** and **4b** are analogous to **Preferred Alternative 2**, but for the recreational sector. **Preferred Sub-alternatives 4a** and **4b** would require NMFS to monitor the recreational sector for a persistence in increased landings and if necessary reduce the recreational ACL the following fishing year for the amount of the recreational overage.

The selection of any of the sub-alternatives of **Preferred Alternative 2** through **Preferred Alternative 4** does not change the basic premise of **Alternative 1 (No Action)** that commercial fishing would be stopped when the commercial ACL has been met or projected to be met or the following recreational fishing season shortened when recreational ACL is exceeded. Thus, only when overages occur would the various alternatives have possibly differing economic effects. The relative magnitude of short-term economic effects of the various alternatives would depend on the likelihood of triggering the hogfish AMs. The alternatives' long-term economic effects would depend on their effects on the sustainability of the stock to support continued fishing opportunities for the commercial and recreational fishing participants, overall the potential economic impacts of **Preferred Alternatives 2** through **Preferred Alternative 4** are not expected to be significant.

There is no expected economic effects difference between **Alternative 1 (No Action)**, **Preferred Alternative 2 (Preferred Sub-Alternatives 2a** and **2b)**, and **Preferred Alternative 4 (Preferred Sub-Alternatives 4a** and **4b)**.

4.12.3 Social Effects

AMs can have significant direct and indirect social effects because, when triggered, can restrict harvest in the current season or subsequent seasons. However, AMs are critical in keeping landings from exceeding the recommended catch levels, which is crucial under a rebuilding plan.

Alternative 1 (No Action) would maintain the current AMs, which would provide some protection to keep the ACLs from being exceeded and negative effects on the rebuilding plan.

Preferred Alternative 2 and **Preferred Sub-alternatives 2a** and **2b** would have similar effects on commercial fishermen and businesses as **Alternative 1 (No Action)**, except that there may be more flexibility in the paypack provision because the total ACL must be exceeded and the stock be overfished. Additionally, **Preferred Alternative 2** would make the commercial AMs for the hogfish stocks consistent with AMs for other snapper grouper species.

Because there is no in-season closure for the recreational sector in place (**Alternative 1 (No Action)**), there is no additional means to reduce the risk of an overage, particularly for the FLK/EFL stock. **Preferred Alternative 3/ Preferred Sub-alternatives 3b** and **3d** would require an in-season closure regardless of stock status, which would be expected to be more beneficial than **Sub-alternatives 3a** and **3c** for fishermen by contributing to success in the rebuilding plan for the FLK/EFL stock, and sustaining harvest for the GA-NC stock.

Similar to **Alternative 1 (No Action)**, **Preferred Alternative 4/ Preferred Sub-alternatives 4a** and **4b** would maintain the same post-season recreational AM but make the AMs consistent with other snapper grouper species.

4.12.4 Administrative Effects

Under **Alternative 1 (No Action)**, AMs would not be separate for the GA-NC and FLK/EFL stocks. Therefore, any increase or decrease in administrative burden associated with **Alternatives 2-4** (including their sub-alternatives) would be caused by more or less frequently implemented AMs. **Preferred sub-alternatives 2a** and **2b** would continue the in-season commercial sector closure AM with slight changes to the administrative environment based on the frequency with which each of the AM options would be triggered. **Sub-alternative 2b** (**Preferred**) is likely to be triggered the most often; and therefore, would be associated with the highest level of administrative impacts in the form of document preparation and notifications sent to the commercial sector participants informing them that the ACL the following year would be reduced. **Sub-alternative 2a** (**Preferred**) is likely to follow **Sub-alternative 2b** (**Preferred**) in frequency of implementation. However, if AMs are not implemented when they are biologically necessary, the risk of overfishing increases and the administrative burden associated with having to curtail overfishing are much greater than those associated with implementing an effective AM. **Sub-alternatives 3a, 3b (Preferred), 3c,** and **3d** (**Preferred**) would consider an in-season recreational sector closure AM with slight changes to the administrative environment based on the frequency with which each of the AM options would be triggered. **Preferred sub-alternatives 3b** and **3d** are likely to be triggered more often than **Sub-alternatives 3a** and **3c**; and therefore, would be associated with a higher level of administrative impacts in the form of document preparation and notifications sent to the recreational sector participants informing them of the closure of the recreational sector for the remainder of the year. The administrative impacts associated with **Preferred Sub-alternatives 4a** and **4b** are largely the same as all the sub-alternatives under **Alternative 3** for the recreational sector, with the addition of continued monitoring for persistence of increased landings when the recreational ACL has been exceeded. Because landings are already closely monitored and recreational AMs are in place, the addition of the payback provision of the recreational AM would not constitute an additional

administrative burden. Payback provisions for the recreational sector under **Preferred Sub-alternative 4a** and **4b** alternatives are the least likely to have administrative burdens compared with **Preferred Sub-alternatives 2a** and **2b, Sub-alternatives 3a, 3b (Preferred), 3c,** and **3d (Preferred)**, because two conditions would have to be met, the species would have to be overfished *and* the total ACL (for both the commercial and recreational sectors) would have to be met.