# Southern Flounder

Environmental Quality

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*Governor*

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**MEMORANDUM**

TO: N.C. Marine Fisheries Commission

FROM: Dr. Louis Daniel

DATE: Nov. 2, 2015

SUBJECT: Information for Southern Flounder Fishery Management Plan Supplement

Enclosed are the documents, memoranda, and presentations that have been produced relative to the Southern Flounder Fishery Management Plan supplement to Amendment 1. The draft supplement was presented to the Marine Fisheries Commission in May 2015, at which meeting the commission developed a suite of six options to solicit public comment. The six proposals are also included, along with the public comment summaries from the public meeting and the written comment period.

Also enclosed are memoranda developed in relation to the stock assessment, the external peer-review summaries of the stock assessment, presentations provided to the commission on the stock assessment and supplement, analysis of the six commission proposals, and other correspondence developed in relation to the fishery management plan. A table showing the history of the harvest reductions since the original Southern Flounder Fishery Management Plan and the corresponding management measures is attached to this memo.

| Southern Flounder | MFC Meeting | Threshold (SPR) | Target (SPR) | Harvest reduction needed to end overfishing | Units | Commercial Reduction | Recreational Reduction | Commercial Measure | Recreational Measure |
|---|---|---|---|---|---|---|---|---|---|
| Original 2005 FMP | 10-Feb-05 | F20% | F25% | 18%* to reach F20% within 5-years, MFC passed 17.2% with forecast years of 2005-2009 | Pounds | 15.1 | 30.5 | Implement a 14-inch minimum size limit, a closure period from December 1-December 31, a minimum mesh size of 5 ½-inches stretched mesh on large mesh gill nets, 3,000 yard limit on large mesh gill nets and 5 ½-inch stretched mesh on escape panels in flounder pound nets on the commercial fishery. The closure would disallow the harvest and sale of flounder by any means other than federally permitted flounder trawls working in the Atlantic Ocean. Another stock assessment will be conducted three years after the implementation of the plan to evaluate the progress towards rebuilding the population. | Implement a 14-inch minimum size limit and an 8-fish bag limit in all inside waters for all recreational fisheries. |
| Amendment 1 | 10-Nov-10 | F25% | F35% | 20.5%** to reach F25% based on 2007 landings | Number | 22.2 | 20.2 | Accept management measures to reduce protected species interactions as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery. Specific minimum measures for the flounder gill net fishery are provided in Amendment I Issue Paper 10.1.1 (page 129) that meet the requirements of the sea turtle settlement. [Interim Measures that the MFC had been discussing since Jan 2009] | |
| Supplement A to 2005 FMP | 10-Feb-11 | F25% | F35% | 20.5%** to reach F25% | Number | 22.2 | 20.2 | | Increase the minimum size limit to 15 inches and decrease the creel limit to 6 fish. Proclamation FF-29-2011 (refer to Supplement A to the 2005 FMP) |
| Amendment 1 | 28-Feb-13 | F25% | F35% | 20.5%** to reach F25% | Number | 22.2 | 20.2 | | |
| Supplement A to Amendment 1 | 19-Nov-15 | F25% | F35% | MFC determine in range of 0 to 60% | Number | | | Amendment 1 to the Southern Flounder FMP was adopted by the MFC. Amendment 1 established the threshold SPR of 25% and the target SPR of 35% and implemented management measures for the commercial and recreational fisheries. For the recreational fishery, the management measures established in Supplement A were incorporated into Amendment 1 (a coast-wide 15-inch minimum size limit and a six-fish recreational bag limit). For the commercial fishery, some of the measures intended to reduce sea turtle interactions were adopted as management measures for southern flounder. These included limiting the number of fishing days each week and establishing maximum yardage limits for gill nets with a mesh size from 4.0 through 6.5 inches stretch mesh | |

* Original DMF position to AC was 30% to reach Target, but final recommendation was 18.1% for projection with confidence bars that met Threshold ( see 11/15/2004 MFC emergency meeting)
** Reduction was based on a 14 inch minimum size limit, increases to a 30.6% reduction if 15 inch minimum size due to increase in potential discards.
Average SPR (2005-2007) was 20%, Amendment raised the biological reference points to account for changes in yield per recruit results

**Predicted landings reduction estimates cannot account for changes in fishermen's behavior or in fish availability, which both have a considerable impact on landings.**
**Therefore, the magnitude of future landings reductions is inherently uncertain**

This document is in DRAFT form and all parts are subject to change.

**Supplement A to Amendment 1 of the N.C. Southern Flounder Fishery Management Plan**

**Implement Short-Term Management Measures to Address Stock Concerns**

See Sections 5.3, 10.1, 10.1.1 of the 2013 Amendment 1 to the N.C. Southern Flounder Fishery Management Plan

**May 4, 2015**

## Executive Summary

Southern flounder (*Paralichthys lethostigma*) is one of the most economically important estuarine finfish species for commercial and recreational fisheries in North Carolina. Stock assessments completed by the North Carolina Division of Marine Fisheries (NCDMF) in 2004 and 2009 determined the southern flounder stock was overfished and overfishing was occurring throughout the time-series, beginning in 1991. Since the adoption of the Southern Flounder Fishery Management Plan (FMP) in 2005, numerous management actions were put in place intended to end overfishing and rebuild the stock. In 2014, a new stock assessment was completed for southern flounder in North Carolina waters. It was not accepted for management by the NCDMF due to legitimate and substantial concerns raised by the peer reviewers, concerns with which the NCDMF agrees. NCDMF determined the assessment could not be used to define stock status due to mixing of the stock on a regional scale. Without an approved stock assessment it was not possible to determine if the stock is overfished or overfishing is occurring; however, data inputs used in the stock assessment were determined to be valid. It was noted that a high fraction of the harvest consisted of immature fish. Regional data also showed a generally consistent pattern of coast-wide, multi-decadal decline in recruitment and abundance. These concerns prompted the Marine Fisheries Commission (MFC) to pass a motion to pursue a supplement to reduce catch of southern flounder by no less than 25% and no greater than 60%.

The supplement process is a temporary, fast-acting mechanism to address an urgent issue before the usual five-year scheduled review period of a FMP. A supplement is not intended to be a review of all measures that can potentially be used to manage the southern flounder fishery, thus a subset of options was chosen to calculate estimated reductions based on feasibility of implementation in the short-term. Catch reductions provided were based on an average of 2011-2014 commercial and recreational data; however, 2014 harvest data were not finalized, 2014 gill net discards estimates were not available, and 2014 recreational gig data were not available at the time this report was developed. Catch was defined as the number of southern flounder harvested and estimated dead discards. Catch reductions are only estimates that include many assumptions about harvest, discards and population dynamics.

Catch reductions were estimated for five proposed management options to reduce annual catch and increase escapement of southern flounder: (1) implement a season closure, (2) increase the minimum size limit, (3) decrease the recreational bag limit, (4) implement a season closure and also increase the minimum size limit, (5) implement a season closure, increase the minimum size limit and decrease the recreational bag limit. The first option is a season closure, which allows

for more escapement of southern flounder, assuming harvest is not recouped and discards do not increase substantially. Season closures at the end of the season will have different impacts geographically and for each gear. Estimates indicated a season closure for the total fishery (commercial and recreational) will need to begin Oct. 16 for a 25% reduction and begin Sept. 1 for a 60% reduction. To achieve approximately the same reduction between sectors, the recreational fishery will require a much longer season closure than the commercial fishery because the peak catch occurs earlier in the season. The second option, an increase in the size limit, will allow harvest to continue throughout the current season and also increase escapement. Commercial gear modifications will be important to help mitigate expected discard increases. Estimated reductions from increasing the minimum size limit to 15 or 16 inches for the total fishery are 14% and 28%, respectively. The third option, decreasing the recreational bag limit, was estimated to not achieve at least the minimum requested catch reduction. The fourth option, combining a season closure with an increase in the minimum size limit, will reduce total fishery catch by an estimated 25% with a season closure starting Nov. 1 and a 15-inch minimum size limit. The fifth option includes a season closure, an increase in the minimum size limit and a decrease in the recreational bag limit. To achieve an estimated 25% reduction with a minimum size limit of 15 inches and a one-fish recreational bag limit, a season closure for the total fishery of Nov. 16-May 15 will be needed. Catch reductions for Options 2, 4 and 5 (those with a size limit increase) do not include further reductions that would be expected from an increase in gill net and pound net escape panel mesh sizes. Determining reductions levels and methods that are equitable within the requested range among sectors, gears, and geographic regions will be difficult due to the nature of the southern flounder fishery.

Some portions of the approach and conclusions discussed in this supplement differ from previous NCDMF management documents for southern flounder. Since there is not an approved stock assessment to determine sustainable harvest levels, any level of reduction selected can only be based on the degree of concern about the current state of the southern flounder stock as understood by data trends. Regardless of the reduction level and management measures chosen, it will be difficult to determine if the estimated catch reductions are actually achieved due to current data limitations (i.e., uncertainty about discards). In previous documents developed by the NCDMF for southern flounder fishery management, reductions from new measures were based on harvest rather than catch (although discards were included in stock assessments). Catch reductions are considerably lower than harvest reductions for most options due to expected discards. Harvest reduction estimates required fewer assumptions, but do not take discards into account. Lastly, due to evidence the stock is mixing on a regional scale, it should be understood that southern flounder fishery trends in other South Atlantic states will impact the likelihood of achieving estimated reductions due to management measures used in N.C. waters.

The draft supplement will be presented to the MFC at its May 20-22 business meeting, at which time, the MFC has three options: reject the draft supplement (ending the process), approve the draft supplement as presented for public comment, or modify the draft supplement and approve the modified version for public comment. If the process continues, the draft supplement will be available at an announced time for public comment. All public comments received will be provided to the MFC for its Aug. 19-21 business meeting, at which time, the MFC will select its preferred management option. Selection of the preferred management option is final approval of the supplement. If the supplement is approved, management measures would be implemented by proclamation and would likely be effective Sept. 1.

## I. ISSUE AND ORIGINATION

At the Feb. 19, 2015 MFC business meeting, the MFC passed a motion to pursue a supplement to reduce catch of southern flounder by no less than 25% and no greater than 60%. This motion was based on discussions by the MFC that the purpose of reducing catch was to increase overall escapement of southern flounder.

## II. BACKGROUND

Management History

The original N.C. Southern Flounder FMP, adopted in 2005, set overfishing and overfished thresholds and targets using a spawning potential ratio (SPR) of 20% and 25%, and implemented management measures intended to end overfishing and rebuild the stock. Management actions were developed to expand spawning stock biomass while allowing for sustainable harvest. Through the FMP, several steps were taken to better manage southern flounder for a sustainable harvest including a 14-inch minimum size limit for commercial and recreational fisheries statewide and an eight-fish recreational bag limit for the recreational fishery as recommended by the NCDMF and adopted by the MFC in February 2005 to enable a greater percent of southern flounder to spawn at least once. Other measures implemented with the adoption of the 2005 FMP included a December commercial closure period, prohibiting the use of gill nets with a mesh length of 5.0 to 5.5 inches from April 15 – Dec. 15, establishing a 3,000-yard limit for gill nets with a mesh length of five inches or greater statewide, requiring 5.5-inch escapement panels in pound nets statewide, and a four-inch minimum tail bag requirement for crab trawls in western Pamlico Sound.

The 2009 N.C. Southern Flounder Stock Assessment (Takade-Heumacher and Batsavage 2009) proposed increasing the threshold SPR from 20% to 30% and increasing the target SPR from 25% to 35% to reduce the risk of recruitment overfishing. The assessment results indicated that under these new reference points the stock in North Carolina was overfished and overfishing had been occurring throughout the entire time series (1991-2007). While the stock assessment indicated the stock status was improving with decreases in fishing mortality, increases in spawning stock biomass, and expansion of age classes, a reduction in the overall harvest was still needed to achieve sustainable harvest. Thus, the NCDMF began developing Southern Flounder FMP Amendment 1 in 2010. During the development of Amendment 1, the NCDMF reached a settlement agreement concerning sea turtle interactions in the commercial gill net fishery which enacted management measures on May 15, 2010 to reduce these interactions (Proclamation M-8-2010). Upon analysis of these measures, it appeared they would result in the necessary harvest reduction (22.2%) to end overfishing in two years and achieve sustainable harvest in the commercial fishery. In November 2010, the MFC approved sending the draft of Amendment 1 to the Southern Flounder FMP to the Department of Environment and Natural Resources (DENR) Secretary and Joint Legislative Commission on Seafood and Aquaculture for review. Delays in the review of Amendment 1 caused by the legislative schedule resulted in the NCDMF requesting approval to begin the supplement process in January 2011 so management measures could be implemented in the recreational fishery to end overfishing and achieve sustainable

harvest. For the required reductions to the commercial fishery, the approach was to wait and assess the impacts to harvest from measures implemented in 2010 for large mesh gill nets in conjunction with the settlement agreement.

In February 2011, the MFC adopted Supplement A to the Southern Flounder FMP to implement recreational harvest restrictions due to the delay in legislative review of Amendment 1. Supplement A to the 2005 Southern Flounder FMP implemented a 15-inch minimum size limit statewide and six-fish recreational bag limit for the recreational fishery (Proclamation FF-29-2011). In February 2013, Amendment 1 to the Southern Flounder FMP was adopted by the MFC. Amendment 1 established the threshold SPR of 25% and the target SPR of 35% and implemented management measures for the commercial and recreational fisheries. For the recreational fishery, the management measures established in Supplement A were incorporated into Amendment 1 (a coast-wide 15-inch minimum size limit and a six-fish recreational bag limit). For the commercial fishery, some of the measures intended to reduce sea turtle interactions were adopted as management measures for southern flounder. These included limiting the number of fishing days each week and establishing maximum yardage limits for gill nets with a mesh size from 4.0 through 6.5 inches stretch mesh (NCDMF 2013).

In December 2014, the NCDMF completed a new stock assessment. The 2014 assessment used the same type of model as the 2009 assessment (i.e., catch-at-age model), but used a new computer program with new and updated data and accounted for new research related to reproductive ecology. Upon review of the 2014 assessment, the external peer reviewers and the NCDMF determined the model could not fully account for stock mixing during spawning and quantify migration of southern flounder to and from North Carolina waters. Sustainability benchmarks could not be developed for southern flounder using the statistical catch-at-age model used in the 2014 Southern Flounder Stock Assessment. Subsequently, the 2014 Southern Flounder Stock Assessment was not accepted for management use by the NCDMF due to legitimate and substantial concerns raised by the external peer reviewers, concerns with which the NCDMF agreed. The fact the stock assessment was not accepted provides no answer as to whether the 2005 threshold and target or the more risk adverse threshold and target from Amendment 1 (2013) were appropriate or met.

Stock Concerns

The NCDMF cannot quantify levels of sustainable harvest without a valid stock assessment; however, certain patterns in the southern flounder fishery and population are concerning and may warrant management action. Many of the data inputs for the stock assessment were considered valid by peer-reviewers for use in analyzing trends. A pattern that was noted in the first southern flounder stock assessment (NCDMF 2005) is the high fraction of immature fish in the harvest. Based on the recent maturity schedule published by Midway et al. (2013) and the catch-at-length data from commercial and recreational fisheries, 46%-73% of southern flounder harvested in North Carolina waters were below the length at 50% maturity (L50; Figure 1). This provides an estimate of immature fish in the harvest, although some fish above the L50 are immature and some below the L50 are mature. This proportion has decreased only slightly since 2005, despite increases in the minimum size limit.

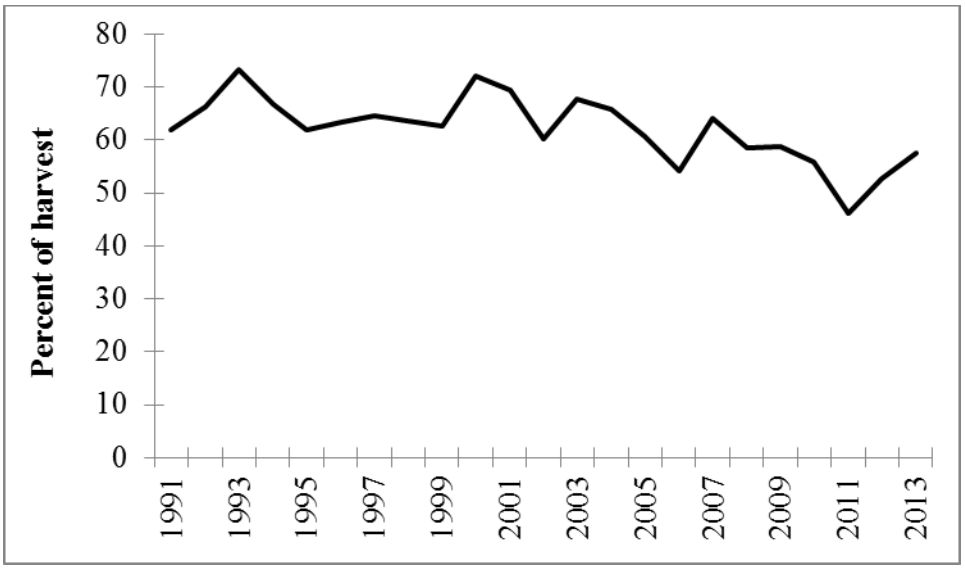


Figure 1. Percent of the annual harvest less than the length at 50% maturity (L50) for southern flounder. The L50 was approximated at 400 mm (15.8 inches) total length for this analysis. Note: all harvest, including sublegal harvest, except recreational gig harvest was included in this analysis.

Based on genetic, otolith morphometric, and tagging data, southern flounder appear to form a single South Atlantic population, from North Carolina to Florida (Anderson and Karel 2012; Anderson et al. 2012; Midway et al. 2014; Craig et al. *In review*; Wang et al. *In press*). As such, population trends in different states are likely coupled via spawning, recruitment, and migration. Therefore, it may be appropriate to consider population trends from other South Atlantic states as indicators of what may be occurring with the overall southern flounder population in the South Atlantic, including North Carolina waters. Indices of abundance from North Carolina, South Carolina, and Georgia, derived from fishery-independent surveys in state waters and analyzed by their respective marine fisheries management agencies, show a generally consistent pattern of coast-wide, multi-decadal decline in recruitment and general abundance of sub-adults and adults (Figures 2 and 3). While some uncertainty in the magnitude or timing of population decline exists, none of the seven indices were interpreted as indicative of improving population status.

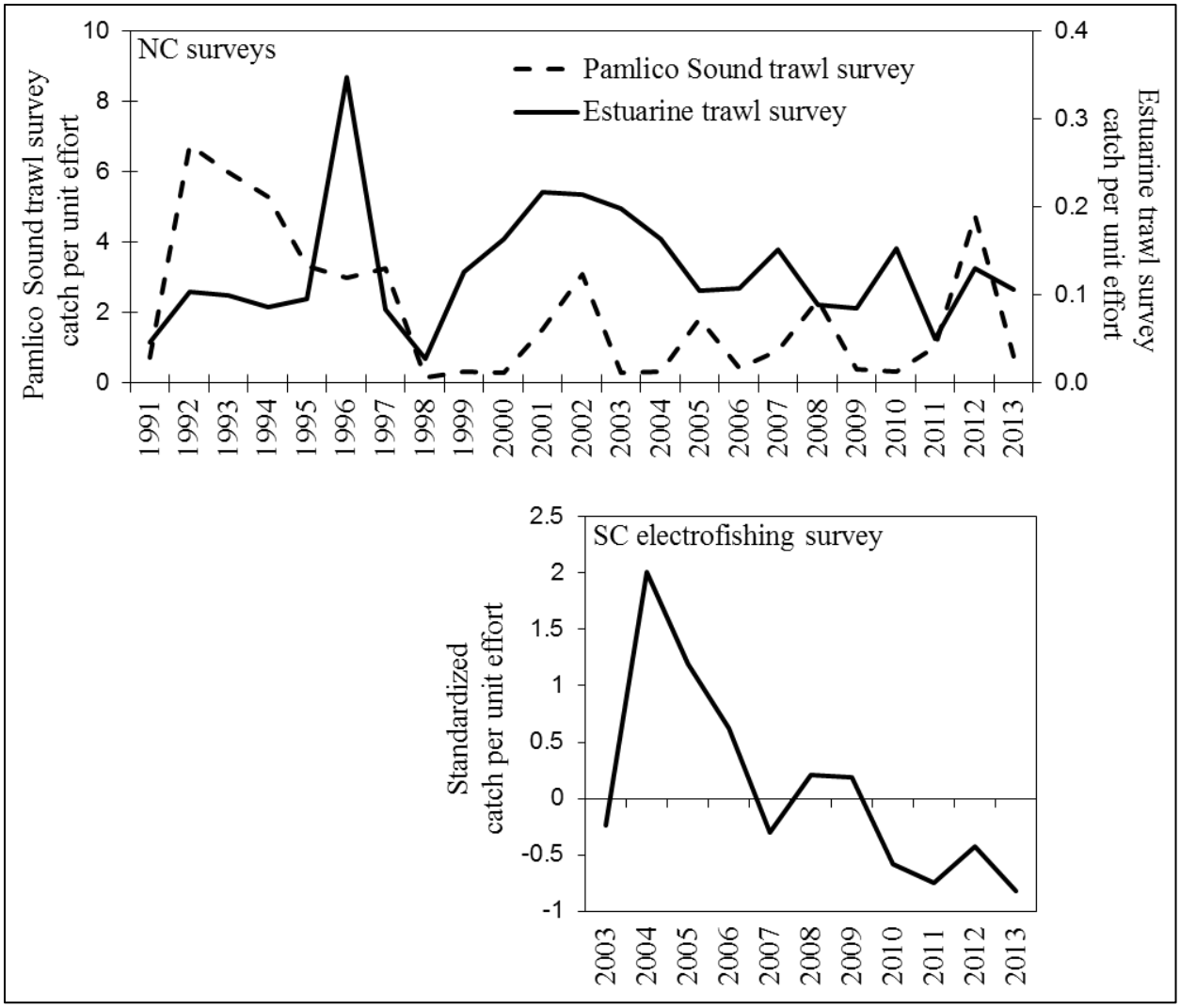


Figure 2. Indices of juvenile abundance developed from North Carolina Pamlico Sound and Estuarine Trawl Surveys and South Carolina Electrofishing Survey. North Carolina indices were developed by North Carolina Division of Marine Fisheries and the South Carolina index was developed by South Carolina Department of Natural Resources.

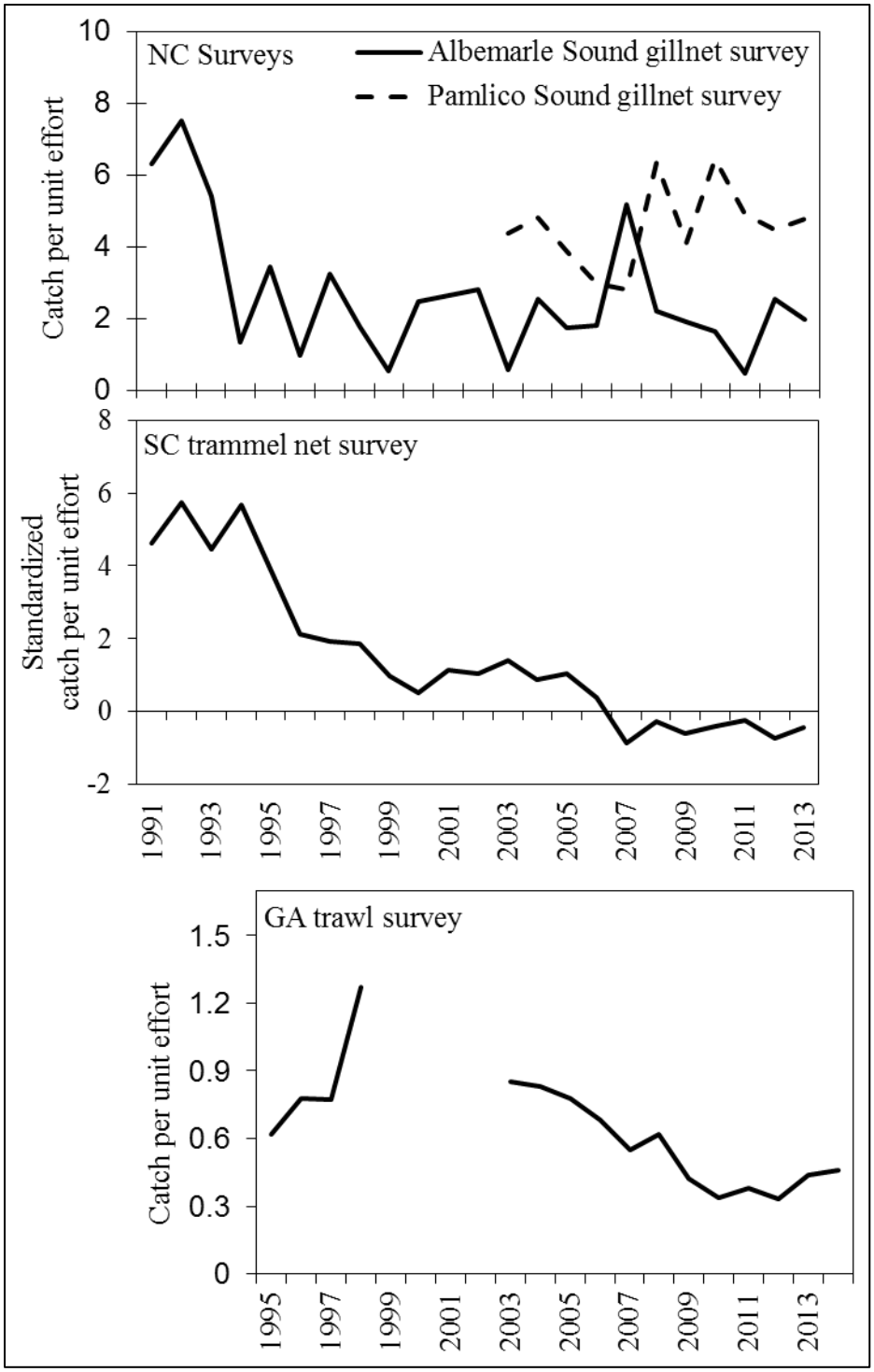


Figure 3. Indices of abundance of sub-adults and adults developed from North Carolina Albemarle Sound and Pamlico Sound Independent Gill Net Surveys, South Carolina Trammel Net Survey, and Georgia Ecological Monitoring Survey (GA Trawl). North Carolina indices were developed by NCDMF staff; the South Carolina index was developed by South Carolina Department of Natural Resources staff; and the Georgia index was developed by Georgia Department of Natural Resources staff.

A regional stock assessment is needed to account for migration and mixing throughout the South Atlantic and to quantify the offshore component of the southern flounder stock. However, pursuing a regional stock assessment would change the current management unit of the fishery and would not be appropriate for a supplement (based on long-term viability and urgency), as it constitutes a wholesale change in management strategy that would require an amendment to the FMP. For the purpose of this supplement and consistent with Amendment 1, the current management unit is defined as southern flounder in all coastal and joint waters throughout North Carolina.

## Supplement Process

N.C. General Statute 113-182.1 and the MFC FMP Guidelines (NCMFC 2010) provide a supplement mechanism to modify a plan between the usual five-year scheduled reviews when the Secretary of the DENR determines an issue is in the interest of the long-term viability of the fishery and the urgency of the issue makes it impossible to address it through the FMP amendment process. The draft supplement must contain analysis of the proposed management change including pertinent data with projected outcomes, and proposed rules or proclamation measures necessary to implement that position. Supplement management measures are temporary (interim) and must be incorporated into the FMP at the time of the next review (currently scheduled for 2018) or they expire on the date the revised FMP is adopted. Also, the MFC may only consider a single management issue for each draft supplement. For Supplement A, the single management issue is to reduce catch in order to improve escapement. Uncertainty over whether the stock is overfished or overfishing is occurring, concerns that immature fish make up a large portion of the catch, and coast-wide indices of abundance that have declined since the 1990s support the urgency of the issue.

## Characterization of the Fishery

### *Recreational*

Most of the recreational harvest of southern flounder occurs inshore in North Carolina's estuaries and coastal rivers; however, the ocean harvest near reefs is an important component of the recreational hook and line fishery. The hook and line fishery occurs year-round but the majority of the harvest is during summer months. Data from the National Marine Fisheries Service's Marine Recreational Information Program (MRIP) were used to estimate hook and line harvest because that is the primary gear intercepted by MRIP creel clerks. In 2012, the Marine Recreational Fishing Statistics Survey (MRFSS) was replaced by MRIP to improve the methodology used to generate recreational estimates of catch and effort. Hook and line anglers harvested approximately 79% of the known recreational harvest and 17% of the total recreational and commercial harvest (Table 1). The recreational gig fishery harvests less southern flounder but harvests them more consistently throughout the year than the hook and line fishery, typically peaking in late-summer and early-fall. Because MRIP rarely intercepts fishermen using gigs (due to fishing at night), the NCDMF began a mail-based survey of recreational gigging in 2010. Based on responses to the mail-based survey and the number of Coastal Recreational Fishing

License (CRFL) holders, the NCDMF estimated the harvest and trips taken by the recreational gig fishery in North Carolina. Recreational gigs accounted for 21% of the known recreational harvest and 5% of the total harvest. In 2011-2013, recreational anglers and giggers together averaged 495,685 trips and 459,177 pounds of southern flounder annually (Table 1), with the majority of the harvest occurring in the southeastern part of the state from Onslow through Brunswick counties.

Table 1. Average annual effort and landings for the North Carolina recreational southern flounder fishery from 2011-2013. Recreational gig harvest data were not available for 2014, so 2014 was excluded from the average presented in this table.

| Gear | Trips | Pounds | % of Recreational harvest | % of Total harvest |
|---|---|---|---|---|
| Gig | 24,477 | 96,748 | 21.1 | 4.5 |
| Hook and Line | 471,208 | 362,429 | 78.9 | 16.9 |
| Total | 495,685 | 459,177 | 100.0 | 21.4 |

Additionally, Recreational Commercial Gear License (RCGL) holders are allowed to use limited amounts of commercial gears such as gill nets, trawls, pots, and seines. Recreational Commercial Gear License holders are not allowed to sell their catch and must abide by the same size and creel limits as all recreational anglers. Due to the discontinuation of the survey used to estimate RCGL-holder harvest, the amount of southern flounder caught by RCGL holders is unknown, but is assumed to be small based on RCGL harvest in the last years of the survey. On average, RCGL holders made 18,296 trips (all gears) and landed 68,826 pounds of southern flounder annually from 2002-2007. Roughly 73% of the southern flounder landed by RCGL gear was landed by gill nets.

The recreational hook and line fishery harvest of southern flounder peaked in 2010 (Figure 4). Harvest generally increased after the 2005 Southern Flounder FMP, but generally declined since 2011 when Supplement A implemented a 15-inch minimum size limit and six-fish bag limit for the recreational fishery. However, inshore recreational harvest was extremely variable since 2008, suggesting other factors besides regulations are influencing harvest levels. The recreational ocean harvest of southern flounder steadily decreased since the 2005 Southern Flounder FMP was implemented; however because regulations did not become stricter in ocean waters in 2005 the reason for this is unclear (Figure 4). Preliminary 2014 data indicates the lowest recreational southern flounder hook and line harvest since 1999. Due to the short amount of time data were collected from the recreational gig fishery (since May 2010), trends in harvest by this fishery are not clear.

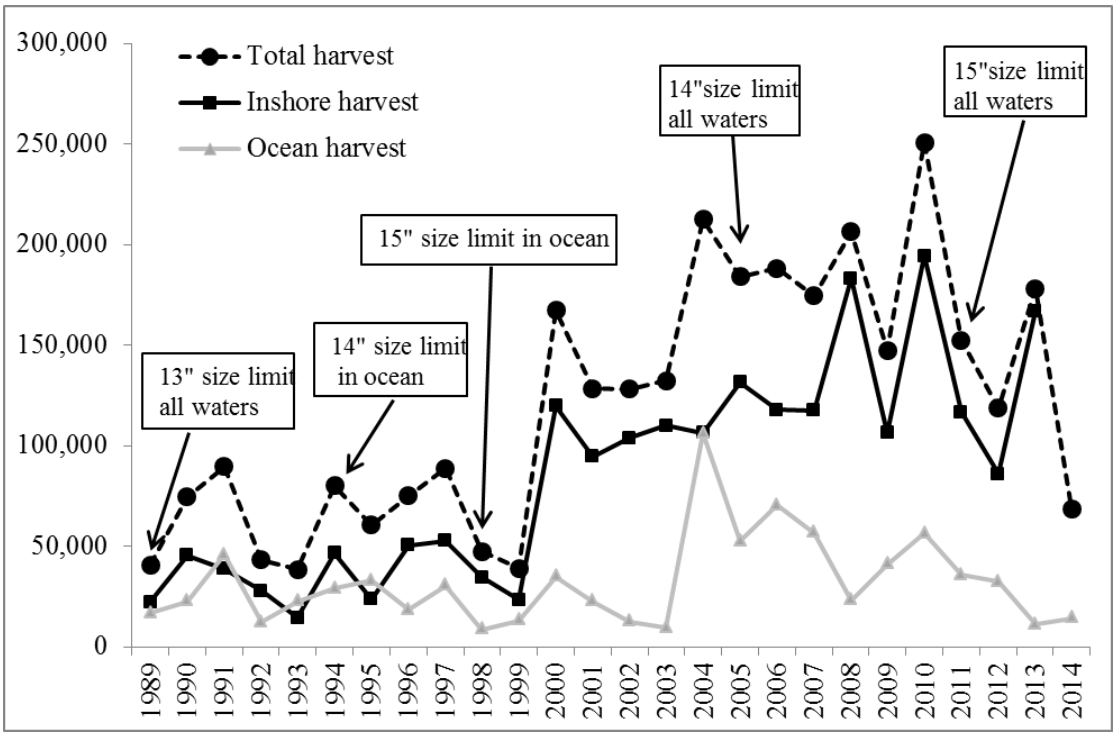


Figure 4. Recreational hook and line harvest from MRIP data 1989-2014 (2014 data are preliminary) and major fishery regulation changes.

*Commercial*

Commercially, southern flounder are harvested by pound nets, gill nets, gigs, and various other commercial gears such as shrimp trawls, crab trawls, seines, and crab pots. The majority of the commercial harvest occurs by gill nets and flounder pound nets, although the harvest by gigs has increased in recent years. Approximately 70% of North Carolina's commercial landings came from the Albemarle and Pamlico sounds in 2011-2013. Data from the North Carolina Trip Ticket Program (NCTTP) were used to estimate the harvest, trips, participants, dealers and ex-vessel value for the commercial fishery (Table 2). The NCTTP considers all flounder caught in inshore waters as southern flounder and all flounder caught in the ocean as summer flounder; as such, only flounder caught inshore were considered for commercial harvest. The NCTTP defines large mesh gill nets as ≥ five inches and small mesh gill nets as < five inches stretched mesh. Small mesh gill nets accounted for a relatively small portion (approximately 6%) of landings in the commercial southern flounder gill net fishery. The large mesh gill net fishery operates year-round, but most of the southern flounder harvest occurred in May-November, peaking in October in 2011-2013. Gill nets are used in most estuarine waters where regulations allow. Gill nets accounted for roughly 55% of the commercial harvest and 43% of the total recreational and commercial fishery harvest. Flounder pound nets are used mainly in eastern portions of the estuaries and are currently not used south of Beaufort Inlet. Southern flounder harvest by pound nets occurs almost exclusively in September-November when fish are migrating toward ocean inlets. Pound nets accounted for 36% of the commercial harvest and 29% of the total harvest. Commercial gigs accounted for 8% of the commercial harvest and 6% of the total harvest, with

other commercial gears accounting for just less than 1% of each category, respectively. On average, there were 20,069 commercial trips landing 1,689,645 pounds of southern flounder annually with an ex-vessel value of $4,283,451 in 2011-2013. A variety of regulations have been put in place via proclamation or rule for the commercial and recreational fisheries that target flounder species (Appendix 1).

Table 2. Average effort, participants, and landings for the North Carolina commercial southern flounder fishery from 2011-2013. Commercial value data were not available for 2014, so 2014 was excluded from the average presented in this table.

| Gear | Trips | Participants | Dealers | Ex-vessel value | Pounds | % of commercial harvest | % of total harvest |
|---|---|---|---|---|---|---|---|
| Gill Net | 14,638 | 854 | 165 | $2,305,055 | 932,792 | 55.2 | 43.4 |
| Pound Net | 1,649 | 75 | 34 | $1,621,415 | 614,899 | 36.4 | 28.6 |
| Gig | 2,503 | 258 | 100 | $322,605 | 127,413 | 7.5 | 5.9 |
| Other | 1,282 | 282 | 98 | $34,377 | 14,541 | 0.9 | 0.7 |
| Total | 20,069 | 1,175 | 237 | $4,283,451 | 1,689,645 | 100.0 | 78.6 |

The commercial fishery harvest of southern flounder peaked in 1994 (Figure 5). Harvest by gill nets peaked in 1998, whereas harvest by pound nets peaked in 1993. Regulations implemented by the 2005 Southern Flounder FMP appear to not have impacted commercial landings, which increased until 2009 before decreasing in 2010 and 2011 and increasing again in 2012-2014. Analysis of commercial landings by area suggests lower availability of southern flounder in the Albemarle Sound Management Area (ASMA; where much of southern flounder harvest occurs), rather than regulations was the main reason for the decline in statewide harvest in 2010 and 2011. This is further supported by reductions across multiple gears in the ASMA in 2010-2011 and substantial increases in harvest in 2013.

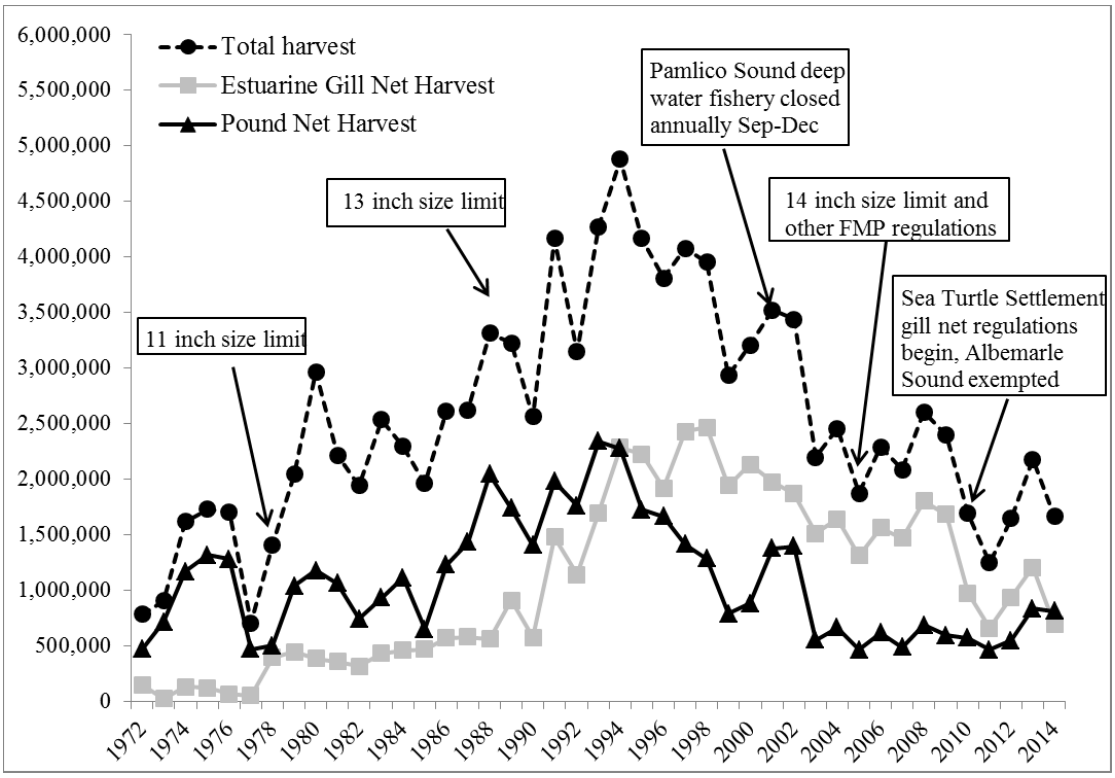


Figure 5. Commercial landings (lbs) from NCTTP 1972-2014 (2014 data are preliminary) and major fishery regulation changes

## III. AUTHORITY

North Carolina General Statutes

113-134. Rules.
113-182. Regulation of fishing and fisheries.
113-182.1. Fishery Management Plans.
113-201. Legislative findings and declaration of policy; authority of Marine Fisheries Commission.
113-221.1. Proclamations; emergency review.
143B-289.52. Marine Fisheries Commission – powers and duties.

North Carolina Marine Fisheries Commission Rules (15A NCAC)

03M .0503 Flounder

## IV. DISCUSSION

The discussion below includes management alternatives that were discussed by the Southern Flounder Plan Development Team as methods for achieving the reductions requested by the MFC. Because a supplement is not intended to be a review of all measures that can potentially be used to manage the southern flounder fishery, a subset of options was chosen to calculate estimated reductions based on feasibility and likelihood of being implemented in the short-term. Other potentially viable options for long-term management requiring further review by the NCDMF and stakeholders would be appropriate to be addressed in an amendment to the Southern Flounder FMP.

Management Measures Not Analyzed For Requested Reductions

*Total Allowable Catch (TAC) and Quota implementation*

Permits are required for any seafood dealer who wishes to participate in fisheries managed under a quota due to the need to know the level of compliance in reporting. As part of the permitting conditions under the dealer quota monitoring rule (15A NCAC 03O .0503(b)), seafood dealers are required to report their landings by noon daily for the previous day's landings (including zero landings) as long as the fishery remains open. Seafood dealers can report their daily landings via email, fax, or phone. Managing southern flounder under a quota would be difficult using this current process. For instance, in 2014, there were 231 seafood dealers reporting landings of southern flounder. This is more than double the current number of dealers who hold quota monitoring permits for other species and would require additional staff to enter quota monitoring logs, verify these logs, monitor compliance, summarize data and conduct analysis. In addition, the southern flounder fishery is unique when compared to other quota monitored species in the state because it occurs January-November from the North Carolina/Virginia border to the South Carolina/North Carolina border. This would require staff to monitor the quota and, more importantly, track compliance for landing reports for the entire open season throughout the state.

An advantage and possible option the NCDMF has when it comes to implementing a quota on a species such as southern flounder is the use of electronic reporting. Due to the nature of the southern flounder fishery (occurring most of the year, covering nearly all estuarine waters, large number of seafood dealers), tracking the quota via logs is inefficient. A more efficient method would be for seafood dealers to submit their southern flounder landings with the NCDMF Trip Ticket software program. This would allow access to landings data for southern flounder directly from the trip ticket database as opposed to the quota monitoring database and would not require data entry. In 2014, 86% of southern flounder trip ticket landings were reported using the software program. From a quota monitoring standpoint, 86% of the landings may be adequate to determine the status of the quota. Although the majority of the landings were reported with the software, only 31% of seafood dealers landing southern flounder reported with the software. One issue to overcome with monitoring a southern flounder quota using the software program is the NCDMF cannot legally require landings to be submitted more frequently than once a month. A request for the authority to require trip ticket reports be submitted at less

than monthly intervals has been submitted to the N.C. General Assembly, but to date, no bill has been introduced to implement this change.

Managing the southern flounder fishery via a quota or TAC would be better accomplished through the amendment process because statute and rule changes and additional staff would be required prior to implementation. If considered in an amendment, the NCDMF would be able to investigate a combination of the trip ticket reporting requirements (monthly reporting) with the permit quota monitoring requirements (gear and effort information) to address obstacles to implementing a quota. The public would also have the opportunity to provide ample input. Methods to effectively determine the level of use and correlation of electronic reporting to the overall harvest, taking into account NCDMF resource limitations could be evaluated. Since a supplement is to be implemented quickly and remain in place until the time of the next adoption of the FMP, a quota is not a viable option for consideration at this time. This issue could be further explored in an amendment.

*Maximum size limit*

A maximum size limit is typically used to protect large, mature fish from harvest, thereby increasing the spawning stock biomass. In the Southern Flounder FMP Amendment 1, a maximum size limit was considered. If used in combination with a minimum size limit, this effectively serves as a slot limit. At that time, a 24-inch maximum size limit was used to explore this idea. The findings were that in 1991-2007, approximately 0.3% of flounder in the commercial fishery and 2.3% in the recreational fishery were harvested above 24 inches. In 2011-2014, approximately 0.1% of flounder in the commercial fishery and 0.6% in the recreational fishery were harvested above 24 inches. Therefore, to reduce harvest substantially the maximum size would need to be considerably lower than 24 inches. Approximately 87% of harvest occurs between 14 and 18 inches and 93% occurs between 14 and 20 inches. A maximum size limit would increase discards due to fish caught and discarded above the maximum size. To reduce discards in the commercial fishery due to the minimum size limit, minimum mesh sizes for gill nets and pound net escape panels are currently in place; however it is unlikely a minimum mesh size chosen to reduce catch below a minimum size limit would also reduce catch above a maximum size limit. Therefore, discards in the commercial fishery would increase for fish above the maximum size limit. In the recreational hook and line fishery, fish above the maximum size would also continue to be caught, thus increasing discards. Due to the small number of large fish caught and the likelihood of increased discards, a maximum size limit was not recommended by the NCDMF or the MFC in the past as a method of reducing harvest. Because the largest flounder are often the most valuable to the commercial fishery, and most sought after by the recreational fishery, there would likely be an economic impact to this measure. Lastly, growth of southern flounder is quite variable and although larger fish are more likely to be mature females, some mature at 14-15 inches. Because a large percentage of the current harvest is from fish 14-15 inches, protection of fish at these sizes would be beneficial to the spawning stock biomass. Although reductions resulting from a maximum size limit are not included in this supplement, this issue could be further explored in an amendment.

*Area closures*

Area closures would involve closing portions of the inshore or ocean water to protect southern flounder during a particular life stage. Upper portions of the Neuse, Pamlico and Pungo Rivers were closed to shrimp trawling beginning in 2006 to minimize juvenile southern flounder bycatch. Southern flounder use a wide variety of inshore habitats and selecting a specific habitat that will protect large numbers of fish may be difficult due to the mobility of fish. During the fall migration, southern flounder rapidly pass through various estuarine areas, concentrating at inlets on their way to the ocean. Inlet corridors are already closed to large mesh gill nets in Pamlico Sound from Sept. 1 through Dec. 15 to minimize sea turtle interactions; however, closing areas will likely result in fishermen targeting flounder just outside the closed area and possibly recouping most of the harvest. Additionally, exact migratory corridors are not known and would require extensive research to determine. This issue could be further explored in an amendment.

Management Measures Analyzed As Options For Requested Reductions

The reductions in catch provided below are based on an average of 2011-2014 data. These years were chosen because the most recent major regulation change for southern flounder occurred early in 2011. In February 2011, the minimum size limit was increased to 15 inches for the recreational fishery. There have been various regulation changes to the commercial gill net fishery (gear modifications, area exemptions, area closures, etc.) since 2011; however, many of these measures began in 2010 as part of the sea turtle lawsuit settlement agreement. Some of these measures were adopted for southern flounder management in Amendment 1 to the Southern Flounder FMP in February 2013. It is important to note, harvest data from 2014 is still preliminary and is likely to change. Recreational gig harvest and discard estimates were not yet available for 2014. Commercial gill net discard estimates were also not available for 2014 to include in the reduction calculations.

The reductions presented are estimates that assume consistent fishery catch, southern flounder length distributions and year class strength. If any of these assumptions are incorrect, it can affect the accuracy of estimated reductions. Catch reductions were calculated using estimates of dead discards that are only available for commercial gill nets and recreational hook and line and gig fisheries. Due to assumptions made in calculating hook and line discards and lack of estimates for other important fisheries (commercial pound nets and gigs), confidence in estimated harvest reductions was higher than catch reductions. Importantly, due to the uncertainty about estimates of dead discards, it will be difficult to determine if estimated catch reductions are actually achieved; however, accurate catch reduction estimates would provide the best indication of the benefits of management measures for the stock. Regardless of the approach taken for estimating reductions - catch or harvest - the impact of discards should be considered when evaluating any new management measure. Although the discussion focuses on catch reductions as requested by the MFC, harvest reductions were also calculated for each option (see Appendix 2). In previous documents developed by the NCDMF for southern flounder fishery management, reductions from new measures were based on harvest rather than catch (although discards were included in stock assessments).

The first step in estimating reductions was to calculate the number of fish harvested by recreational and commercial fisheries. Harvest is defined as the number of fish kept. All reductions were calculated in numbers of fish rather than weight because the request was for reductions in catch (including discards). The NCDMF collects data on discards for some fisheries (commercial gill net, recreational hook and line and gig fisheries), but only in numbers of fish rather than weight. The NCTTP commercial fishery inshore flounder harvest data in weight was converted to numbers of fish using data collected by NCDMF fish house sampling programs by market grade, gear, month and year (Table 3). Available fish house sampling data for 2014 was used but a small percentage of the data were not yet complete at the time of this report. Recreational harvest is reported in numbers of fish by MRIP and the NCDMF mail-based survey of gigging. Recreational data included inshore and ocean areas.

To calculate catch reductions, discards were also estimated. For the purposes of this supplement, catch was defined as the number of southern flounder that die as a result of being captured including those kept, discarded dead and those released alive that later die due to injuries sustained by capture (post-release discard mortality). Recreational releases of flounder were rarely recorded by MRIP beyond the genus (*Paralichthys*) level. Releases were not observed by interviewers and most recreational fishermen are not able to report flounder to the species level. In other words, recreational releases of flounder in MRIP are only recorded as "flounder" and do not differentiate between summer flounder, southern flounder or Gulf flounder. To estimate the number of southern flounder released, the proportion of southern flounder estimated by MRIP as harvested (relative to other *Paralichthys* species) was applied to the number of reported released flounder (*Paralichthys*) from the same Wave (1-6), Mode (type of fishing) and Area (inshore vs. ocean). This method relies on an important assumption that the flounder discard species ratio is the same as the harvest species ratio. The NCDMF mail-based survey was used to estimate the number of southern flounder discarded by the recreational gig fishery. Estimates of discards were also calculated for the estuarine commercial gill net fishery based on NCDMF observer data. For the remaining commercial gears it was assumed that no dead discards occurred during 2011-2014 because sufficient data were not available to estimate discards. Based on studies of post-release discard mortality, seasonal mortality rates were applied to available estimates of discards by gear to estimate numbers of discard mortalities (i.e., dead discards). Detailed methods used to calculate reductions for each option discussed in this supplement are available in Appendix 3. All reductions presented in the Discussion were from the total sector (commercial or recreational) catch or total fishery (commercial and recreational) catch. To show the impacts to each gear, reductions from gear totals were also calculated and are available in Appendix 4.

Table 3. Numbers of southern flounder by gear and sector used for calculating reductions based on 2011-2014* average. ND = no data available

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Estimate Type | Gill net | Pound net | Gig | Other | Total | Hook & line | Gig | Total | Total |
| Harvest | 466,646 | 306,565 | 71,753 | 10,249 | 855,212 | 129,536 | 50,903 | 180,439 | 1,035,651 |
| Dead Discards | 11,339 | ND | ND | ND | 11,339 | 80,954 | 2,758 | 83,713 | 95,051 |
| Catch | 477,984 | 306,565 | 71,753 | 10,249 | 866,551 | 210,490 | 53,661 | 264,152 | 1,130,703 |

*2014 data are preliminary, 2014 commerical discard and all recreational gig data were not available

Option 1: Implement a season closure

A season closure is used to restrict harvest during certain times of the year, reduce annual landings and discards, and increase spawning stock biomass. The 2005 Southern Flounder FMP implemented a month-long season closure in December for the commercial fishery (NCDMF 2005). The recreational fishery is currently open year round. The effect of additional season closures on catch was examined in half-month intervals starting Aug. 1. This date was chosen to encompass the range (25% to 60%) of reductions requested by the MFC. The current commercial inshore flounder season is Jan. 1 – Nov. 30 and the recreational season is open all year.

Tagging and maturity data indicate southern flounder remain in estuarine waters until they mature, beginning their spawning migration to ocean waters in fall months. As a result, any split season closure to the fishery (closing and then reopening before the end of the year) will be unlikely to realize the estimated reduction. This is because southern flounder could be caught once the fishery is reopened and before they emigrate from estuaries. Due to this potential for recoupment of harvest, the season closures presented here are cumulative starting at the end of the season (without a split season option). Since the temporal distribution of harvest for the commercial and recreational fisheries are different, achieving the same reduction for each sector would require closures of different length by sector.

There are multiple potential advantages and disadvantages to season closures. A season closure for southern flounder in the fall will allow for more escapement (number of mature individuals leaving estuaries to spawn) assuming harvest does not increase dramatically prior to the closure. The longer the season closure, the less likely the fishery could recoup landings by increasing harvest prior to the closure. If harvest is allowed for any gear that typically harvests southern flounder during the closure period, there is a high likelihood for recoupment of some or all harvest. If harvest is closed, but any commercial or recreational gear that regularly catches flounder is allowed to continue fishing during the closure period there will be discards, thus diminishing the estimated catch reduction. For these reasons, the best chance to achieve the estimated reductions is to remove all gears regularly catching flounder from the water and prohibit the sale of flounder caught in inshore waters during a closed. Nevertheless, in some cases, stopping all fishing by gears that catch flounder will not be reasonable or practical and this must be considered when implementing a season closure. While most gears that harvest flounder also target other species, some gears such as hook and line and small mesh gill net fisheries that harvest flounder often do not target flounder. If the closure occurs at the end of the season, fish are more likely to be larger and mature and the ratio of immature fish in the annual harvest may well increase; however, if catch is reduced by an end of the season closure this would increase escapement and the spawning stock biomass. Not all southern flounder protected from harvest or discard by a closed season will mature and spawn each year. Many may remain in the estuaries through the following year, thus making them vulnerable to fishing pressure in the subsequent fishing season. An assumption in calculating reductions due to a closed season is harvest during open months will not differ from the 2011-2014 average harvest during those same months. It should be noted, however, that landings for both sectors have been quite variable from year to year and should not be expected to match the 2011-2014 average in future years. Additionally, effort and catch may increase prior to a closure, resulting in a lower reduction than estimated.

*Reductions for the commercial fishery*

The timing and magnitude of peak southern flounder landings are different for the gill net, pound net and gig fisheries, so a season closure will impact each gear differently. In closure periods beginning prior to Sept. 1, gill nets contributed the largest reduction from the overall fishery but pound nets contributed the largest reduction with closure periods starting Sept. 1 (Table 4, Figure 6). This is due to concentration of pound net harvest in September-November. To achieve an estimated 25% catch reduction for the commercial fishery, a season closure will need to start in late-October. A closure beginning in late-September will be needed to achieve an estimated 60% reduction in the commercial fishery. An end of season closure will impact the pound net fishery most among commercial gears; a closure Oct. 1 – Nov. 30 will reduce the pound net catch by an estimated 81% (see Appendix Table A4.1 and Figure A4.1). In comparison, this closure would reduce the gig and gill net catch by approximately 18% and 37%, respectively.

Season closures will have different impacts geographically for the commercial fishery. Harvest peaks in areas at different times due to variation in gear used and southern flounder availability. Late in the year, the harvest tends to concentrate on the eastern side of estuaries as flounder migrate toward ocean inlets. A late-season closure may shift gill net and gig effort to areas that produce higher numbers of southern flounder earlier in the season (e.g., western sides of estuaries), thus recouping some harvest. Pound nets are stationary gear and could not easily be moved from eastern sides of estuaries to recoup landings, so this fishery would likely be greatly impacted by a late-season closure.

It was assumed that commercial harvest of flounder would cease during a season closure, which would be expected to decrease fishery harvest in the short-term. It is possible that effort will increase prior to the closure, especially in the gill net and gig fisheries, resulting in recoupment of some harvest expected to be lost due to the closure. This shift in peak effort may be mitigated by seasonal gill net closures due to protected species interactions or availability of fish but these impacts are difficult to predict. Migration of flounder during the fall months produces the highest catches of the year for the gill net and pound net fisheries. As these gears are the primary methods of harvesting flounder, a closure of fall months would be likely to produce reductions that could not be recouped by shifting effort earlier in the season. Other commercial gears that catch flounder include gigs, small mesh gill nets, crab trawls, shrimp trawls and crab pots. If any gear that catches flounder is allowed to operate during a closed season, the estimated reduction will be diminished due to any dead southern flounder discards produced (and any harvest that is allowed). Additionally, shifting harvest earlier in the season will likely increase the proportion of smaller fish in the harvest.

The only available discard or discard mortality estimates for commercial gear used for harvesting southern flounder was for estuarine gill nets. With no estimates of dead discards for the remaining commercial gears, the total average commercial catch used in this supplement is likely lower than the actual catch for 2011-2014. This likely makes the calculated catch reduction somewhat higher than it would be if discards were known for all gears. It was assumed there would be no discard mortality during a closed season; however, this assumption would be incorrect if any gear that catches flounder is left in the water. Because there were no estimates of discards available for most commercial gears and gill net discards represent a small component

of the commercial catch, the estimated commercial catch and harvest reductions due to a season closure are very similar.

Table 4. Commercial catch reductions (percent) from the total commercial catch for season closures based on a 2011-2014* average. Bolded rows include a reduction within the requested range for the total commercial fishery. See harvest reductions in Table A2.1.

| Closure | Gill net | Pound net | Gig | Other gears | Total |
|---|---|---|---|---|---|
| Nov 16-Dec 31 | 1 | 3 | <1 | <1 | 5 |
| Nov 1-Dec 31 | 5 | 10 | 1 | <1 | 16 |
| **Oct 16-Dec 31** | 12 | 20 | 1 | <1 | **33** |
| **Oct 1-Dec 31** | 20 | 29 | 2 | <1 | **50** |
| Sept 16-Dec 31 | 30 | 35 | 2 | <1 | 67 |
| Sept 1-Dec 31 | 34 | 35 | 3 | <1 | 72 |
| Aug 16-Dec 31 | 38 | 35 | 3 | 1 | 77 |
| Aug 1-Dec 31 | 41 | 35 | 4 | 1 | 81 |
| Jan 1-Dec 31 | 55 | 35 | 8 | 1 | 100 |

*2014 data are preliminary, 2014 discard estimates were not available

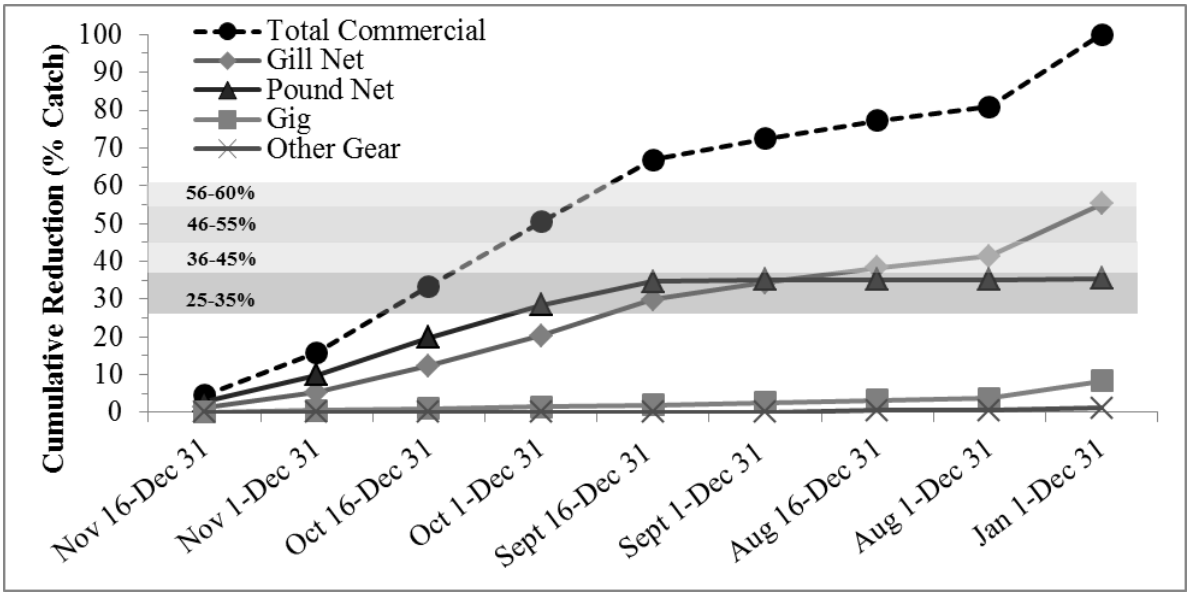


Figure 6. Commercial catch reductions (percent) from the total commercial catch for season closures based on a 2011-2014 average.

*Reductions for the recreational fishery*

For closures starting prior to Oct. 1, hook and line contributed more than gigs to reductions from the total recreational fishery (Table 5, Figure 7). This is due to the greater harvest and discards for hook and line for most of the year; however, in fall the gig harvest is greater than hook and line, thus more of the total recreational fishery reduction comes from gigs after Oct. 1. A closure beginning Aug. 16 was estimated to be needed for the recreational fishery to meet the minimum reduction requested by the MFC. Estimates indicate a complete shutdown of the recreational flounder fishery would be required to achieve the maximum catch reduction in the range requested by the MFC. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions).

Catch reductions from season closures were greater for the recreational gig fishery than for the hook and line fishery. A complete year closure would only result in an estimated 55% catch reduction for hook and line gear, whereas this would result in a 100% reduction for gig catch (see Appendix Table A4.2 and Figure A4.2). This is based on the assumption that hook and line gear would continue to be used during a season closure and gigs would not be used. While hook and line gear is used to target many different species other than flounder, gigs are primarily used for flounder. Because flounder are often caught when targeting other species with hook and line, and additional flounder may be available in the system if other gears are closed, it was assumed that southern flounder harvested on average in 2011-2014 would be caught and released during a closed season. Therefore, seasonal discard mortality rates were applied to average hook and line harvest plus discards from 2011-2014 for each closed period to estimate expected dead discards. Although this is likely an overestimate of the number of dead discards from hook and line gear that would occur during a season closure, this method was determined to provide the best estimate with available data. In the recreational gig fishery, all discards were assumed to be dead due to injuries sustained by this gear. If this assumption is incorrect, the estimated reduction will change only slightly since gig discards are a small component of the recreational catch.

Table 5. Recreational catch reductions (percent) from the total recreational catch for season closures based on a 2011-2014* average. Bolded rows include a reduction within the requested range for the total recreational fishery. See harvest reductions in Table A2.2.

| Closure | Hook & Line | Gig | Total |
|---|---|---|---|
| Dec 16 - Dec 31 | <1 | 1 | 1 |
| Dec 1 - Dec 31 | <1 | 2 | 2 |
| Nov 16 - Dec 31 | <1 | 3 | 3 |
| Nov 1 - Dec 31 | 2 | 4 | 5 |
| Oct 16 - Dec 31 | 4 | 5 | 9 |
| Oct 1 - Dec 31 | 6 | 6 | 13 |
| Sep 16 - Dec 31 | 11 | 8 | 18 |
| Sep 1 - Dec 31 | 14 | 9 | 23 |
| **Aug 16 - Dec 31** | **22** | **11** | **33** |
| **Aug 1 - Dec 31** | **26** | **12** | **38** |
| Jan 1 - Dec 31 | 44 | 20 | 64 |

*2014 data are preliminary, 2014 gig harvest and discard data were not available

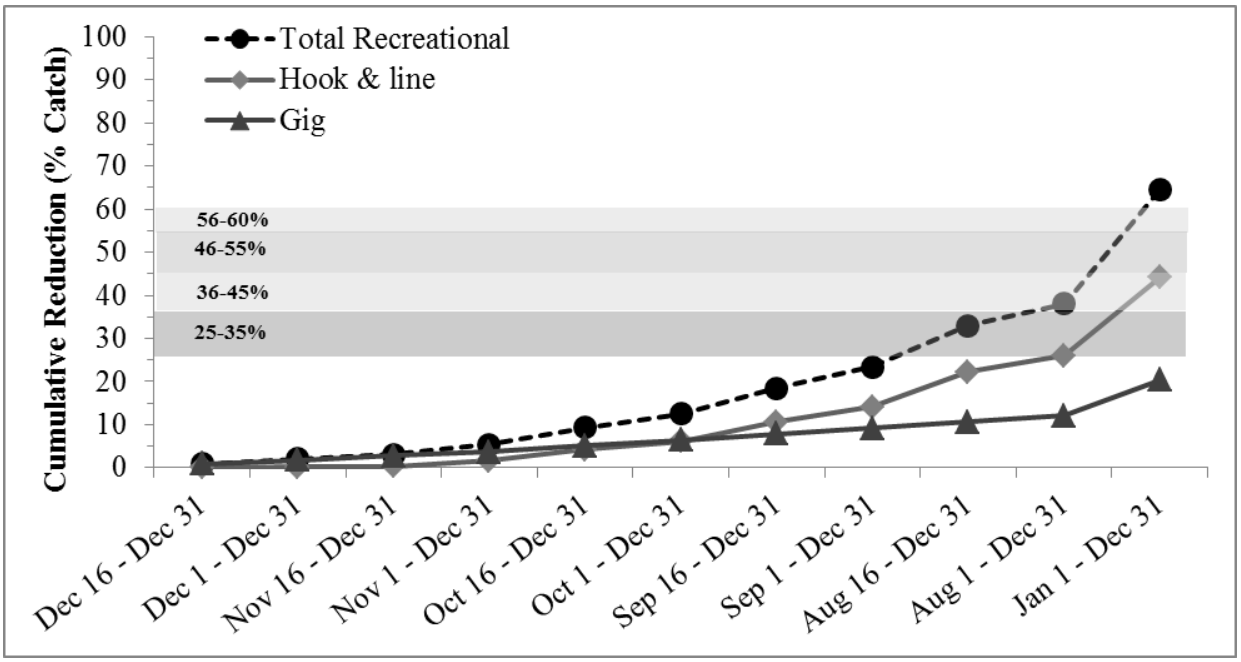


Figure 7. Recreational catch reductions (percent) from the total recreational catch for season closures based on a 2011-2014 average.

*Reductions for the combined fishery*

Reductions from various season closures were also explored for the combined fishery (commercial and recreational). The total catch in numbers of fish was calculated and all

reductions were relative to these totals. To reach the lower end of the catch reduction range requested for this supplement a season closure would need to begin Oct. 16 (28%; Table 6, Figure 8). The closure would need to start Sept. 1 for a catch reduction that reached 60%. Because the peak harvest occurs at different times for the commercial and recreational fisheries, different closure periods were examined for the two sectors. For example, a reduction at the lower end of the requested range could be achieved by an Oct. 16-Dec. 31 commercial closure and a Nov. 16-Dec. 31 recreational closure (26%; Table 7). A similar reduction could be achieved by a commercial closure from Nov. 1-Dec. 31 and a complete recreational season closure (24%; Table 7). This analysis demonstrates closures for the recreational fishery must be much longer than for the commercial fishery to achieve an equal reduction for each sector. The reason is recreational harvest peaks much earlier in the year than the commercial harvest. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions).

Table 6. Catch reductions (percent) from the combined fishery catch for season closures based on a 2011-2014* average. Bolded rows include a reduction within the requested range for the combined fishery total. See harvest reductions in Table A2.3.

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Closure | Gill net | Pound net | Gig | Other | Total | Hook & line | Gig | Total | Total |
| Nov 16-Dec 31 | 1 | 2 | < 1 | < 1 | 3 | < 1 | 1 | 1 | 4 |
| Nov 1-Dec 31 | 4 | 8 | < 1 | < 1 | 12 | < 1 | 1 | 1 | 13 |
| **Oct 16-Dec 31** | 9 | 15 | 1 | < 1 | **26** | 1 | 1 | 2 | **28** |
| **Oct 1-Dec 31** | 16 | 22 | 1 | < 1 | **39** | 2 | 2 | 3 | **42** |
| **Sept 16-Dec 31** | 23 | 27 | 1 | < 1 | **51** | 2 | 2 | 4 | **55** |
| **Sept 1-Dec 31** | 26 | 27 | 2 | < 1 | **55** | 2 | 2 | 4 | **60** |
| Aug 16-Dec 31 | 29 | 27 | 2 | < 1 | 59 | 3 | 2 | 5 | 64 |
| Aug 1-Dec 31 | 32 | 27 | 3 | < 1 | 62 | 3 | 3 | 6 | 68 |
| Jan 1-Dec 31 | 42 | 27 | 6 | 1 | 77 | 7 | 5 | 12 | 89 |

*2014 data are preliminary, 2014 commercial gill net discard estimates were not available, 2014 recreational gig data were not available

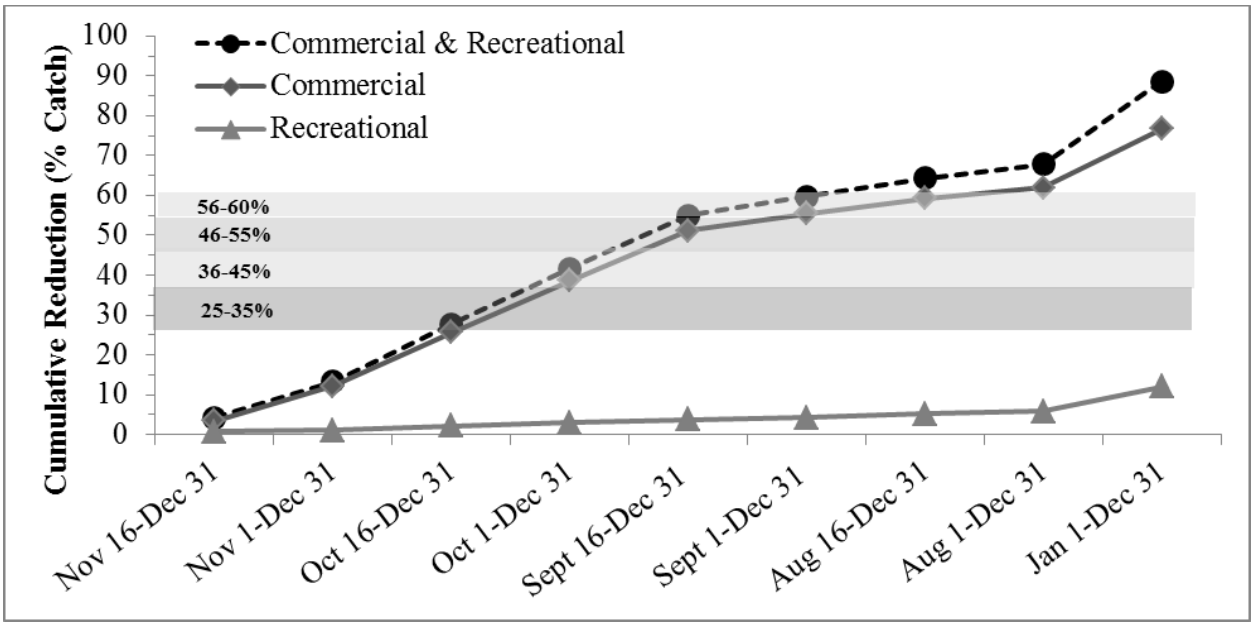


Figure 8. Catch reductions (percent) from the combined fishery catch for season closures based on a 2011-2014 average.

Table 7. Catch reductions (percent) from combined fishery catch for season closures by sector based on 2011-2014* average. Closures start on the dates shown and end on Dec 31. Bolded reductions were within the requested range. See harvest reductions in Table A2.4

| | Recreational closure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Commercial closure | 1-Jan | 1-Aug | 16-Aug | 1-Sep | 16-Sep | 1-Oct | 16-Oct | 1-Nov | 16-Nov |
| 1-Jan | 89 | 82 | 82 | 81 | 80 | 80 | 79 | 78 | 77 |
| 1-Aug | 74 | 68 | 67 | 66 | 66 | 65 | 64 | 63 | 63 |
| 16-Aug | 71 | 65 | 64 | 63 | 63 | 62 | 61 | **60** | **60** |
| 1-Sep | 67 | 61 | 61 | **60** | **59** | **59** | **58** | **57** | **56** |
| 16-Sep | 63 | **57** | **56** | **55** | **55** | **54** | **53** | **52** | **52** |
| 1-Oct | **51** | **45** | **44** | **43** | **42** | **42** | **41** | **40** | **39** |
| 16-Oct | **38** | **31** | **31** | **30** | **29** | **29** | **28** | **27** | **26** |
| 1-Nov | 24 | 18 | 17 | 16 | 16 | 15 | 14 | 13 | 13 |
| 16-Nov | 15 | 9 | 9 | 8 | 7 | 6 | 6 | 5 | 4 |

*2014 data are preliminary, 2014 commercial gill net discard estimates were not available, 2014 recreational gig data were not available

Option 2: Minimum size limit increase

Increasing the minimum size limit is a management measure used to help end overfishing, rebuild the spawning stock, and allow a greater portion of fish an opportunity to spawn before they can be harvested. Based on southern flounder maturity at size derived from Midway and

Scharf (2012), the size at 50% maturity (L50) is approximately 15.75 inches (Table 8). Reductions are presented for increasing the minimum commercial minimum size limit to 15 inches or 16 inches for both sectors. While increasing the minimum size limit above 16 inches is possible, this was not examined in the supplement due to the expected level of discards.

Minimum size limit increases can be effective at reducing harvest as long as compliance with the regulations is consistent. The reductions associated with a minimum size limit increase assume the proportion of undersized fish in the harvest remains similar to the current proportion. Data from before and after the commercial minimum size limit change in 2005 indicate that the percentage of undersized fish in the harvest remained relatively similar and without trend (Table 9). Although there is a slight increasing trend in the percentage of undersized southern flounder in the recreational harvest since the minimum size limit change in 2011 (Table 10), more years of complete data are needed to fully assess this potential trend.

Increasing the minimum size limit may have the effect of increasing the total harvest of fish above the new minimum size limit. Due to the relatively greater fecundity (the number of eggs released by a female) of larger individuals, increased harvest of larger individuals would not be beneficial for spawning stock biomass; however, it is not clear that harvest of larger individuals would increase. If a larger minimum gill net mesh size was implemented it is possible that harvest of larger individuals would increase for that gear since larger mesh sizes tends to catch larger fish; however, some gill net fishermen already use nets with mesh size above the current minimum. More importantly, harvest of larger southern flounder by other commercial and recreational gears would likely not increase since they already target all size classes. Although it is possible the distribution of harvest of larger individuals may change among gears, the total harvest of these fish may not change substantially as a result of a minimum size limit increase; however, if the spawning stock biomass increases, there may well be increased catches of large fish in the future.

There are multiple potential advantages and disadvantages to raising the minimum size limit. This would potentially allow a larger number of fish the opportunity to leave estuaries to spawn prior to being harvested, thus increasing the size of the spawning stock. Increasing the minimum size limit would also be consistent with NCDMF strategies for setting minimum size limits for other managed species, based on maturity information. However, not all discarded undersized southern flounder will survive to spawn; some will die after release. Some will survive release but will subsequently grow to legal size and be harvested at a later date within the year, thus decreasing the impact of the minimum size limit change on fishery harvest. Some fish that survive after being discarded may not mature until the next year, remaining in estuaries where they could be caught by the fishery the following season. Although this would not decrease the reduction in catch for the first year, it could make estimated reductions less likely to be achieved in the following year and decrease the benefit to spawning stock biomass in subsequent years. In the short term, a minimum size limit increase would diminish the pool of fish available for harvest, which in turn would produce a decrease in overall catch and harvest. However, increasing the minimum size limit would allow harvest to continue throughout the currently open season. The relative percentage reduction to the fishery will be greatest in the first half of the year because growth of southern flounder is rapid during the summer and more fish will be legal size by the fall compared to the spring.

Table 8. Percent of females mature by length based on 2014 southern flounder stock assessment.

| Total length (inches) | % Mature |
|---|---|
| 10 | 1 |
| 11 | 1 |
| 12 | 3 |
| 13 | 8 |
| 14 | 17 |
| 14.5 | 24 |
| 15 | 34 |
| 15.5 | 45 |
| 15.75 | 50 |
| 16 | 55 |
| 17 | 76 |
| 18 | 89 |
| 19 | 95 |
| 20 | 98 |
| 21 | 99 |
| 22 | 100 |

Table 9. Annual percentage of undersized southern flounder in annual commercial harvest.

| Year | Size limit | % undersized |
|---|---|---|
| 2003 | 13" | 3 |
| 2004 | 13" | 4 |
| 2005 | 14"* | 9 |
| 2006 | 14" | 6 |
| 2007 | 14" | 7 |
| 2008 | 14" | 7 |
| 2009 | 14" | 7 |
| 2010 | 14" | 6 |
| 2011 | 14" | 3 |
| 2012 | 14" | 8 |
| 2013 | 14" | 6 |
| 2014 | 14" | 4 |

* implemented April 2005

Table 10. Annual percentage of undersized southern flounder in annual recreational harvest.

| Year | Size limit | % undersized |
|---|---|---|
| 2009 | 14"/15"* | 2 |
| 2010 | 14"/15"* | 3 |
| 2011 | 15" | 4 |
| 2012 | 15" | 6 |
| 2013 | 15" | 9 |

* 14" size limit in western portions of Albemarle and Pamlico sounds and its tributaries, and ocean and estuarine waters south of Brown's Inlet to the SC border; 15" size limit north of Brown's Inlet in eastern estuarine and ocean waters

*Reductions for the commercial fishery*

The impact to each gear due to a minimum size limit change was variable. Gill nets contributed the most to the overall commercial fishery reduction (Table 11). The reason is gill nets caught the most southern flounder and a relatively high proportion of 14- and 15-inch fish. An increase in the minimum size limit to 15 inches was estimated to reduce the total commercial catch by 18%. Increasing the minimum size limit to 16 inches would reduce commercial catch by an estimated 32%, which would achieve the minimum catch reduction requested by the MFC. While the 'other gear' category had the greatest reduction by gear (see Appendix Table A4.3), the reduction from this category contributed very little to the overall commercial fishery reduction due to the small amount of harvest (Table 11). The second highest reduction by gear was for gill nets.

Catch reductions were calculated for the commercial fishery based on increasing the minimum size limit to 15 inches and 16 inches from the current 14-inch limit. Catch reductions do not include further reductions that would be expected from an increase in gill net and pound net escape panel mesh sizes. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions). An increase in gill net and pound net escape panel mesh sizes would likely result in larger catch reductions than those shown below due to the expected smaller number of dead discards.

Estimates of discard percentages at 14-, 15- and 16-inch minimum size limits using gill net stretched mesh sizes of 5.5 (the current minimum for large mesh nets), 5.75, 6.0 and 6.5 inches from the NCDMF observer program are provided (Table 12). Mesh sizes above 6.5 inches were seldom observed and would not be considered viable options because they are not allowed in accordance with the division's Federal Sea Turtle Incidental Take Permit (ITP). Analysis of NCDMF observer data indicates that increasing mesh size reduces the number of undersized fish retained in gill nets. The majority of the observations occurred in Pamlico Sound, which is an important area for the fishery, but the majority of large mesh gill net landings of flounder are typically from the ASMA. It is important to consider the ASMA typically has a higher proportion of smaller southern flounder in catches, and thus would be expected to produce more discards, than Pamlico Sound. A study by Kimel et al (2008) had similar results to NCDMF observer data regarding percentages of discards at different mesh sizes and minimum size limits. Due to the geographic and temporal range of data, and measurements of all sizes of flounder

caught, NCDMF observer data were determined to be the most appropriate for characterizing the percentage of discards at various mesh sizes. Nevertheless, this approach and results have not been through the typical NCDMF review process and further analysis may yield different results.

Estimates of discard percentages at 14-, 15- and 16-inch minimum size limits using pound net escapement (escape) panel stretched mesh sizes of 5.5 (the current minimum size), 5.75 and 6.0 inches from NCDMF studies are provided (Table 13). Analysis of data from NCDMF studies testing pound net escape panels in Albemarle Sound, Pamlico Sound and Back Sound indicates increasing escape panel mesh size reduces the number of undersized fish retained in pound nets (Brown 2014, unpublished NCDMF data). NCDMF studies did not test escape panels with mesh sizes above six inches, but it is assumed that larger mesh sizes would further reduce discards. However, it should be noted that the MFC rule defining pound net sets indicates that six inches is the maximum mesh size for escape panels that the NCDMF Director can require (15A NCAC 03J .0501 (e)(1)). Most of the samples from NCDMF studies came from Albemarle Sound and Back Sound. Although these areas are important areas of pound net harvest, the majority of pound net landings typically come from Pamlico Sound. The dataset used for this analysis may be the best available; however, due to time constraints this approach and results may require additional review and further analysis may yield different results.

Reductions presented here were based on catch for the whole year. If the minimum size limit increase was implemented late in the year, reductions would likely be smaller than those presented here during the first year of the change. However, because southern flounder grow quickly throughout the year, estimating commercial fishery reductions based on data from fall months may be more accurate. Reductions based on annual data will most likely be overestimates due to the likelihood of discards in the first half of the year growing into the legal limit and being caught by the end of the year.

Dead discards were estimated for each commercial gear for calculating catch reductions. Because there were no available discard mortality estimates for commercial gears aside from gill nets, the seasonal gill net post-release discard rates were also applied to the expected discards for all commercial gears resulting from raising the minimum size limit. There is no reason to expect this rate to be the same for all commercial gears, but this method was used to account for discard mortality in a consistent manner using the only available data. If the applied post-release discard rate is lower or higher than the true rate for any of the gears, the estimated catch reductions will be correspondingly higher or lower than reality.

Some positive and negative impacts due to increasing the minimum size limit are specific to the commercial fishery. Most commercial gears will have increased discards without gear modifications to allow southern flounder to avoid being caught. The expected increase in discards from the commercial fishery could be mitigated by modifying gear to allow fewer sublegal fish to be caught. The 2005 Southern Flounder FMP implemented a minimum large mesh gill net size of 5.5 inches stretched mesh and required escape panels of 5.5 inches stretched mesh in flounder pound nets coast wide in conjunction with the minimum size limit increase (NCDMF 2005). NCDMF data indicate increasing the mesh size for these gears will decrease the percentage of flounder caught at 14 and 15 inches. Although some fishermen already use mesh sizes greater than the minimum, many do not and would need to order new nets and/or panels. An increase in the minimum size limit would impact some fishing areas more than others due to southern flounder life history patterns and habitat use. NCDMF gill net observer

data indicate the Albemarle Sound Management Area (ASMA) could be most impacted by the minimum size limit increase, followed by Core/Back sounds (Table 14). Because the discard post-release mortality rate for gill nets is much higher in summer compared to other months, a closure of especially the large gill net fishery during summer months would greatly reduce discard mortality.

Table 11. Catch reductions (percent) from total commercial catch for minimum size limit increases based on 2011-2014* commercial catch average. Bolded row includes a reduction within the requested range for the total commercial fishery. See harvest reductions in Table A2.5.

| Size limit | Gill net | Pound net | Gig | Other | Total |
|---|---|---|---|---|---|
| 15 inch | 11 | 6 | 1 | 0 | 18 |
| **16 inch** | 18 | 12 | 2 | 0 | **32** |

*2014 data are preliminary

Table 12. Percent of flounder below potential minimum size limits by gill net mesh size in 2004-2006, 2008, and 2012-2013* from NCDMF observer program.

| | Streched mesh size (inches) | | | | |
|---|---|---|---|---|---|
| Criteria | 5.5 | 5.75 | 6 | 6.25 | 6.5 |
| % below 14 inch | 26 | 15 | 7 | 5 | 4 |
| % below 15 inch | 59 | 41 | 20 | 12 | 11 |
| % below 16 inch | 81 | 68 | 46 | 35 | 31 |
| Total fish measured | 26,245 | 13,967 | 31,751 | 3,293 | 3,175 |

*Years chosen due to statewide observer coverage

Table 13. Percent of flounder below potential minimum size limits by pound net escape panel mesh size from NCDMF studies in 1994, 1995, 1998 and 2011*.

| | Streched mesh size (inches) | | |
|---|---|---|---|
| Criteria | 5.5 | 5.75 | 6.0 |
| % below 14 inch | 39 | 15 | 5 |
| % below 15 inch | 55 | 30 | 25 |
| % below 16 inch | 75 | 53 | 56 |
| Total fish measured | 937 | 634 | 121 |

*Years of the NCDMF escape panel studies with consistent methodology

Table 14. Percentage by length grouping of total southern flounder 14 inches and above in the commercial gill net fishery as measured in 2012-2013 by the NCDMF Observer Program.

| Criteria (inches) | ASMA | Pamlico Sound | Pamlico Sound tributaries | Core/Back sounds | Southern areas | Total |
|---|---|---|---|---|---|---|
| 14.0-14.9 | 41 | 23 | 35 | 39 | 30 | 31 |
| 14.0-15.9 | 74 | 53 | 60 | 65 | 60 | 61 |
| Number 14.0+ | 5,935 | 10,975 | 1,413 | 2,643 | 2,693 | 23,724 |

*Reductions for the recreational fishery*

The current recreational minimum size limit is 15 inches, therefore only the reduction from a 16-inch minimum size limit was examined for the recreational fishery. The reduction at 16 inches was below the minimum range requested by the MFC (Table 15). Most of the estimated reduction from the total recreational fishery came from hook and line gear. Western counties had the greatest reduction for the hook and line fishery resulting from a 16-inch minimum size limit relative to northern and southern regions of the state (Figure 9). The NCDMF mail-based gig survey does not provide fish length data, but the MRIP collects length data for hook and line-harvested southern flounder. Lengths of fish harvested by gigs were assumed to be similar to those harvested by hook and line, but there are likely differences in length distributions between the gears that could impact the estimated reductions due to a minimum size limit increase. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions). It was assumed that all recreational harvest 15.0-15.9 inches from the 2011-2014 average would be caught and discarded with a minimum size limit increase to 16 inches. Unlike commercial gill nets and pound nets, hook and line gear cannot be modified to mitigate increases in discards that could result from increasing the minimum size limit. In contrast, recreational gigs operate by visually targeting flounder so it would be possible to avoid undersized flounder. The catch reductions presented here may be underestimates if gigs are able to avoid some undersized fish. Another likely outcome of increasing the minimum size limit is more discards of summer flounder and Gulf flounder, two species in the same genus as southern flounder. Summer flounder is more common north of Cape Hatteras, while Gulf flounder is mostly found in ocean waters south of Cape Hatteras. These species tend to be smaller than southern flounder in North Carolina so are more likely to be undersized. Although these flounder species are often caught in North Carolina, in recent years southern flounder has dominated the recreational flounder harvest. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards, but still did reach the MFC requested range (see Appendix 2 for harvest reductions).

Table 15. Catch reductions (percent) from total recreational catch with a 16-inch size limit based on 2011-2014* recreational catch average. See harvest reductions in Table A2.6.

| Size Limit | Hook & Line | Gig | Total |
|---|---|---|---|
| 16 inch | 10 | 2 | 12 |

*2014 data are preliminary, 2014 gig data were not available

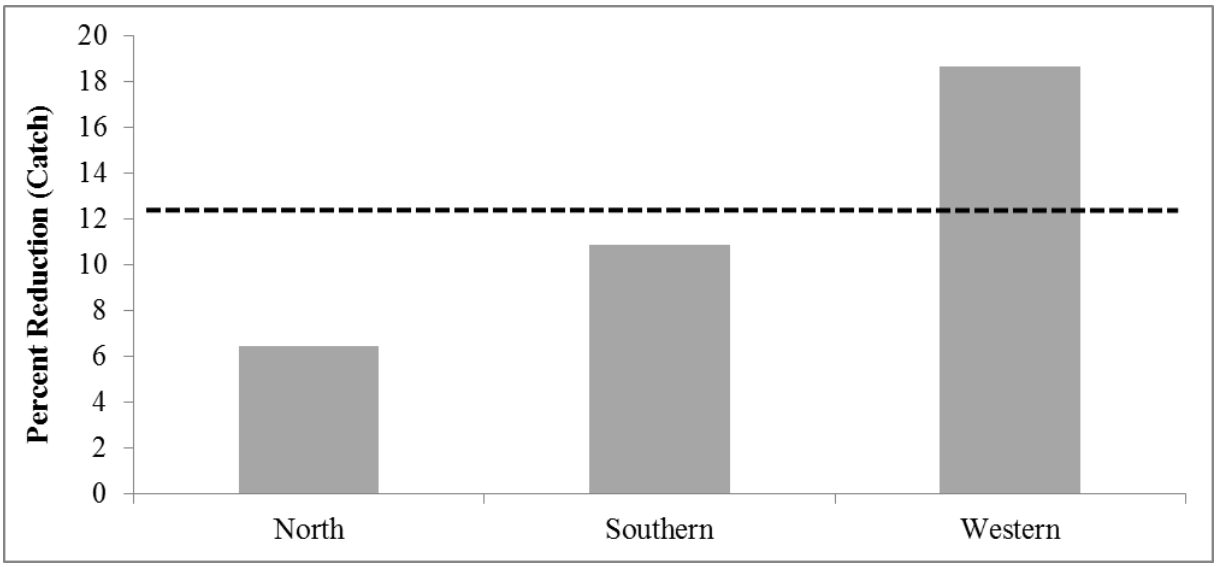


Figure 9. Reduction for recreational southern flounder hook and line fishery with 16-inch minimum size by region (North = Currituck-Carteret counties, Southern = Onslow-Brunswick counties, Western= counties on west side of Pamlico Sound). The dotted line is the mean reduction.

*Reductions for the combined fishery*

Reductions from a minimum size limit increase to 15 or 16 inches were also estimated for the combined fishery. The total catch in numbers of fish was calculated and all reductions were relative to this total. An increase to 15 inches (for the commercial fishery) would result in catch reductions below 25% (Table 16). Increasing the minimum size limit to 16 inches for both sectors resulted in a catch reduction above the minimum requested by the MFC (28%). Catch reductions do not include further reductions that would be expected from an increase in gill net and pound net escape panel mesh sizes. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions). An increase in gill net and pound net escape panel mesh sizes would likely result in larger catch reductions than those shown below due to the expected smaller number of dead discards.

Table 16. Catch reductions (percent) from the combined fishery catch for minimum size limit increases based on 2011-2014* combined fishery average. Bolded row includes a reduction within the requested range for the combined fishery total. See harvest reductions in Table A2.7.

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Size limit | Gill net | Pound net | Gig | Other gears | Total | Hook & line | Gig | Total | Total |
| 15 inch | 9 | 4 | 1 | < 1 | 14 | 0 | 0 | 0 | 14 |
| **16 inch** | 14 | 9 | 2 | < 1 | **25** | 2 | < 1 | 3 | **28** |

*2014 data are preliminary, 2014 commercial gill net discard estimates were not available, 2014 recreational gig data were not available

Option 3: Decrease the recreational bag limit

A creel or recreational bag limit for the recreational fishery is the number of fish allowed to be kept during a trip by an individual or boat. The 2005 Southern Flounder FMP implemented an eight-fish recreational bag limit for the recreational southern flounder fishery (NCDMF 2005). Supplement A to the Southern Flounder FMP decreased the recreational bag limit to six fish for the recreational flounder fishery in 2011. A similar management measure for the commercial fishery, trip limits, was not included as an option in this supplement because of drastic differences in trip level harvest by gear and month.

The reduction from decreasing to a one-fish recreational bag limit was estimated at less than 25% (Table 17, Figure 10). The hook and line fishery contributed the most to reductions from recreational bag limit decreases because of the greater harvest from this gear; however, reduction by gear was greater for the recreational gig fishery than for hook and line at any recreational bag limit because more flounder are caught on average per trip by gigging than by hook and line (see Appendix Table A4.5). Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions).

Table 17. Catch reductions (percent) from total recreational catch for recreational bag limit decreases based on 2011-2014* average. See harvest reductions in Table A2.8.

| Bag Limit | Hook & Line | Gig | Total |
|---|---|---|---|
| 1 fish | 15 | 7 | 23 |
| 2 fish | 6 | 3 | 10 |
| 3 fish | 3 | 1 | 5 |
| 4 fish | 1 | 1 | 3 |
| 5 fish | 1 | <1 | 2 |

*2014 data are preliminary, 2014 gig data were not available

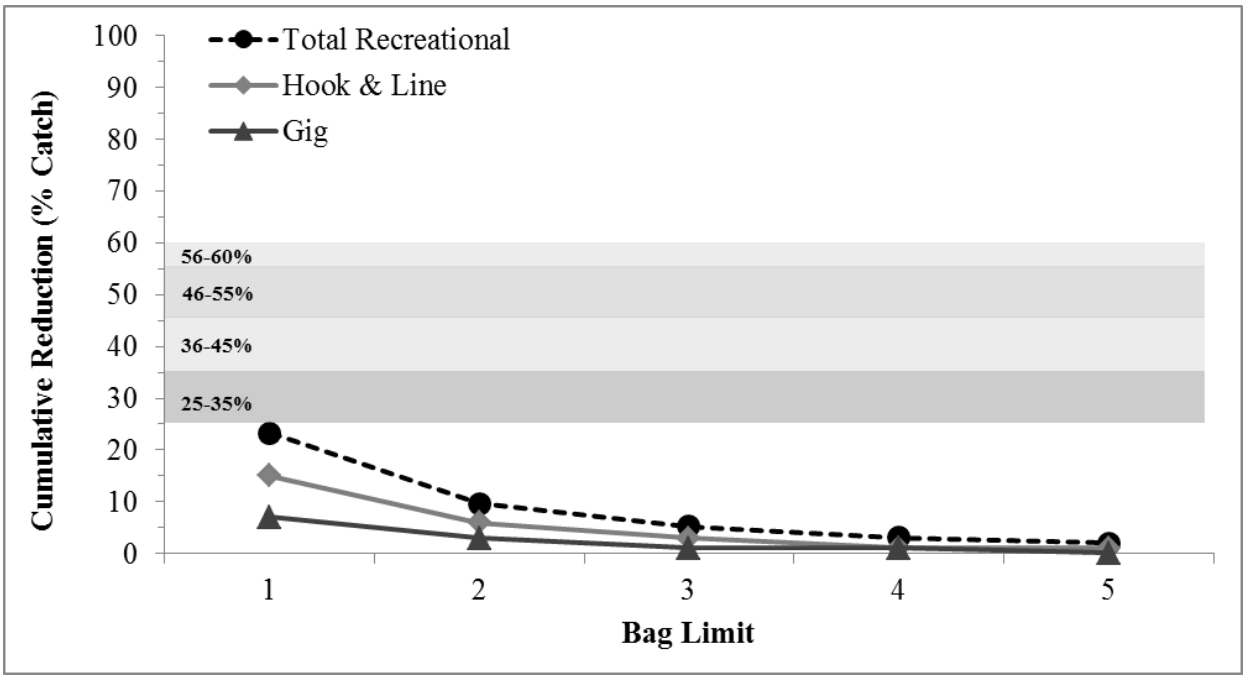


Figure 10. Catch reductions (percent) from recreational catch by gear for recreational bag limit decreases based on 2011-2014 average.

Option 4: Implement a season closure and increase the minimum size limit

Another option for reducing catch is to combine a season closure with a minimum size limit increase. This option has the potential to increase the benefits to the stock compared to implementing one type of measure alone. The reductions provided by an increase in the minimum size limit will allow the same reduction to be achieved, but with a shorter season closure than with a season closure alone. This would enable fishing to continue for more days. Increasing the minimum size limit would also reduce the likelihood of the fishery recouping landings by increasing effort prior to a season closure. A season closure will reduce the number of discards that might occur if the only management change was a minimum size limit increase. Both measures should increase escapement. A minimum size limit increase would increase escapement for fish below that limit, whereas a season closure at the end of the year would

increase escapement for fish above and below the minimum size limit. Despite these benefits, all of the potential negative impacts discussed for season closures (Option 1) and increased minimum size limits (Option 2) will also need to be considered for this option. The impact of a combined approach on the percentage of immature fish in the harvest is unclear. A minimum size limit increase would reduce the percentage of immature fish in the harvest, while a season closure at the end of the year is likely to increase the percentage of immature fish in the harvest.

*Reductions for the commercial fishery*

If the minimum size limit was increased to 15 inches for the commercial fishery, a reduction above 25% was estimated to be achievable with a season closure two weeks shorter than with a season closure alone. A season closure would not be needed for a reduction above 25% with a 16-inch minimum size limit. Increasing the minimum size limit to 15 inches combined with a season closure starting Nov. 1 would result in an estimated reduction of 31% (Table 18, Figure 11). To achieve an estimated 60% catch reduction, a closure beginning Oct. 1 would be needed. Alternatively, a 16-inch minimum size limit and a closure starting Nov. 16 would result in an estimated 36% reduction. Starting the season closure Oct. 16 with a 16-inch minimum size limit resulted in an estimated 55% catch reduction. Catch reductions do not include further reductions that would be expected from an increase in gill net and pound net escape panel mesh sizes. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions). An increase in gill net and pound net escape panel mesh sizes would likely result in larger catch reductions than those shown below due to the expected smaller number of dead discards.

Table 18. Catch reductions (percent) from the total commercial catch for season closures and minimum size limit increases based on 2011-2014* commercial average. Bolded rows include a reduction within the requested range for the total commercial fishery. See harvest reductions in Table A2.9.

| Closure | 15 inch limit | 16 inch limit |
|---|---|---|
| **Nov 16-Dec 31** | 22 | **36** |
| **Nov 1-Dec 31** | **31** | **43** |
| **Oct 16-Dec 31** | **46** | **55** |
| **Oct 1-Dec 31** | **59** | 67 |
| Sept 16-Dec 31 | 73 | 78 |
| Sept 1-Dec 31 | 77 | 81 |
| Aug 16-Dec 31 | 81 | 85 |
| Aug 1-Dec 31 | 84 | 87 |
| Jan 1 - Dec 31 | 100 | 100 |

*2014 data are preliminary, 2014 discard estimates were not available

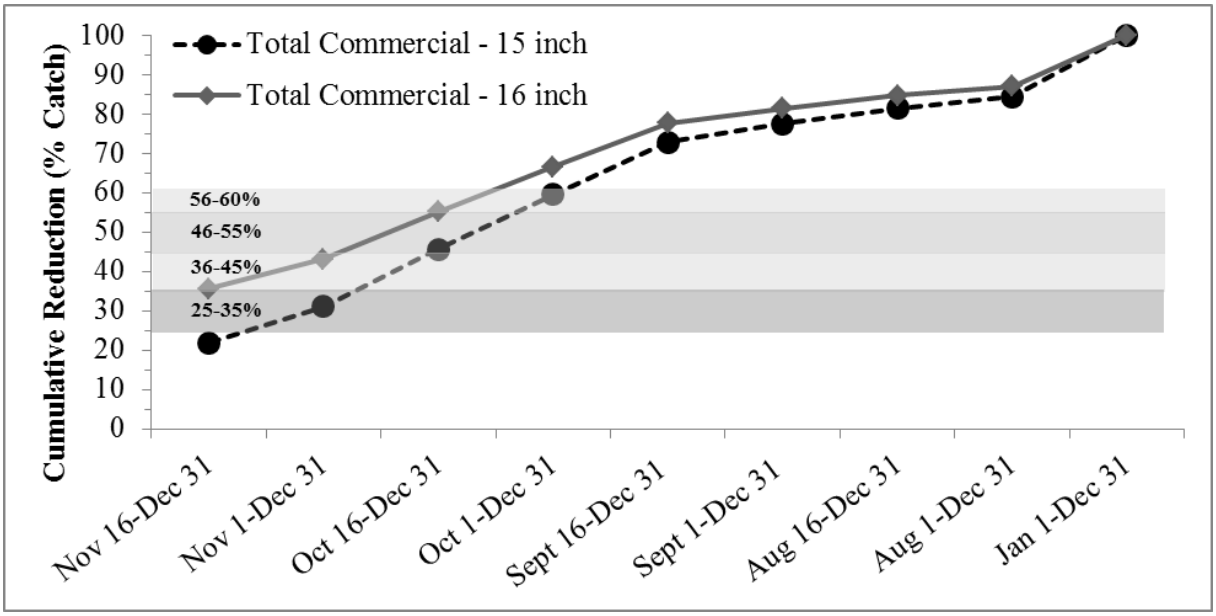


Figure 11. Commercial catch reductions (percent) from the total commercial fishery catch for season closures and minimum size limit increases based on 2011-2014 average.

*Reductions for the recreational fishery*

A season closure beginning Sept. 16 and a 16-inch minimum size limit resulted in an estimated catch reduction for the recreational fishery above the minimum requested by the MFC (28%; Table 19, Figure 12). Estimates indicated closing the entire season would be required to achieve a catch reduction above 60% for the recreational fishery. Combining a minimum size limit increase with a season closure achieved a reduction above 25% with a season closure one month less than with a season closure alone. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions).

Table 19. Catch reductions (percent) from the total recreational catch for season closures and a 16-inch minimum size limit based on 2011-2014* recreational average. Bolded rows include a reduction within the requested range for the total recreational fishery. See harvest reductions in Table A2.10.

| Closure | 16 inch limit |
|---|---|
| Dec 16 - Dec 31 | 13 |
| Dec 1 - Dec 31 | 14 |
| Nov 16 - Dec 31 | 15 |
| Nov 1 - Dec 31 | 17 |
| Oct 16 - Dec 31 | 20 |
| Oct 1 - Dec 31 | 23 |
| **Sep 16 - Dec 31** | **28** |
| **Sep 1 - Dec 31** | **32** |
| **Aug 16 - Dec 31** | **41** |
| **Aug 1 - Dec 31** | **45** |
| Jan 1 - Dec 31 | 69 |

*2014 data are preliminary, 2014 gig data were not available

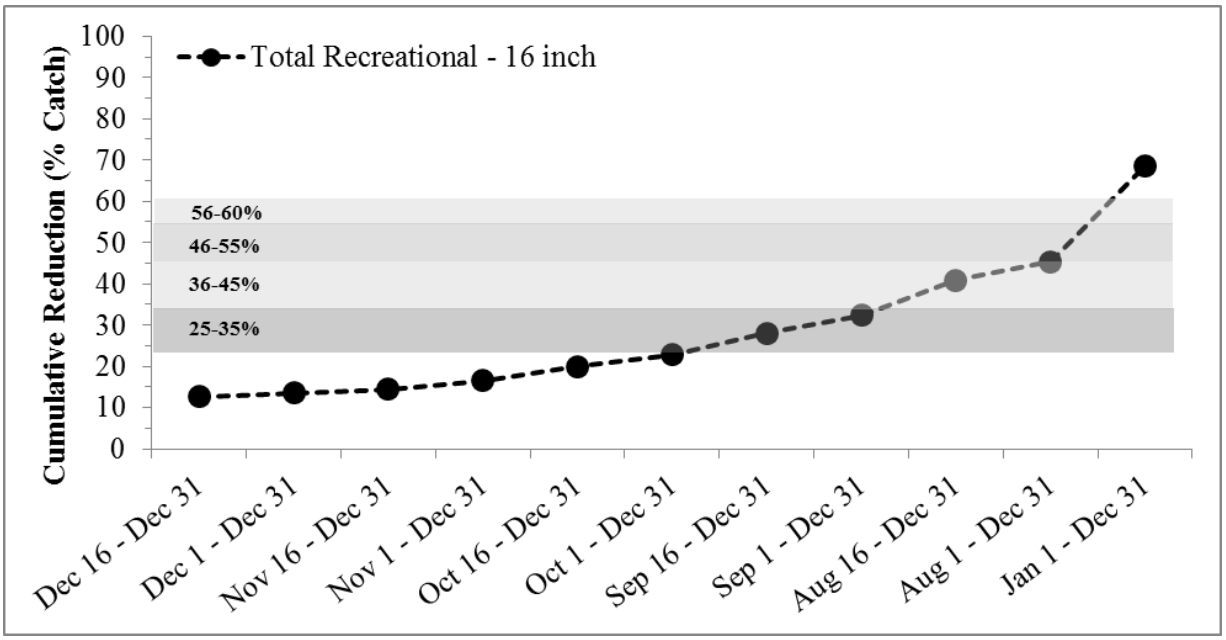


Figure 12. Catch reductions (percent) from the total recreational catch for season closures and a 16-inch minimum size limit based on 2011-2014 recreational average.

*Reduction for the combined fishery*

Reductions from a minimum size limit increase to 15 or 16 inches combined with season closures were also estimated for the combined southern flounder fishery. An increase to 15 inches (for the commercial fishery) combined with a closure Nov. 16 – Dec. 31 resulted in an estimated reduction of 18% (Tables 20, Figure 13). With a closure Nov. 1-Dec. 31 the estimated

reduction increased to 25%. A closure period of Oct. 1-Dec. 31 combined with a 15-inch minimum size limit resulted in an estimated reduction of 50%. Increasing the minimum size limit to 16 inches combined with a closure Nov. 16-Dec. 31 resulted in an estimated reduction of 31%. An Oct. 1-Dec. 31 closure and a 16-inch minimum size limit resulted in an estimated 58% reduction. Catch reductions do not include further reductions that would be expected from an increase in gill net and pound net escape panel mesh sizes. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions). An increase in gill net and pound net escape panel mesh sizes would likely result in larger catch reductions than those shown below due to the expected smaller number of dead discards.

Table 20. Catch reductions (percent) from the combined fishery catch for season closures and size limit increases based on 2011-2014* combined fishery average. Bolded rows include a reduction within the requested range. See harvest reductions in Table A2.11.

| Closure | 15 inch limit | 16 inch limit |
|---|---|---|
| **Nov 16-Dec 31** | 18 | **31** |
| **Nov 1-Dec 31** | **25** | **37** |
| **Oct 16-Dec 31** | **38** | **48** |
| **Oct 1-Dec 31** | **50** | **58** |
| Sept 16-Dec 31 | 61 | 67 |
| Sept 1-Dec 31 | 65 | 71 |
| Aug 16-Dec 31 | 69 | 74 |
| Aug 1-Dec 31 | 72 | 77 |
| Jan 1 - Dec 31 | 90 | 92 |

*2014 data are preliminary, 2014 commercial gill net discard estimates were not available,

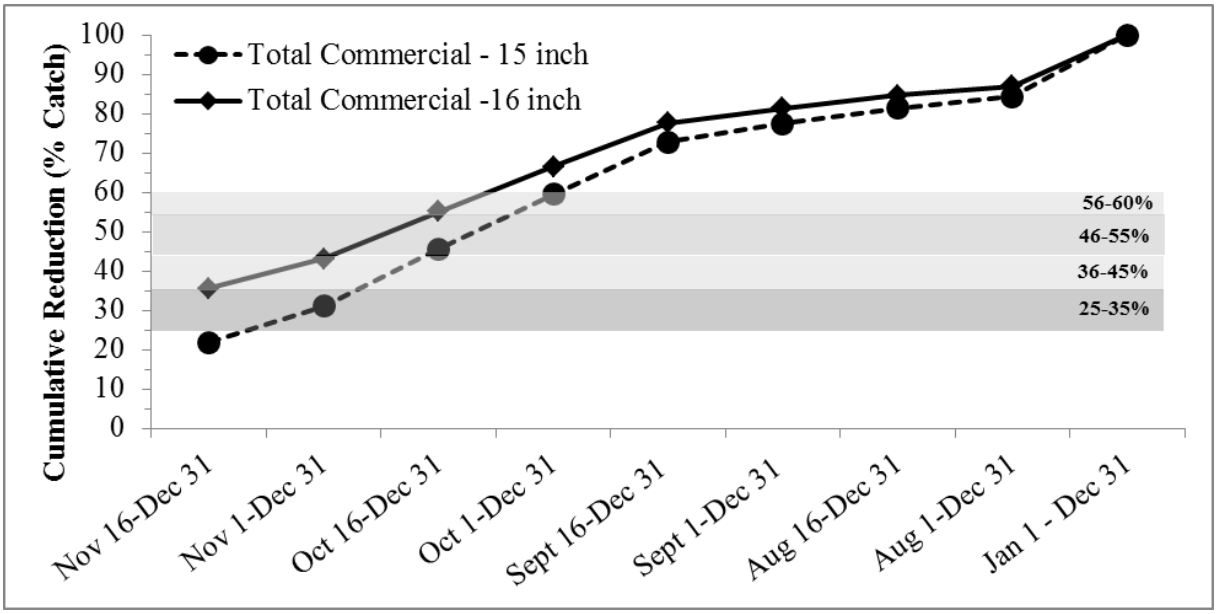


Figure 13. Catch reductions (percent) from the combined fishery catch for season closures and minimum size limit increases based on 2011-2014 combined fishery average.

Option 5: Implement a season closure, increase the minimum size limit and decrease recreational bag limit

The final option included in this supplement for reducing catch is to combine a season closure, a minimum size limit increase and a recreational bag limit decrease. The recreational bag limit is a regulation for the recreational fishery only and therefore no additional commercial reduction is gained by adding this reduction. However, a decrease in the recreational bag limit does impact the total fishery reduction. This option includes all the advantages and disadvantages of implementing each management measure alone. A major advantage to combining measures in this way is to shorten the season closure but still maintain the requested fishery reduction. Also, reducing the recreational bag limit could make reductions more equitable between sectors for this option.

*Recreational fishery reductions*

Reductions within the target range (25-60%) can potentially be obtained through many potential combinations of minimum size limit, recreational bag limit, and season closures (Table 21). Although a reduction within the requested range is possible without reducing the recreational bag limit, this measure would reduce the needed season closure length at either the current minimum size limit or with a 16-inch minimum size limit. Reducing the recreational bag limit to one fish was estimated to reduce the fishery by less than 25% at the current minimum size limit unless a closure starting Nov. 16 is implemented (Table 21, Figure 14). With a two-fish recreational bag limit, the closure would need to start Sept. 16 to reach an estimated 25% reduction. With a minimum size limit of 16 inches it would be possible to reduce the recreational bag limit to one fish and avoid a season closure. A closure beginning Dec. 16, increasing the minimum size to 16 inches and reducing to a one-fish recreational bag limit resulted in an estimated reduction of 32%. A closure beginning Nov. 1, a minimum size limit increase to 16 inches and a recreational bag limit of two fish per angler would achieve an estimated reduction of 24%. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions).

Table 21. Catch reductions (percent) from the total recreational catch for season closures, recreational bag limit decreases and a minimum size limit increase to 16 inches based on 2011-2014* recreational average. Bolded rows include a reduction within the requested range for the total recreational fishery. See harvest reductions in Table A2.12.

| | 15 inches | | | | | | 16 inches | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Closure | 1 fish | 2 fish | 3 fish | 4 fish | 5 fish | 6 fish | 1 fish | 2 fish | 3 fish | 4 fish | 5 fish | 6 fish |
| **Dec 16 - Dec 31** | 24 | 11 | 6 | 4 | 3 | 1 | **33** | 21 | 17 | 15 | 14 | 13 |
| **Dec 1 - Dec 31** | **25** | 12 | 7 | 5 | 4 | 2 | **34** | 22 | 18 | 16 | 15 | 14 |
| **Nov 16 - Dec 31** | **26** | 12 | 8 | 6 | 5 | 3 | **34** | 23 | 19 | 17 | 16 | 15 |
| **Nov 1 - Dec 31** | **27** | 15 | 10 | 8 | 7 | 5 | **36** | **25** | 21 | 19 | 18 | 17 |
| **Oct 16 - Dec 31** | **30** | 18 | 14 | 12 | 11 | 9 | **39** | **28** | 24 | 22 | 22 | 20 |
| **Oct 1 - Dec 31** | **33** | 21 | 17 | 15 | 14 | 13 | **41** | **30** | **27** | **25** | 24 | 23 |
| **Sep 16 - Dec 31** | **37** | **26** | 23 | 21 | 20 | 18 | **45** | **35** | **32** | **30** | **29** | **28** |
| **Sep 1 - Dec 31** | **41** | **31** | **27** | **26** | **25** | 23 | **48** | **39** | **36** | **34** | **34** | **32** |
| **Aug 16 - Dec 31** | **49** | **39** | **36** | **35** | **34** | **33** | **55** | **47** | **44** | **43** | **42** | **41** |
| **Aug 1 - Dec 31** | **53** | **44** | **41** | **40** | **39** | **38** | **58** | **51** | **48** | **47** | **46** | **45** |
| Jan 1 - Dec 31 | 73 | 68 | 66 | 66 | 65 | 64 | 76 | 72 | 70 | 70 | 69 | 69 |

*2014 data are preliminary, 2014 gig data were not available

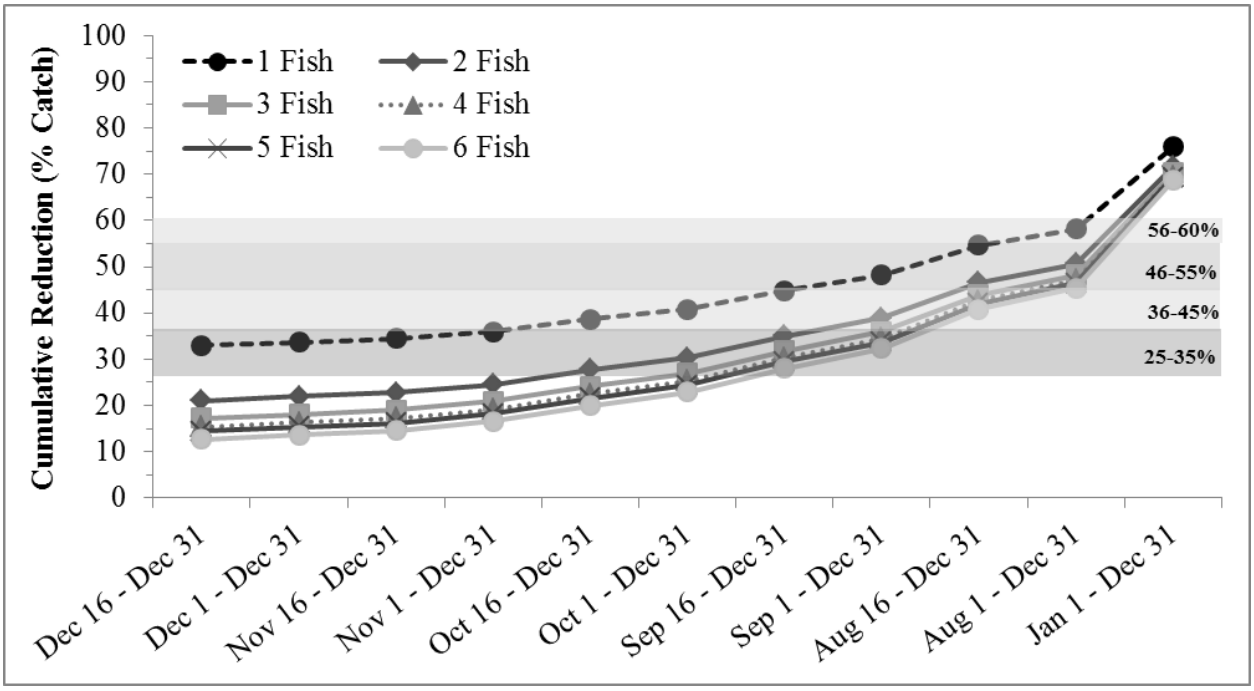


Figure 14. Catch reductions (percent) from the recreational catch by gear for season closures, recreational bag limit decreases and a 16-inch minimum size limit based on 2011-2014 recreational average.

*Combined fishery reductions*

Reduction from a season closure, minimum size limit increase and recreational bag limit decrease were estimated for the total fishery. Due to the small additional reduction gained by decreasing the recreational bag limit, only a one- or two-fish recreational bag limit were included in reduction estimates. Increasing the commercial fishery size limit to 15 inches, implementing a closure Nov. 16-Dec. 31 and decreasing the recreational bag limit to one fish would result in an estimated 22% reduction (Table 22, Figure 15). To achieve an estimated 25% reduction with a minimum commercial size limit of 15 inches and one-fish recreational bag limit, a season closure of Nov. 16-May 15 would also be needed. Reductions gained from a season closure in winter and early-spring are small due to minimal flounder fishing during that time relative to other seasons. A closure period of Oct. 1-Dec. 31 combined with a 15-inch minimum size limit and a one-fish recreational bag limit was estimated to reduce catch by 52%. Increasing the minimum size limit to 16 inches with a closure Nov. 16-Dec. 31and a two-fish recreational bag limit resulted in an estimated reduction of 32% (Table 22, Figure 16). An Oct. 1-Dec. 31 closure with a 16-inch minimum size limit and a one-fish recreational bag limit resulted in an estimated 60% reduction. Reductions were only slightly lower with a two-fish recreational bag limit instead of a one-fish recreational bag limit due to the small number of catches with more than one southern flounder. Catch reductions do not include further reductions that would be expected from an increase in gill net and pound net escape panel mesh sizes. Catch reductions were considerably lower than harvest reductions for this option due to the expected increase in dead discards (see Appendix 2 for harvest reductions). An increase in gill net and pound net escape panel mesh sizes would likely result in larger catch reductions than those shown below due to the expected smaller number of dead discards.

Table 22. Catch reductions (percent) from the combined fishery for season closure, minimum size limit increase and a one- or two-fish recreational bag limit based on 2011-2014* combined fishery average. Bolded rows include a reduction within the requested range. See harvest reductions in Table A2.13.

| | 15 inch limit | | 16 inch limit | |
|---|---|---|---|---|
| Closure | 1 fish bag limit | 2 fish bag limit | 1 fish bag limit | 2 fish bag limit |
| **Nov 16-Dec 31** | 22 | 19 | **34** | **32** |
| **Nov 1-Dec 31** | **29** | **27** | **41** | **39** |
| **Oct 16-Dec 31** | **41** | **39** | **50** | **49** |
| **Oct 1-Dec 31** | **52** | **51** | **60** | **59** |
| Sept 16-Dec 31 | 63 | 62 | 69 | 68 |
| Sept 1-Dec 31 | 67 | 66 | 72 | 71 |
| Aug 16-Dec 31 | 71 | 70 | 76 | 75 |
| Aug 1-Dec 31 | 74 | 73 | 78 | 77 |
| Jan 1 - Dec 31 | 91 | 90 | 92 | 92 |

*2014 data are preliminary, 2014 commercial gill net discard estimates were not available, 2014 recreational gig data were not available

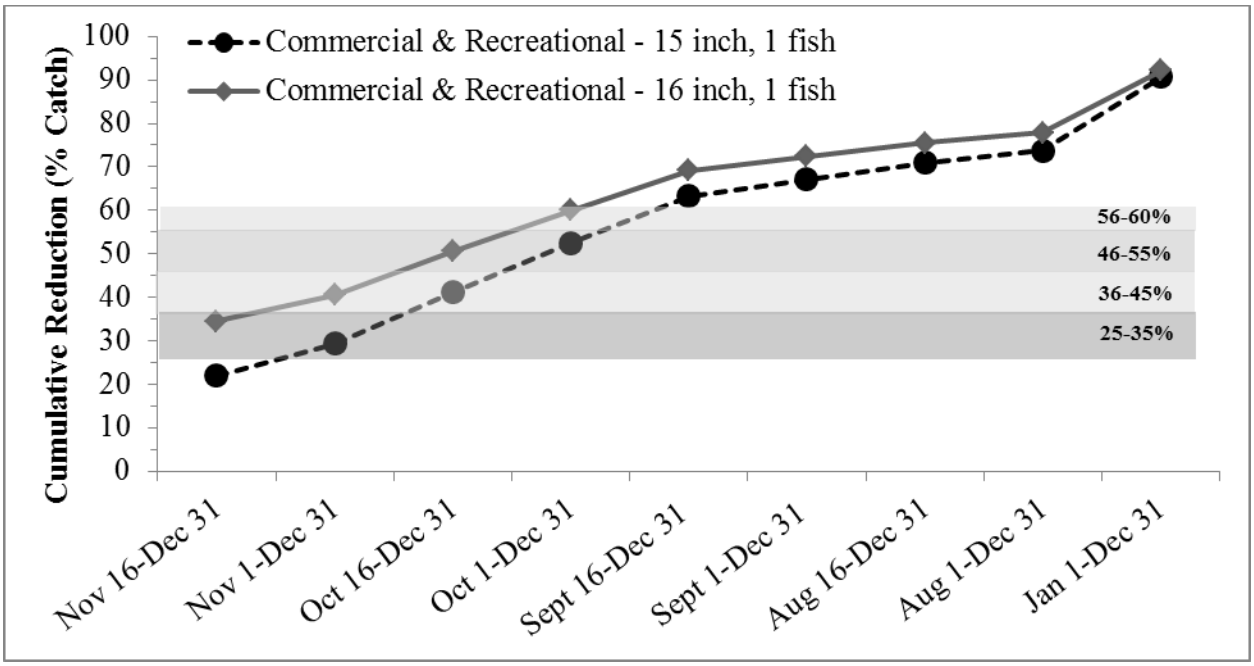


Figure 15. Catch reductions (percent) from the combined fishery catch for season closures, minimum size limit increases and a one-fish recreational bag limit based on 2011-2014 combined fishery average.

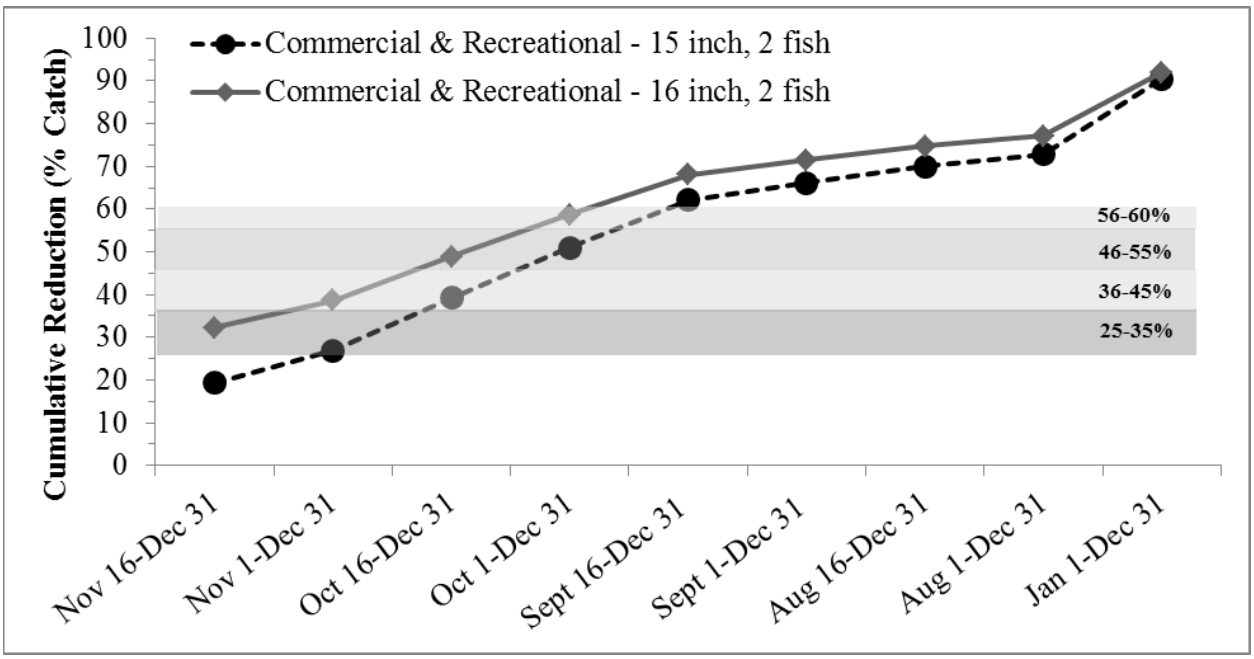


Figure 16. Catch reductions (percent) from the combined fishery catch for season closures, minimum size limit increases and a two-fish recreational bag limit based on 2011-2014 combined fishery average.

The goal of the management options discussed in this supplement is to reduce catch within the range requested by the MFC such that southern flounder spawning stock biomass is increased. Increasing escapement directly impacts the spawning stock biomass in the short-term and may have even greater benefits in the long-term. Because there is not an approved southern flounder stock assessment to use for setting sustainable harvest levels, the reduction chosen can only be based on the degree of concern about the current state of the southern flounder stock as understood by data trends. Additionally, until a stock assessment is developed that is deemed acceptable for management of southern flounder it will not be possible to determine whether any new management measures implemented through a supplement to reduce catch have resulted in sustainable harvest levels. Further confounding appropriate harvest levels, evidence suggests southern flounder is likely one stock within the South Atlantic. Southern flounder migrating from N.C. estuarine waters often enter waters south of North Carolina's southern border where they will be susceptible to harvest in the other states' waters, possibly prior to spawning the first time. Therefore, the benefits to the spawning stock biomass achieved by reducing catch in N.C. waters will be mitigated by fishing effort and regulations in other South Atlantic states.

## V. PROPOSED MANAGEMENT OPTIONS

(+ Potential positive impact of action)
(- Potential negative impact of action)

**Commercial Fisheries:**

1. Implement a season closure (half-month periods starting at the end of the season)
   + Achieves reductions throughout requested range
   + May increase the spawning stock biomass
   + May increase harvest with possible improvements in the economic performance of the fishery in the long-term
   + No discard mortality if all gear is removed from water
   + Increases escapement (number of mature individuals able to spawn)
   + Decreases opportunity for recoupment (relative to mid-season closures)
   - To avoid recoupment, harvest from any gear must cease during closure.
   - Decreases harvest with possible economic losses to the fishery
   - Continues harvest of primarily immature fish
   - Inequity in reductions by gear and area
   - Effort may increase during open seasons, diminishing the reductions
   - If any gears that catch flounder are left in the water, this will result in discard mortality.
   - If harvest is allowed for any gears during closed seasons, this will result in recoupment. Effort may increase in other fisheries resulting in unsustainable harvest levels.
   - Rule 15A NCAC 03J. 0501 states a pound net must be set 30 consecutive days to be a valid permit, potentially requiring additional NCDMF action if a season closure reduces pound net sets to less than 30 days.
   - Additional regulations will make data trends more difficult to interpret.

2. Increase the minimum size limit (15” and 16”) with gear modifications

+ Achieves reduction within requested range at 16-inch minimum size limit
+ May increase the spawning stock biomass
+ May increase harvest with possible improvements in the economic performance of the fishery in the long-term
+ Increases the proportion of fish that are mature before they can be harvested
+ Increases escapement
+ Fishing can continue throughout year (except current December closure)
+ If proper modifications to gill nets and pound nets are made, discards will not increase.
- If minimum mesh sizes for large mesh gill nets and pound net escape panels are not increased enough, discards will increase.
- Decreases harvest with possible economic losses to the fishery
- Some regions may be impacted more than others (i.e., Albemarle Sound, Core/Back Sound, western Pamlico Sound and its tributaries).
- Some gears may be impacted more than others.
- Impacts on catches greatest in early half of the year (January-June)
- Predicted reduction may be less than actual due to recoupment once fish reach legal size
- Effort may increase in other fisheries resulting in unsustainable harvest levels.
- Additional regulations will make data trends more difficult to interpret.

3. Implement a season closure and increase the minimum size limit with gear modifications

+ Achieves reductions throughout requested range
+ May increase the spawning stock biomass
+ May increase harvest with possible improvements in the economic performance of the fishery in the long-term
+ Increases escapement
+ Shorter season closure needed to achieve similar reduction than season closure alone
+ Smaller increase in discards than minimum size limit increase alone
+ Likely smaller percentage of immature fish in the harvest
+ If proper modifications to gill nets and pound nets are made, discards will not increase.
+/- May result in more equitable reduction among gear types than Options 1 and 2
- Decreased harvest with possible economic losses to the fishery
- Effort may increase during open seasons, diminishing the reductions
- If minimum mesh sizes for large mesh gill nets and pound net escape panels are not increased enough, discards will increase.
- Some regions may be impacted more than others (i.e., Albemarle Sound and western Pamlico Sound and tributaries).
- Impacts on catches greatest in early half of the year (January-June)
- Predicted reduction may be less than actual due to discards growing to legal size
- Fishing activity must cease during closed periods.
- If any gears that catch flounder are left in the water, this will result in discard mortality or harvest if sale of flounder is allowed.
- If the closure does not extend through the end of the season, recoupment will occur.
- Effort may increase in other fisheries resulting in unsustainable harvest levels.
- Additional regulations will make data trends more difficult to interpret.

**Recreational Fisheries:**

1. Implement a season closure (half-month periods starting at the end of the season)
   + Achieves reductions within most of requested range (complete closure required for 60%)
   + May increase the spawning stock biomass
   + May increase harvest with possible improvements in the economic performance of the fishery in the long-term
   + Aug. 1 through Dec. 31 and Aug. 16 through Dec. 31 achieve requested reduction range.
   + Closures at the end of the season (i.e., fall months) allow for escapement (number of mature individuals emigrating from estuaries to spawn).
   - Decreased harvest with possible economic losses to the fishery
   - Possible increase in catch of other managed species
   - Increased discards of southern, summer, and Gulf flounder
   - Additional regulations will make data trends more difficult to assess effectiveness.

2. Increase the minimum size limit (16")
   + May increase the spawning stock biomass
   + May increase harvest with possible improvements in the economic performance of the fishery in the long-term
   + Reduces the percentage of immature fish in the harvest
   + Increases escapement
   - Does not achieve a reduction within requested range
   - Decreased harvest with possible economic losses to the fishery
   - Increased discards of southern, summer, and Gulf flounder
   - Disproportionate impact for western Pamlico Sound and tributaries
   - Adds complexity to current regulations
   - Possible increase in catch of other managed species
   - Additional regulations will make data trends more difficult to assess effectiveness.

3. Decrease the recreational bag limit (1-5 fish per person per trip)
   + May increase the spawning stock biomass
   + May increase harvest with possible improvements in the economic performance of the fishery in the long-term
   - Does not achieve a reduction within requested range
   - Increased discards of southern, summer, and Gulf flounder
   - Decreased harvest with possible economic losses to the fishery
   - Possible increase in catch of other managed species
   - Additional regulations will make data trends more difficult to assess effectiveness.

2. Implement a season closure, increase the minimum size limit and decrease the recreational bag limit
   + Achieves reductions within most of requested range
   + May increase the spawning stock biomass
   + May increase harvest with possible improvements in the economic performance of the fishery in the long-term
   + Many possible combinations of reductions within requested range

+ Shorter season closure needed to achieve similar reduction than season closure alone
- Disproportionate impact for western Pamlico Sound and tributaries
- Increased discards of southern, summer, and Gulf flounder
- Decreased harvest with possible economic losses to the fishery
- Possible increase in catch of other managed species
- Adds complexity to current regulations
- Additional regulations will make data trends more difficult to assess effectiveness.

## VI. MANAGEMENT RECOMMENDATIONS

MFC Selected Management Strategy

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NCDMF

- No recommendation at this time

## VII. RESEARCH RECOMMENDATIONS (From NCDMF 2014 Southern Flounder Stock Assessment)

- Retain mail survey of recreational gig survey harvest and discards. Develop methodology to validate mail survey results, possibly using dockside survey.
- Collect discard data (ages, species ratio, lengths, fates) from gears targeting southern flounder (pound net, gigs, hook and line, trawls).
- Develop and implement consistent strategies for collecting age and sex samples from commercial/recreational fisheries and independent surveys to achieve desired precision for stock assessment.
- Collect age data from estuarine trawl survey and Pamlico Sound survey to more accurately estimate YOY abundance (instead of using length cutoffs based on length frequency plot interpretations).
- Tagging study to estimate emigration (unit stock) and mortality rates.
- Expand, improve, or add inshore surveys of southern flounder to develop indices that we can be confident in for future stock assessments.
- Expand, improve or add fishery-independent surveys of the ocean component of the stock.
- Conduct studies to better understand ocean residency of southern flounder.
- Determine locations of spawning aggregations of southern flounder.
- Conduct sampling of the commercial/recreational ocean spear fishery harvest/discards.
- Re-establish a RCGL survey to obtain harvest, discard, and effort information.
- Develop spatial model to account for inshore and ocean components of the stock.

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Appendix 1. Fishery regulations by sector

Table A1.1. Recreational flounder fishery regulations

| | Inland Waters | | | Ocean Waters | | |
|---|---|---|---|---|---|---|
| Year | Size Limit | Bag Limit | Season | Size Limit | Bag Limit | Season |
| 1989 | 13" | ---- | ---- | 13" | ---- | ---- |
| 1990 | 13" | ---- | ---- | 13" | ---- | ---- |
| 1991 | 13" | ---- | ---- | 13" | ---- | ---- |
| 1992 | 13" | ---- | ---- | 13" | ---- | ---- |
| 1993 | 13" | ---- | ---- | 13" | ---- | ---- |
| 1994 | 13" | ---- | ---- | 14" | 8 | ---- |
| 1995 | 13" | ---- | ---- | 14" | 8 | ---- |
| 1996 | 13" | ---- | ---- | 14" | 8 | ---- |
| 1997 | 13" | ---- | ---- | 14.5" | 10 | ---- |
| 1998 | 13" | ---- | ---- | 15" | 8 | ---- |
| 1999 | 13" | ---- | ---- | 15" | 8 | ---- |
| 2000 | 13" | ---- | ---- | 15" | 8 | ---- |
| 2001 | 13" | ---- | ---- | 15.5" | 8 | 5/1-5/14 |
| 2002 | 13"/14"* | ---- | ---- | 15.5" | 8 | 4/3-7/4 |
| 2003 | 13"/14"** | ---- | ---- | 15" | 8 | ---- |
| 2004 | 13"/14"** | ---- | ---- | 14" | 8 | ---- |
| 2005 | 14" | 8 | ---- | 14" | 8 | ---- |
| 2006 | 14" | 8 | ---- | 14" | 8 | ---- |
| 2007 | 14" | 8 | ---- | 14.5" | 8 | ---- |
| 2008 | 14"/15.5"** | 8 | ---- | 14"/15.5"** | 8 | ---- |
| 2009 | 14"/15"** | 8 | ---- | 14"/15"** | 8 | ---- |
| 2010 | 14"/15"** | 8 | ---- | 14"/15"** | 8 | ---- |
| 2011 | 15" | 6 | ---- | 15" | 6 | ---- |
| 2012 | 15" | 6 | ---- | 15" | 6 | ---- |
| 2013 | 15" | 6 | ---- | 15" | 6 | ---- |
| 2014 | 15" | 6 | ---- | 15" | 6 | ---- |

* 14 inch size limit implemented October 1st

** Smaller minimum size limit in western portions of Albemarle and Pamlico sounds and tributaries, and ocean and estuarine waters south of Brown's Inlet; larger minimum size limit north of Brown's Inlet in eastern estuarine and ocean waters.

Table A1.2. Commercial flounder fishery regulations

| Year | Month(s) / Day(s) | Regulation change |
|---|---|---|
| 1979 | Jan - | 11-inch TL minimum size |
| 1988 | Sep - | 13-inch TL minimum size |
| 1992 | Sep 1 - | Escapement panels required in pound nets in Core Sound and southeast Pamlico Sound (four panels at least six meshes high and eight meshes long) |
| 1998 | Sep 1 - | Escapement panels required in flounder pound nets statewide with a minimum mesh size of 5.5 inches, Albemarle Sound west of Alligator River exempted (NCAC 03J .0107) |
| 1999 | Dec 16 - | NMFS emergency rule closed southeastern Pamlico Sound to large mesh* gill nets due to interactions with sea turtles for the season |
| 2000 | Oct 28–Dec 31 | Deep-water large mesh* gill net fishery in Pamlico Sound closed by NMFS due to sea turtle mortalities |
| 2000 | Nov 2 - | NMFS issued Incidental Take Permit (ITP) to the NCDMF for the gill net fishery. Established the Pamlico Sound Gill Net Restricted Area (PSGNRA) and imposed gill net fishery management measures. |
| 2000 | Oct 27 - | The NCDMF closed the PSGNRA to the use of large mesh* gill nets due to sea turtle interactions |
| 2001 | Sep 1–Dec 15 | NMFS closed the Pamlico Sound deep water large mesh* gill-net fishery annually. The PSGNRA continued to operate under an ITP that included: permitted entry, restricted areas, a 2,000 yard limit for all gill-net operations, weekly fishermen reporting, and mandatory scientific observer coverage (Federal Rule 50 CFR Part 223). |
| 2002 | Sep 1–Dec 15 | Reoccurring closure of Pamlico Sound deep water area established by NMFS (Federal Rule 50 CFR Part 223) |
| 2002 | | Reoccurring regulations established for PSGNRA: open under ITP regulations until Sept 1, closed until mid-Sept, then open to 24/7 fishing for the remainder of the season unless interactions with sea turtles exceed ITP thresholds. Three inlet corridors established where large mesh* gillnets were prohibited: Oregon Inlet (OIC), Ocracoke Inlet (OC) and Hatteras Inlet Corridors (HC). Two new mainland restricted areas established. Small mesh gill nets were exempted from the permitting requirements. |
| 2003 | | Three-year ITP granted for the gill-net fishery. Implemented a sea turtle observer and characterization program in PSGNRA September through December. |
| 2005 | | NCDMF received a six-year ITP for the gill-net fishery with changes including increased observer coverage. The mainland portion of the Pamlico Sound was no longer required to have a permit |

*large mesh gill nets are defined as ≥ 5 inch stretched mesh in the North Carolina Trip Ticket Program; beginning in 2010 with the Sea Turtle Settlement large mesh was defined as 4.5 to 6.5 inches stretched mesh

Table A1.2 continued

| Year | Month(s) / Day(s) | Regulation change |
|---|---|---|
| 2005 | Apr - | 14-inch minimum size limit in estuarine waters |
| 2005 | Apr 15 - | Minimum mesh size of 5.5- inch stretched mesh for large mesh* gill nets (rule 15A NCAC 03J. 0103(a)(2)) |
| 2005 | Sep 1 - | 3,000-yard limit on gill nets (rule 15A NCAC 03J .0103(i)(1) ) |
| 2005 | Sep 1 - | Escape panels of 5.5-inch stretched mesh required in pound nets statewide (ended exemption in Albemarle Sound west of the Alligator River) (rule 15A NCAC 03J .0501(e)(2)) |
| 2005 | Oct 24 - | A minimum tailbag mesh size of 4-in stretched mesh in crab trawls in western Pamlico Sound to minimize bycatch of undersized southern flounder. |
| 2005 | Dec 1–31 | Reoccurring commercial flounder fishery closure (except where noted) |
| 2006 | July 1 - | Upper portions of the Neuse, Pamlico, and Pungo rivers closed to shrimp trawling and implemented a maximum combined 90 foot headrope length in the mouths of the Pamlico and Neuse rivers and all of the Bay River to minimize southern flounder bycatch (Rules 15A NCAC 03R .0114) |
| 2007 | Nov 15–Dec 15 | The PSGNRA season closed due to sea turtle interactions surpassing thresholds (proclamation M-19-2007). |
| 2007 | Dec 1–15 | Commercial fishery open due to multiple significant variable conditions, except gill nets 4 to 6.5 inches stretch mesh remained closed in the PSGRNA |
| 2009 | Oct 22 - Nov 30 | The PSGNRA season closed due to sea turtle interactions surpassing authorized thresholds (proclamation M-24-2009). |
| 2009 | Dec 1–15 | Commercial pound net fishery open due to multiple significant variable conditions |
| 2010 | May 15 - | Due to Sea Turtle Lawsuit Settlement, large mesh* gill nets were limited to use: four nights per week (Tuesday - Friday) with 15 meshes deep, a maximum of 2,000 yards north of and 1,000 yards south of Hwy 58 Bridge with 100-yards of continuous net. They are also required to have leaded bottom lines, prohibited to use floats north of the Highway 58 Bridge and must leave a space of 25-yards between sections of net. Excempted areas included western Albemarle Sound, Currituck Sound and the PSGNRA from September through November (proclamation M-8-2010) |
| 2010 | Sep 3-Oct 6 | South Core Sound, Back Sound, North River and tributaries (area D1) closed to large mesh* gill nets due to sea turtle interactions with gill nets (proclamation M-16-2010) |
| 2011 | Jan 20-Mar 28 | Albemarle Sound Management Area (ASMA), Pamlico Sound, Pamlico, Pungo, Bay, and Neuse Rivers and the Cape Fear River exempted from Sea Turtle Settlement measures (four day fishing week, the mesh height, lead line and float requirements, and the 100 yard continuous length limit) for large mesh* gill nets to allow for a shad harvest season (proclamation M-2-2011) |

*large mesh gill nets are defined as ≥ 5 inch stretched mesh in the North Carolina Trip Ticket Program; beginning in 2010 with the Sea Turtle Settlement large mesh was defined as 4.5 to 6.5 inches stretched mesh

Table A1.2 continued

| Year | Month(s) / Day(s) | Regulation change |
|---|---|---|
| 2011 | Sep 12 - | Restrictions on large mesh* gill nets no longer required in Albemarle, Croatan, and Roanoke sounds north and west of Highway 64/264 bridges as well as Pamlico, Bay, and Neuse rivers (proclamation M-27-2011) |
| 2011 | Sep 18 - | An extra day was allowed for large mesh* gill nets south of Beaufort Inlet (proclamation M-30-2011) |
| 2011 | July 18-Oct 3 | Area D1 closed to large mesh* gill nets due to turtle interactions (proclamation M-24-2011) |
| 2012 | Feb 2-Mar 28 | The ASMA, Pamlico Sound, Pamlico, Pungo, Bay, and Neuse Rivers and the Cape Fear River exempted from Sea Turtle Settlement measures (four day fishing week, the mesh height, lead line and float requirements, and the 100 yard continuous length limit) for large mesh* gill nets to allow for a shad harvest season (proclamation M-6-2012). |
| 2012 | May 20 - | 1,000 yards maximum large mesh* gill-net length, Beaufort Inlet to Hwy 58 Br (proclamation M-23-2012). |
| 2012 | May 20-Oct 14 | Area D1 closed to large mesh* gill nets due to turtle interactions (proclamation M-23-2012). Annual closure of May 8-Oct 14 to be used for this area in future to avoid sea turtle interactions. |
| 2012 | Sep 26–Oct 15 | PSGNRA closed to large mesh* gill nets due to sea turtle interactions |
| 2012 | Oct 15-Nov 30 | Area D1 open to large mesh* gill nets (proclamation M-52-2012) |
| 2012 | Oct 8-Nov 30 | 2,000 yards maximum large mesh* gill-net length and must be present at nets by noon each day in Albemarle Sound and its tributaries (to limit sturgeon interactions and mortalities; proclamation M-49-2012) |
| 2012 | Oct 4-Nov 30 | Southern portions of Croatan/Roanoke sounds subject to M-8-2010 due to turtle interactions |
| 2013 | Mar 7- | Albemarle, Currituck, Croatan, and Roanoke sounds north and west of Highway 64/264 bridges, Pamlico, Pungo, Bay, and Neuse rivers, and only in January-April for upper New and Cape Fear rivers, limit the use of large mesh* gill nets to four nights/week and 2,000 yards, except south of Beaufort Inlet allow five nights/week and maximum 1,000 yards ( proclamation M-7-2013) |
| 2013 | May 8-Oct 14 | Annual closure for large mesh* gill nets in area D1 (proclamation M-17-2013). |
| 2013 | Feb 7, Mar 7 | Large mesh* gill net shad exemptions for the ASMA Feb 7 (proclamation M-2-2013) and Pamlico Sound and tributaries March 7 (proclamation M-7-2013). |
| 2013 | July 14–Oct 1 | Use of large mesh* gill nets prohibited south of Highway 58 Bridge (area E) via proclamation M-20-2013 due to sea turtle interactions |
| 2013 | July 24–Oct 1 | Use of large mesh* gill nets prohibited in Pamlico Sound/northern Core Sound due to sea turtle interactions (proclamation M-21-2013) |

*large mesh gill nets are defined as ≥ 5 inch stretched mesh in the North Carolina Trip Ticket Program; beginning in 2010 with the Sea Turtle Settlement large mesh was defined as 4.5 to 6.5 inches stretched mesh

Table A1.2 continued

| | | |
|---|---|---|
| 2013 | Sep 1–Sep 11 | Areas B and E closed until ITP approved (due to PSGNRA ITP not being extended another year) |
| 2013 | Oct 15 - Nov 30 | Area D1 open to large mesh* gill nets (proclamation M-33-2013). |
| 2014 | Mar 18 - | Gill nets with mesh length greater than 5 inches must be equiped with tie downs 10 yards apart and can not be within 50 yards of the shore in the Neuse, Pamlico, and Pungo Rivers. Use of gill nets 5 inches or greater is prohibited within 10 feet of any point on the shoreline while set or deployed from June to October (proclamation M-10-2014) |
| 2014 | May 5 - Sept 15 | Use of large mesh* gill-nets prohibited in Internal Coastal Waters to avoid discards of red drum. Major portions of areas A and C and the New River were |
| 2014 | Sept 1 - | The remainder of area A is reopened from the red drum closure (proclamation M-25-2014). |
| 2014 | Sept 15- | The remainder of management unit C is reopened and all of management unit D2 is reopened from the red drum closure (proclamation M-29-2014). |
| 2014 | Sept 22 | Management units B and E are opened to large mesh* gill nets (proclamation M-30-2014) |
| 2014 | Sep 24-Nov 2 | Area E closed to large mesh* gill nets due to turtle interactions (proclamation M-31-2014), reopened via proclamation M-39-2014 |
| 2014 | Oct 1-Oct 27; Oct 1-Nov 6 | Area A closed to large mesh* gill nets due to turtle interactions (proclamation M-33-2014). Portions of western Albemarle Sound and Currituck reopened on Oct 27 (proclamation M-36-2014). Remainder of area A reopened Nov 6 (proclamation M-41-2014) |
| 2014 | Oct 15 - Nov 30 | Area D1 open to large mesh* gill nets (proclamation M-34-2014). |
| 2014 | Oct 26-Nov 6 | Shallow water portions of area B (PSGNRA) closed to large mesh* gill nets due to turtle interactions (proclamation M-37-2014), reopened via proclamation M-40-2014 |

*large mesh gill nets are defined as ≥ 5 inch stretched mesh in the North Carolina Trip Ticket Program; beginning in 2010 with the Sea Turtle Settlement large mesh was defined as 4.5 to 6.5 inches stretched mesh

Appendix 2. Harvest reductions

Table A2.1 Commercial harvest reductions (percent) from the total commercial harvest for season closures based on 2011-2014* average. Bolded rows include a reduction within the requested range for the total commercial fishery.

| Closure | Gill net | Pound net | Gig | Other gears | Total |
|---|---|---|---|---|---|
| Nov 16-Dec 31 | 1 | 3 | <1 | <1 | 5 |
| Nov 1-Dec 31 | 5 | 10 | 1 | <1 | 16 |
| **Oct 16-Dec 31** | 12 | 20 | 1 | <1 | **34** |
| **Oct 1-Dec 31** | 20 | 29 | 2 | <1 | **51** |
| Sept 16-Dec 31 | 30 | 35 | 2 | <1 | 67 |
| Sept 1-Dec 31 | 34 | 36 | 3 | <1 | 73 |
| Aug 16-Dec 31 | 38 | 36 | 3 | 1 | 77 |
| Aug 1-Dec 31 | 41 | 36 | 4 | 1 | 81 |
| Jan 1-Dec 31 | 55 | 36 | 8 | 1 | 100 |

*2014 data are preliminary

Table A2.2 Recreational harvest reductions (percent) from the total recreational harvest for season closures based on 2011-2014* average. Bolded rows include a reduction within the requested range for the total recreational fishery.

| Closure | Hook & Line | Gig | Total |
|---|---|---|---|
| Dec 16-Dec 31 | < 1 | 1 | 1 |
| Dec 1 - Dec 31 | < 1 | 2 | 3 |
| Nov 16 - Dec 31 | 1 | 4 | 4 |
| Nov 1 - Dec 31 | 3 | 5 | 8 |
| Oct 16 - Dec 31 | 7 | 7 | 14 |
| Oct 1 - Dec 31 | 10 | 9 | 19 |
| **Sep 16 - Dec 31** | 17 | 11 | **28** |
| **Sep 1 - Dec 31** | 23 | 13 | **36** |
| **Aug 16 - Dec 31** | 37 | 15 | **51** |
| **Aug 1 - Dec 31** | 43 | 17 | **59** |
| Jan 1 - Dec 31 | 72 | 28 | 100 |

*2014 data are preliminary, 2014 gig data were not available

Table A2.3 Harvest reductions (percent) from the combined fishery harvest for season closures based on a 2011-2014* average. Bolded rows include a reduction within the requested range for the combined fishery total.

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Closure | Gill net | Pound net | Gig | Other | Total | Hook & line | Gig | Total | Total |
| Nov 16-Dec 31 | 1 | 3 | < 1 | < 1 | 4 | < 1 | 1 | 1 | 5 |
| Nov 1-Dec 31 | 4 | 8 | < 1 | < 1 | 13 | < 1 | 1 | 1 | 15 |
| **Oct 16-Dec 31** | 10 | 17 | 1 | < 1 | **28** | 1 | 1 | 2 | **30** |
| **Oct 1-Dec 31** | 17 | 24 | 1 | < 1 | **42** | 2 | 2 | 3 | **45** |
| **Sept 16-Dec 31** | 25 | 29 | 2 | < 1 | **55** | 3 | 2 | 5 | **60** |
| Sept 1-Dec 31 | 28 | 29 | 2 | < 1 | 60 | 4 | 2 | 6 | 66 |
| Aug 16-Dec 31 | 31 | 29 | 3 | < 1 | 64 | 6 | 3 | 9 | 73 |
| Aug 1-Dec 31 | 34 | 29 | 3 | < 1 | 67 | 7 | 3 | 10 | 77 |
| Jan 1-Dec 31 | 45 | 30 | 7 | 1 | 83 | 13 | 5 | 17 | 100 |

*2014 data are preliminary

Table A2.4 Harvest reductions (percent) from combined fishery harvest for season closures by sector based on 2011-2014 average. Closures start on the dates shown and end on Dec. 31. Bolded reductions were within the requested range.

| | Recreational closure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Commercial closure | 1-Jan | 1-Aug | 16-Aug | 1-Sep | 16-Sep | 1-Oct | 16-Oct | 1-Nov | 16-Nov |
| 1-Jan | 100 | 93 | 92 | 89 | 87 | 86 | 85 | 84 | 83 |
| 1-Aug | 84 | 77 | 76 | 73 | 72 | 70 | 69 | 68 | 68 |
| 16-Aug | 81 | 74 | 73 | 70 | 69 | 67 | 66 | 65 | 65 |
| 1-Sep | 77 | 70 | 69 | 66 | 65 | 63 | 62 | 61 | 61 |
| 16-Sep | 73 | 66 | 64 | 62 | **60** | **59** | **58** | **57** | **56** |
| 1-Oct | **60** | **52** | **51** | **48** | **47** | **45** | **45** | **43** | **43** |
| 16-Oct | **45** | **38** | **37** | **34** | **33** | **31** | **30** | **29** | **29** |
| 1-Nov | **31** | 24 | 22 | 19 | 18 | 16 | 16 | 15 | 14 |
| 16-Nov | 21 | 14 | 13 | 10 | 9 | 7 | 6 | 5 | 5 |

*2014 data are preliminary, 2014 recreational gig data were not available

Table A2.5 Harvest reductions (percent) from total commercial harvest for minimum size limit increases based on 2011-2014* commercial catch average. Bolded rows include a reduction within the requested range for the total commercial fishery.

| Size limit | Gill net | Pound net | Gig | Other | Total |
|---|---|---|---|---|---|
| **15 inch** | 16 | 7 | 2 | 1 | **27** |
| **16 inch** | 32 | 15 | 5 | 1 | **53** |

*2014 data are preliminary

Table A2.6 Harvest reductions (percent) from total recreational harvest for minimum size limit increases based on 2011-2014* recreational catch average.

| Size limit | Hook & Line | Gig | Total |
|---|---|---|---|
| 16 inch | 16 | 6 | 22 |

*2014 data are preliminary, 2014 gig data were not available

Table A2.7. Harvest reductions (percent) from the combined fishery harvest for minimum size limit increase based on 2011-2014* combined fishery average. Bolded row includes a reduction within the requested range for the combined fishery total.

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Size limit | Gill net | Pound net | Gig | Other gears | Total | Hook & line | Gig | Total | Total |
| 15 inch | 13 | 6 | 2 | < 1 | 22 | 0 | 0 | 0 | 22 |
| **16 inch** | 26 | 13 | 4 | 1 | **44** | 3 | 1 | 4 | **47** |

*2014 data are preliminary

Table A2.8 Harvest reductions (percent) from total recreational harvest for recreational bag limit decreases based on 2011-2014* recreational catch average. Bolded row includes a reduction within the requested range for the total recreational fishery.

| Bag limit | Hook & Line | Gig | Total |
|---|---|---|---|
| **1 fish** | 24 | 9 | **33** |
| 2 fish | 10 | 4 | 14 |
| 3 fish | 5 | 2 | 7 |
| 4 fish | 2 | 1 | 3 |
| 5 fish | 1 | 0 | 1 |

*2014 data are preliminary, 2014 gig data were not available

Table A2.9 Harvest reductions (percent) from the total commercial harvest for season closures and minimum size limit increases based on 2011-2014* commercial average. Bolded rows include a reduction within the requested range for the total commercial fishery.

| Closure | 15 inch limit | 16 inch limit |
|---|---|---|
| **Nov 16-Dec 31** | **26** | **46** |
| **Nov 1-Dec 31** | **35** | **53** |
| **Oct 16-Dec 31** | **49** | 63 |
| Oct 1-Dec 31 | 62 | 72 |
| Sept 16-Dec 31 | 75 | 82 |
| Sept 1-Dec 31 | 79 | 85 |
| Aug 16-Dec 31 | 82 | 87 |
| Aug 1-Dec 31 | 85 | 89 |
| Jan 1 - Dec 31 | 100 | 100 |

*2014 data are preliminary

Table A2.10 Harvest reductions (percent) from the total recreational harvest for season closures and 16-inch minimum size limit based on 2011-2014* recreational average. Bolded rows include a reduction within the requested range for the total recreational fishery.

| Closure | 16 size limit |
|---|---|
| Dec 16-Dec 31 | 1 |
| Dec 1 - Dec 31 | 3 |
| Nov 16 - Dec 31 | 4 |
| Nov 1 - Dec 31 | 8 |
| Oct 16 - Dec 31 | 14 |
| Oct 1 - Dec 31 | 19 |
| **Sep 16 - Dec 31** | **28** |
| **Sep 1 - Dec 31** | **36** |
| **Aug 16 - Dec 31** | **51** |
| **Aug 1 - Dec 31** | **59** |
| Jan 1 - Dec 31 | 100 |

*2014 data are preliminary, 2014 gig data were not available

Table A2.11. Harvest reductions (percent) from the combined fishery harvest for season closures and minimum size limit increases based on 2011-2014* combined fishery average. Bolded rows include a reduction within the requested range.

| Closure | 15 inch limit | 16 inch limit |
|---|---|---|
| **Nov 16-Dec 31** | **25** | **50** |
| **Nov 1-Dec 31** | **33** | **55** |
| **Oct 16-Dec 31** | **46** | 63 |
| **Oct 1-Dec 31** | **57** | 71 |
| Sept 16-Dec 31 | 69 | 79 |
| Sept 1-Dec 31 | 74 | 82 |
| Aug 16-Dec 31 | 79 | 86 |
| Aug 1-Dec 31 | 82 | 88 |
| Jan 1 - Dec 31 | 100 | 100 |

*2014 harvest data are preliminary, 2014 recreational gig data were not available

Table A2.12 Harvest reductions (percent) from the recreational fishery harvest for season closures, a minimum size limit increase to 16 inches, and a recreational bag limit decrease based on 2011-2014* recreational fishery average. Bolded rows include a reduction within the requested range for the total recreational fishery.

| | 15 inches | | | | | | 16 inches | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Closure | 1 fish | 2 fish | 3 fish | 4 fish | 5 fish | 6 fish | 1 fish | 2 fish | 3 fish | 4 fish | 5 fish | 6 fish |
| **Dec 16 - Dec 31** | 23 | 10 | 5 | 3 | 2 | 1 | **40** | **29** | **26** | 24 | 24 | 23 |
| **Dec 1 - Dec 31** | 24 | 11 | 7 | 5 | 4 | 3 | **41** | **31** | **27** | **26** | **25** | 24 |
| **Nov 16 - Dec 31** | **26** | 13 | 8 | 6 | 5 | 4 | **42** | **32** | **28** | **27** | **26** | **25** |
| **Nov 1 - Dec 31** | **28** | 16 | 12 | 10 | 9 | 8 | **44** | **34** | **31** | **29** | **29** | **28** |
| **Oct 16 - Dec 31** | **33** | 21 | 17 | 16 | 15 | 14 | **48** | **38** | **35** | **34** | **33** | **33** |
| **Oct 1 - Dec 31** | **37** | **26** | 22 | 21 | 20 | 19 | **51** | **42** | **39** | **38** | **37** | **37** |
| **Sep 16 - Dec 31** | **44** | **34** | **31** | **30** | **29** | **28** | **56** | **49** | **46** | **45** | **44** | **44** |
| **Sep 1 - Dec 31** | **50** | **41** | **39** | **37** | **37** | **36** | **61** | **54** | **52** | **51** | **50** | **50** |
| **Aug 16 - Dec 31** | 62 | **56** | **53** | **52** | **52** | **51** | 70 | 65 | 64 | 63 | 62 | 62 |
| **Aug 1 - Dec 31** | 68 | 63 | 61 | **60** | **60** | **59** | 75 | 71 | 70 | 69 | 69 | 68 |
| Jan 1 - Dec 31 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

*2014 data are preliminary, 2014 gig data were not available

Table A2.13 Harvest reductions (percent) from the combined fishery catch for season closures, minimum size limit increases and a one- or two-fish recreational bag limit based on 2011-2014* combined fishery average. Bolded rows include a reduction within the requested range.

| | 15 inch limit | | 16 inch limit | |
|---|---|---|---|---|
| Closure | 1 fish bag limit | 2 fish bag limit | 1 fish bag limit | 2 fish bag limit |
| **Nov 16-Dec 31** | **30** | **27** | **53** | **51** |
| **Nov 1-Dec 31** | **37** | **35** | **58** | **56** |
| **Oct 16-Dec 31** | **49** | **47** | 65 | 64 |
| **Oct 1-Dec 31** | **60** | **58** | 73 | 72 |
| Sept 16-Dec 31 | 71 | 70 | 80 | 80 |
| Sept 1-Dec 31 | 75 | 74 | 83 | 83 |
| Aug 16-Dec 31 | 80 | 79 | 87 | 86 |
| Aug 1-Dec 31 | 83 | 83 | 89 | 88 |
| Jan 1 - Dec 31 | 100 | 100 | 100 | 100 |

*2014 harvest data are preliminary, 2014 recreational gig data were not available

## Appendix 3. Reduction calculation methods for each option

### Option 1: Implement a season closure

*Commercial fishery*

NC Trip Ticket daily landings were used to split monthly estimated numbers of harvested southern flounder into half-month closure periods. To calculate the catch reduction percentage, estimated average harvest and dead discards for each closed period were divided by the average annual estimated harvest and discard mortalities. The harvest reduction percentage was calculated by dividing the estimated harvest during a closed period by the average annual harvest. The only available discard or discard mortality estimates for a major commercial gear used for harvesting southern flounder was for estuarine gill nets. A generalized linear model (GLM) framework was used to predict southern flounder gill net discards by season based on NCDMF observer data. Data limitations prevented discard estimates at two week intervals (the minimum season closure period analyzed). Instead, a ratio of gill net harvest to discards was applied to harvest numbers for each potential closure period to estimate discards at two week intervals. Seasonal post-release discard mortality rates for sublegal southern flounder were derived from Smith and Scharf (2011) and adapted for use here by NCDMF staff. Post-release discard mortality rates were applied to averaged numbers of discards with a different rate used for October - June (12%) and July - September (64%). These estimates were based on gill nets fished for approximately 24 hours before removing flounder; however, portions of the state were only allowed to fish nets from one hour before sunset until one hour after sunrise to mitigate protected species interactions. It is likely discard morality rates will be lower for nets fished for fewer hours during nighttime only. Despite this, the available rates were used because much of

the gill net harvest occurs in areas that were allowed to fish nets for 24 hours during most of 2011-2014. Additionally, although sublegal discards released dead were included in calculating the discard ratio, the discard mortality rate only accounted for fish that became mortalities after being released alive (i.e., post-release) due to the inability to accurately estimate the portion of the mortality rate. The numbers of dead discards were added to the annual harvest and any time-periods that were closed to calculate the reduction in catch for each period. Because there were no estimates of discards available for other commercial fisheries, the only change from harvest reductions was due to the addition of gill net discards.

*Recreational Fishery*

Weighted post-stratified data from MRIP were placed into half month domains to estimate hook and line harvest and discards. Seasonal post-release discard morality rates of 7% (January-June) and 11% (July-December) were applied to MRIP derived estimates of hook and line discards. These rates were based on NCDMF studies of hook and line post-release mortality of southern flounder, but were further developed by the NCDMF for the draft 2014 southern flounder stock assessment. It was assumed that the hook and line fishery would continue to operate during a season closure. It was also assumed that all southern flounder harvested on average in 2011-2014 would be caught and released during a closed season. Therefore, seasonal discard morality rates were applied to average hook and line harvest and discards from 2011-2014 for each closed period and divide by total catch to estimate catch reductions. For the recreational gig fishery, all discards were assumed to be dead due to injuries sustained by this gear. Consequently, a discard mortality rate was not applied to gig discard estimates, instead all discards were added to gig harvest for a potential closure period and divided by total catch to estimate catch reductions.

<u>Option 2: Increase the minimum size limit</u>

Reductions in catch were calculated by first subtracting the estimated dead discards at size from the average harvest at size to yield the live discards resulting from an increase in the minimum size limit (Tables A3.1 and A3.2). Although the number of discards was unknown for some gears in the 2011-2014 average catch, the expected increase in discards can be estimated based on the average numbers of fish at size in 2011-2014. For example, when increasing to a 15-inch limit, the fish currently harvested at 14 inches would be caught and discarded in the future assuming no attempt is made to modify gear to reduce discards. The number of dead discards was calculated by applying a seasonal post-release discard mortality rate to these expected discards. The number of live discards was divided by the average annual catch (harvest plus dead discards) to provide the catch reduction percentage. Harvest reductions were simply the harvest that would be avoided by increasing the minimum size limit (Tables A3.1 and A3.2) divided by the annual average harvest.

Table A3.1. Harvest and discards used to calculate catch and harvest reductions as a result of increasing minimum size limit to 15 inches. Live and dead discard estimates were calculated assuming no gear modifications to reduce discards. NA indicates gears that would not be impacted by a minimum size limit increase to 15 inches.

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Estimate Type | Gill net | Pound net | Gig | Other | Total | Hook & line | Gig | Total | Total |
| Harvest | 138,237 | 62,777 | 21,371 | 4,302 | 226,688 | NA | NA | NA | 226,688 |
| Dead Discards | 42,040 | 14,189 | 10,648 | 2,130 | 69,008 | NA | NA | NA | 69,008 |
| Live Discards | 96,197 | 48,588 | 10,724 | 2,172 | 157,680 | NA | NA | NA | 157,680 |

*2014 data are preliminary, 2014 commerical discard and all recreational gig data were not available

Table A3.2. Harvest and discards used to calculate catch and harvest reductions as a result of increasing minimum size limit to 16 inches. Dead discard estimates were calculated assuming no gear modifications to reduce discards.

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Estimate Type | Gill net | Pound net | Gig | Other | Total | Hook & line | Gig | Total | Total |
| Harvest | 270,876 | 130,735 | 42,479 | 7,191 | 451,281 | 29,168 | 10,215 | 39,382 | 490,664 |
| Dead Discards | 116,146 | 28,925 | 21,109 | 3,541 | 169,721 | 2,973 | 5,365 | 8,338 | 178,059 |
| Live Discards | 154,731 | 101,810 | 21,370 | 3,651 | 281,561 | 26,195 | 4,850 | 31,044 | 312,605 |

*2014 data are preliminary, 2014 commerical discard and all recreational gig data were not available

*Commercial fishery*

To calculate the catch reduction, the numbers of fish in 1-inch size bins were calculated and averaged for 2011-2014. Catch and harvest reductions were calculated for the commercial fishery based on increasing the minimum size limit to 15 inches and 16 inches from the current 14 inch limit, assuming no gear modifications to reduce discards. Expected dead discards were estimated for each commercial gear for calculating catch reductions. The seasonal post-release discard mortality rates developed for gill nets were based on fish below 14 inches (the current commercial minimum size limit); however, evidence suggests no relationship between fish size and post-release mortality rate (at least below 14 inches) (Smith and Scharf 2011). Therefore, an assumption was made that the rates would not change for fish discarded above 14 inches and the available rates were used to predict post-release discard mortality due to a minimum size limit increase. Because there were no available discard mortality estimates for other commercial gears, the seasonal gill net post-release discard rates were also applied to the expected discards for other fisheries to calculate dead discards for the entire commercial fishery as a result of raising the minimum size limit.

*Recreational Fishery*

Preliminary analyses demonstrate highly comparable percent reductions of southern flounder harvest for both hook and line and flounder gigging for various harvest sizes and recreational bag limits. As such, a cumulative approach is appropriate for investigating proportional harvest reduction within the recreational sector. Reductions for an imposed 16-inch minimum size limit

were calculated by dividing the portion of catch at 15 inches by the total catch from 15 inches to the maximum size observed. Unlike the MRIP recreational hook and line survey, catches are not reported back to DMF's Mail-based Recreational gigging survey at the individual trip level but rather two-month summarizations are given. Furthermore, individual fish sizes are not collected precluding the analyses for these scenarios in the manner they were done for hook and line. To overcome the granularity issues of the mail-based survey, recreational hook and line size frequencies and catch frequencies were used as proxies for minimum size limit reductions for the gig catch.

Option 3: Decrease the recreational bag limit

*Recreational fishery*

Recreational bag limit analysis was calculated by determining the frequency of angler trips with each of the potential recreational bag limits below the current six-fish recreational bag limit. For each recreational bag limit option, all catch frequencies with catches higher than the recreational bag limit of interest were converted to discards. The total catch for each specific recreational bag limit was recalculated and divided by the original harvest estimate to determine the number of fish discarded due to each recreational bag limit. Unlike the MRIP recreational hook and line survey, catches are not reported back to the NCDMF mail-based recreational gigging survey at the individual trip level but rather two-month summarizations are given. Furthermore, individual fish sizes are not collected precluding the analyses for these scenarios in the manner they were done for hook and line. To overcome the granularity issues of the mail-based survey, recreational hook and line size frequencies and catch frequencies were used as proxies for recreational bag limit reductions for the gig catch. Preliminary analyses demonstrate highly comparable percent reductions of southern flounder harvest for both hook and line and flounder gigging for various harvest sizes and recreational bag limits. Because hook and line contribute much more to the recreational fishery, a cumulative approach is appropriate for investigating proportional harvest reduction within the recreational sector.

Option 4: Implement a season closure and increase the minimum size limit

Reductions for this option were calculated within each sector by using reductions from each separate measure as inputs in the following formula: $Z= X + [(1 – X) * Y]$ where X= the reduction fraction due to one measure (e.g., season closure) and Y= reduction fraction due to the other measure (e.g., minimum size limit increase), and Z = the resulting combined reduction.

Option 5: Season closure, increase the minimum size limit and decrease the recreational bag limit

Reductions for this option were calculated within each sector by using reductions from each separate measure as inputs in the following formula: $Z= X+((1-X)*Y) +(1-X+((1-X)*Y)))*W$ where W= the reduction fraction due the one new measure (e.g., recreational bag limit decrease), X= the reduction fraction due to a second measure (e.g., season closure),Y= reduction fraction

due to a third measure (e.g., minimum size limit increase), and Z = the resulting combined reduction.

Appendix 4. Catch reductions by gear (using catch total by gear rather than by sector or fishery)

Table A4.1 Commercial catch reductions (percent) from the catch by gear for season closures based on a 2011-2014 average. Bolded rows include a reduction within the requested range for the total commercial fishery.

| Closure | Gill net | Pound net | Gig | Other gears | Total |
|---|---|---|---|---|---|
| Nov 16-Dec 31 | 2 | 9 | 2 | 1 | 5 |
| Nov 1-Dec 31 | 10 | 28 | 7 | 5 | 16 |
| **Oct 16-Dec 31** | 22 | 56 | 13 | 9 | **33** |
| **Oct 1-Dec 31** | 37 | 81 | 18 | 18 | **50** |
| Sept 16-Dec 31 | 54 | 98 | 23 | 25 | 67 |
| Sept 1-Dec 31 | 62 | 99 | 31 | 34 | 72 |
| Aug 16-Dec 31 | 70 | 99 | 39 | 42 | 77 |
| Aug 1-Dec 31 | 75 | 99 | 46 | 48 | 81 |
| Jan 1-Dec 31 | 100 | 100 | 100 | 100 | 100 |

*2014 data are preliminary, 2014 discard estimates were not available

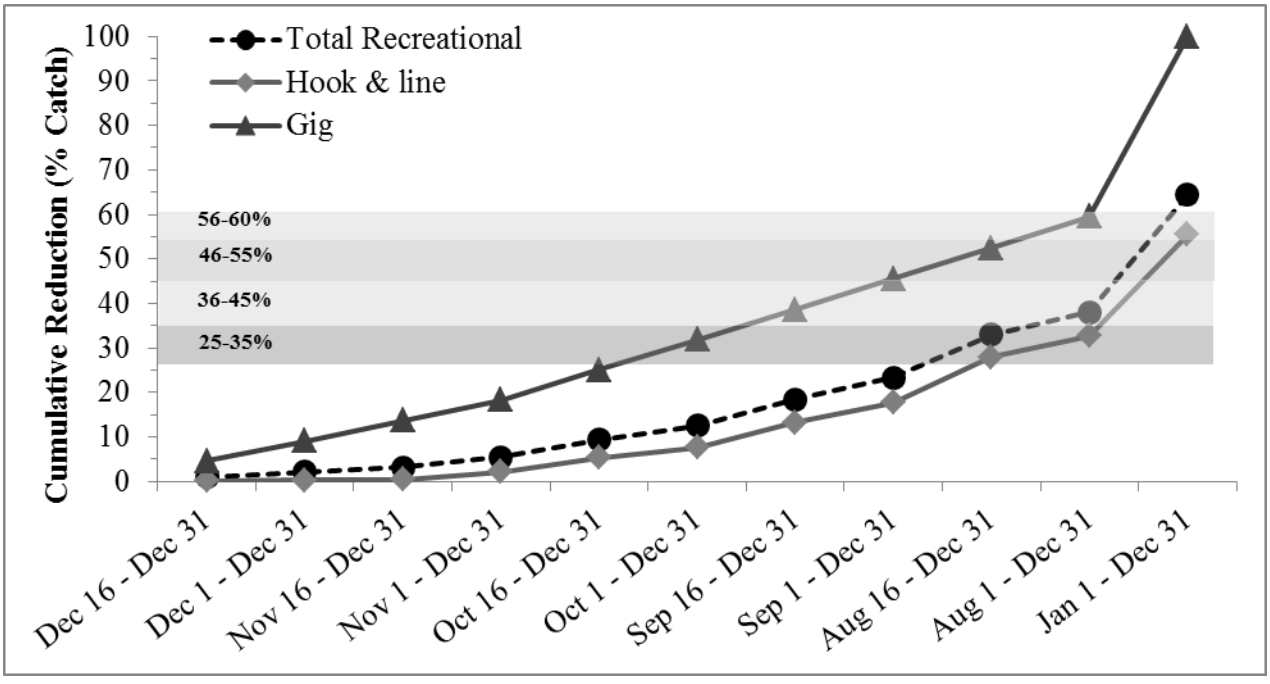


Figure A4.1. Commercial catch reductions (percent) from the catch by gear for season closures based on a 2011-2014 average.

Table A4.2. Recreational catch reductions (percent) from recreational catch by gear for season closures based on a 2011-2014* average. Bolded rows include a reduction within the requested range for the total recreational fishery.

| Closure | Hook & Line | Gig | Total |
|---|---|---|---|
| Dec 16 - Dec 31 | <1 | 5 | 1 |
| Dec 1 - Dec 31 | <1 | 9 | 2 |
| Nov 16 - Dec 31 | <1 | 14 | 3 |
| Nov 1 - Dec 31 | 2 | 18 | 5 |
| Oct 16 - Dec 31 | 5 | 25 | 9 |
| Oct 1 - Dec 31 | 8 | 32 | 13 |
| Sep 16 - Dec 31 | 13 | 39 | 18 |
| Sep 1 - Dec 31 | 18 | 45 | 23 |
| **Aug 16 - Dec 31** | **28** | **52** | **33** |
| **Aug 1 - Dec 31** | **33** | **60** | **38** |
| Jan 1 - Dec 31 | 55 | 100 | 64 |

*2014 data are preliminary, 2014 gig harvest and discard data were not available

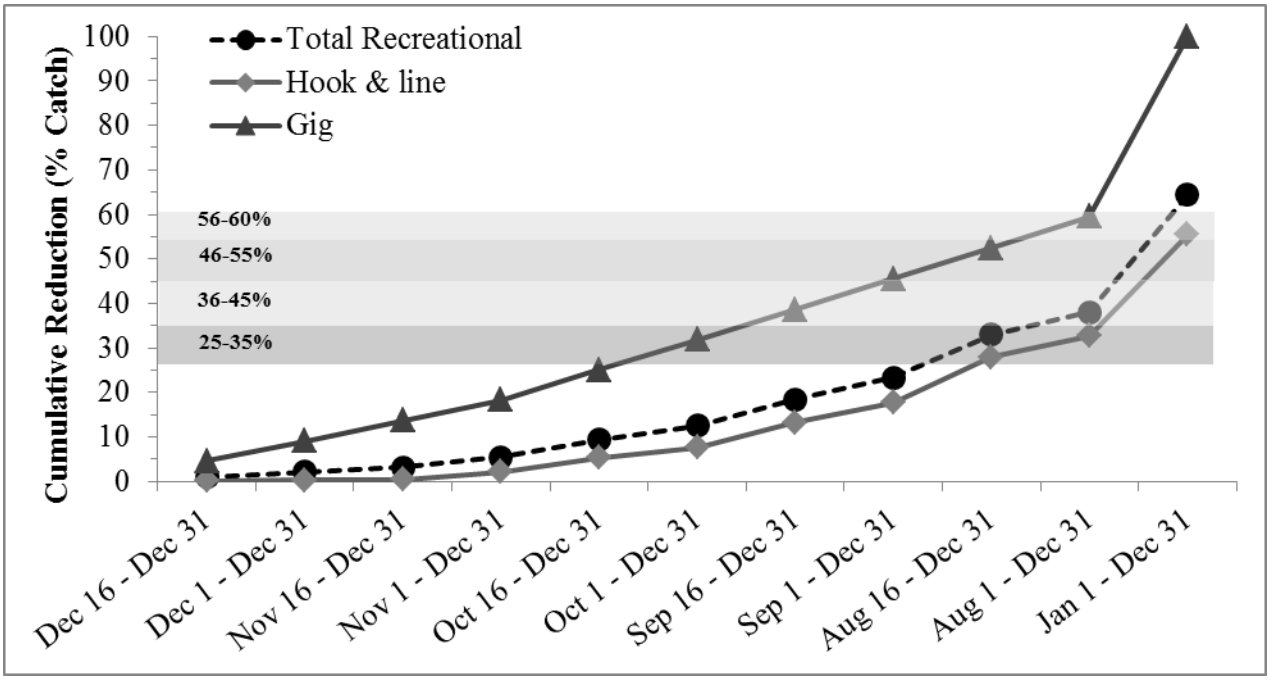


Figure A4.2. Catch reductions (percent) from recreational catch by gear for season closures based on a 2011-2014 average.

Table A4.3. Catch reductions (percent) from catch by gear for a minimum size limit increase based on 2011-2014* commercial catch average. Bolded row includes a reduction within the requested range for the total commercial fishery.

| Size limit | Gill net | Pound net | Gig | Other | Total |
|---|---|---|---|---|---|
| 15 inch | 20 | 16 | 15 | 21 | 18 |
| **16 inch** | 32 | 33 | 30 | 36 | **32** |

*2014 data are preliminary

Table A4.4. Catch reductions (percent) from recreational catch by gear with a 16-inch minimum size limit based on 2011-2014* recreational catch average.

| Size Limit | Hook & Line | Gig | Total |
|---|---|---|---|
| 16 inch | 12 | 9 | 12 |

*2014 data are preliminary, 2014 gig data were not available

Table A4.5. Catch reductions (percent) from recreational catch by gear for recreational bag limit decreases based on 2011-2014* recreational catch average.

| Bag Limit | Hook & Line | Gig | Total |
|---|---|---|---|
| 1 | 19 | 37 | 23 |
| 2 | 8 | 13 | 10 |
| 3 | 4 | 6 | 5 |
| 4 | 2 | 3 | 3 |
| 5 | 1 | 1 | 2 |

*2014 data are preliminary, 2014 gig data were not available

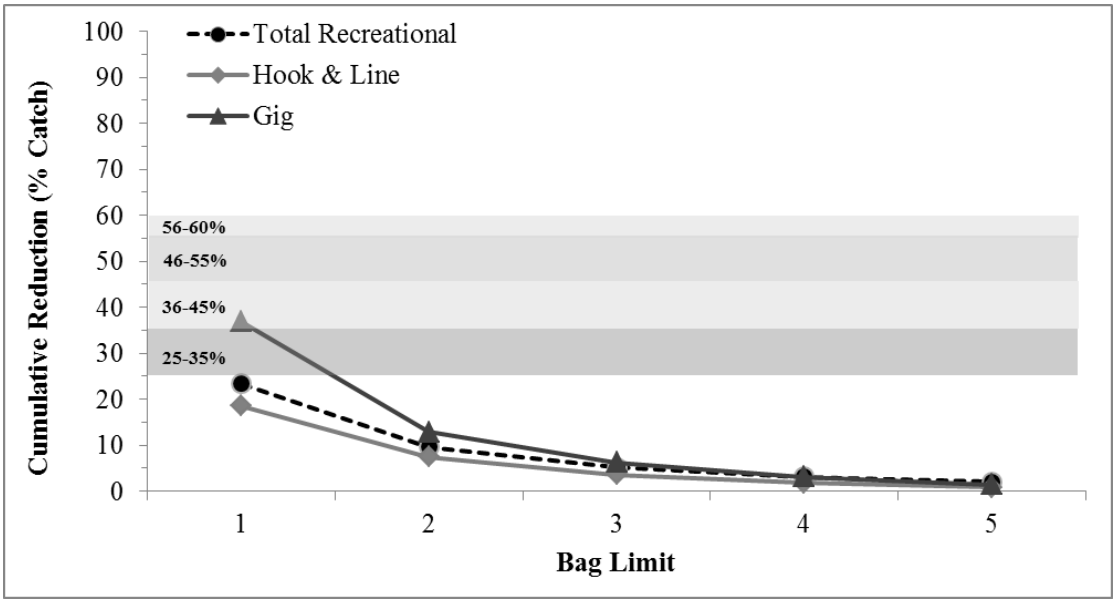


Figure A4.3. Catch reductions (percent) from recreational catch by gear for recreational bag limit decreases based on 2011-2014 average.

# Marine Fisheries Commission Proposals
# for
# Draft Supplement A to Amendment 1 of the
# N.C. Southern Flounder Fishery Management Plan

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***Proposal 1***

Pound Net Set Permits:

- 15-inch minimum size for southern flounder
- Escape panels shall be a minimum mesh size of
    - Option 1: 5 ¾ inch
    - Option 2: 6 inch

  (all other escape panel requirements remain)
- Immediately initiate a Total Allowable Catch that represents a 25 percent reduction of the 2013 landings (highest landings on record since 2005). The 2013 landings represent a 79 percent jump in landings from the 2005 Fishery Management Plan landings level of concern.
- Total Allowable Catch = 625,626 pounds (higher than all but one year between 2005-2012)
- Active pound net set permits may be renewed, but no new permit applications will be processed after June 1, 2015, until the completion of the next amendment.
- No pound net set permit transfers will occur until the completion of the next amendment, except upon death of the permittee pursuant to 15NCAC O3J .0504.
- Daily reporting as a condition of the permit for flounder pound nets.

Commercial Gig:

- Commercial gigging will only be allowed four days per week, beginning Monday at sunrise and ending on Friday at sunrise.
- 15-inch size limit
- Trip limit of 36 flounder per valid Standard Commercial Fishing License with maximum of one limit per operation, regardless of the number of valid Standard Commercial Fishing Licenses present.
    - Option 1: A maximum of one limit per operation regardless of the number of valid Standard Commercial Fishing Licenses present.
    - Option 2: A maximum of two limits per operation regardless of the number of valid Standard Commercial Fishing Licenses present.

Anchored Large Mesh Gill Nets (commercial and recreational):

- 2015 season will remain status quo.
- Effective Jan. 1, 2016, anchored large mesh gill nets will be a prohibited gear in the taking and possession of flounder in internal waters.

Commercial harvest by other gear:

- 15-inch size limit

***Proposal 2***

- All commercial fishing will observe a 15-inch size limit.
- N.C. large mesh gill nets in the southern flounder fishery will close Sept. 16 north of Cape Hatteras and will not open until Jan. 16. South of Cape Hatteras the closure would be Oct. 16 to Jan. 1.
- Pound nets will be subject to the 15-inch size limit and to a 5¾-inch or 6-inch escape panel.
- Commercial giggers will be subject to a 15-inch size limit and a 35-fish trip limit per boat.
- Recreational hook-and-line and giggers will have no reductions unless a closure from Nov. 1 to Dec. 31 is considered necessary to meet appropriate reductions.
- There will be a moratorium on pound net sets and permits based on the past five years of activity, until the next amendment is adopted, unless death or disability of the owner is an issue.

***Proposal 3***

- Retain the 15-inch size limit and 6-fish bag limit for recreational.
- Increase the size limit to 15 inches for commercial, with a 6-inch stretched mesh for large mesh gill nets, and escape panels in pound nets.
- Close all southern flounder fisheries from Nov. 16 –Dec. 31.

***Proposal 4***

- Maintain status quo for commercial.
- Decrease recreational size limit to 14 inches.
- Observe 60-day comment period, with stakeholder input.

***Proposal 5***

- Retain 15-inch size limit and 6-fish bag limit for recreational.
- Increase the size limit to 15 inches for commercial with a 5¾-inch stretched mesh for large mesh gill nets and escape panels in pound nets.
- Close commercial and recreational fisheries from Dec. 1 – 31.

***Proposal 6***

- Minimum mesh size limit of 5¾ inch stretch mesh for large mesh gill nets and escape panels in pound nets.
- Dec. 1 – 31 closure for all gear types, both commercial and recreational.

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

**MEMORANDUM**

TO: N.C. Marine Fisheries Commission

FROM: Tom Wadsworth, Chris Stewart and Trish Murphey
N.C. Division of Marine Fisheries

DATE: July 24, 2015

SUBJECT: Summary of public comments on proposals for southern flounder management

The N.C. Marine Fisheries Commission accepted written public comment June 10 - July 10, 2015 on six proposals being considered by the commission for southern flounder management. Verbal comment was also accepted at a public meeting on July 17, 2015 (minutes attached). Comments included support and/or opposition for the commission's proposals, as well as suggestions not included in the six proposals. The vast majority of the comments received expressed concern for the fishery and supported action to ensure stock recovery.

All email and written comments received during the public comment period will be available online and included with other materials for the Aug. 19-21 commission business meeting.

Approximately 150 members of the public, seven members of the commission and several N.C. Division of Marine Fisheries staff attended the public meeting. There were 66 members of the public that spoke at the meeting. The majority of speakers supported action through the supplement process; however, a sizeable portion of speakers supported status quo or using the amendment process instead. Of those speakers that did not support the supplement process, several supported the use of solid scientific data and/or a new stock assessment to manage southern flounder. Of the small number of speakers that supported specific proposals in their entirety, Proposal 1 had the most support of the six commission proposals. Most speakers that supported action through the supplement process supported one or more of the following: increase the commercial size limit to 15 inches, implement a Total Allowable Catch (TAC) and/or quota for some portion of the fishery, reduce commercial harvest, prohibit harvest of flounder (or all species) by some or all forms of gill nets. A small group of speakers simply voiced support for the supplement or making decisions that benefit the resource. The remaining speakers mentioned a variety of other suggestions or concerns.

Written public comments received included 986 emails and 260 letters for a total of 1,246 written comments. While the vast majority of the written comments received did not specifically support the commission proposals, Proposal 1 did receive the most comments of support of the comments that specified a proposal. A limited number of comments were received that supported the other

proposals. Few emails or letters opposed specific proposals; however, Proposals 1, 2 and 4 did receive some opposition. Most written comment supported some measures contained within one or more of the commission proposals, but either supported additional measures beyond what the proposal contained or did not support some of the measures in the proposals. For example, some comments supported Proposal 1, but without further restrictions on the gig fishery.

Approximately three-quarters of the emails and letters received were form letters (i.e., copies of the same message from different senders) or included a form letter within the body of an email along with other comments. One form letter, expressing support for Proposal 1, was sent in 280 letters and emails from the Recreational Fishing Alliance (RFA), Cape Fear Fly Fishers, Cape Fear Chapter of N.C. Kayak Association and various individuals not affiliated with an organization. A second form letter was sent in 321 letters and emails requesting: a TAC that would reduce the total commercial harvest by 50 percent, a closure of the large mesh flounder gill net fishery, a universal 15-inch minimum size limit, a moratorium on new pound net sets and permits until the stock has recovered, and no change to the current recreational harvest limits. An additional 372 form letters called for: no change in the current recreational limits, a 40 percent reduction in total catch, a 15-inch minimum size limit for commercial fisheries, a TAC, pound net attendance requirements, and daily trip limits for the pound net and gig fisheries. Fifteen form letters requested: a 50 percent reduction in commercial harvest, implementation of a TAC that would be 50 percent lower than the average commercial southern flounder harvest of the last three years, and the suspension of southern flounder harvest by all gill nets.

The division also received comments from several organizations representing recreational and commercial fishing interests in North Carolina. These comments are summarized below:

The Coastal Conservation Association of North Carolina (CCA-NC) provided comment as well as a petition entitled “Restore Estuarine Finfish in North Carolina” with 1,654 signatures. The petition supported the commercial pound net and gig fishery, a 15-inch size limit for commercial and recreational fishermen, a daily creel limit of six fish for recreational anglers, an annual TAC on commercial harvest and a prohibition on large mesh monofilament gill nets in estuarine waters. Additional comments from the CCA-NC dated May 19, 2015 included recommendations to: close the southern flounder commercial and recreational large mesh gill net fisheries completely (or at a minimum from April 15 to Feb. 15), implement a commercial TAC or quota aimed at reducing total catch by 50 percent, increase the commercial size limit to 15 inches, place a moratorium on new pound nets, and not change recreational regulations. The CCA-NC also supported a 50/50 allocation for the two sectors once a coastwide stock assessment is complete. The CCA-NC also requested no change in the current recreational regulations. In a separate email, the CCA-NC also provided comments regarding the observer program and the Incidental Take Permit.

The North Carolina Guides Association (NCGA) requested the commission prohibit the use of large mesh gill nets beginning Jan. 1, 2016. The NCGA also recommended the commission pass Proposal 1 in its entirety with the modification to allow commercial gigging seven nights per week.

The North Carolina Wildlife Federation (NCWF) supported a 40 percent reduction in total southern flounder catch this year and recommended this should include a significant reduction in the commercial large mesh gill net fishery. The NCWF also supported the use of a TAC or quota for flounder beginning in 2016 and an increase in the commercial size limit to 15 inches.

The North Carolina Watermen United (NCWU) sent three letters. The first described landings data to show the commercial harvest of southern flounder is not declining. An additional letter expressed NCWU's position that they do not support the process, the science, the procedure or any of the six proposals. The NCWU requested no action be taken on the flounder fishery and that an independent review of supplemental management measures and a new stock assessment should be completed. A third letter questioned the division's conclusion that juvenile southern flounder are being caught in the fishery and reiterated the need for a new stock assessment before any new fishery management plan is adopted by the division.

The Ocracoke Working Waterman's Association (OWWA) supported a cooperative tagging study with commercial pound net fishermen and the division to tag southern flounder in late-November to enhance understanding of migration and recruitment. The OWWA supported the creation of a sanctuary in the fall for flounder using the division's blue crab sanctuary boundaries around inlets. It also recommended the commission not support Proposal 1 or 2 because they believe the supplement proposals should reflect the amendment that is being supplemented. OWWA supported Proposals 5 and 6 with the caveat that the cull panel modification (5-¾-inch stretch panels) not be put in place until Jan. 1, 2016. OWWA does not support 6-inch cull panels.

The Recreational Fishing Alliance (RFA-NC) supported Proposal 1 in its entirety. It also recommended the division: conduct a comprehensive study of flounder gigging, institute a monitoring program following the implementation of Proposal 1, and create an advisory group to evaluate the biological and economic impacts from the prohibition of large mesh gill nets. In addition, the RFA-NC recommended a moratorium be implemented on all gear permitted by the Recreational Commercial Gear License and to develop and implement species-specific reporting for all commercial fishermen in the southern and summer flounder fisheries.

Other associations and counties also provided comment. The Albemarle Fisherman's Association did not support the supplement, but supported the amendment process. The Cape Fear Chapter of the North Carolina Kayak Association sent a petition with eight signatures that supported Proposal 1. Nash County and the Town of Carolina Beach submitted resolutions that supported the use of the supplement process to implement reductions on southern flounder harvest. Pamlico County submitted a resolution that opposed the supplement process to implement reductions of southern flounder.

The remaining written comments were not form letters and did not represent organizations. Of these, most supported one or more of the following: increase the commercial size limit to 15 inches, implement a TAC and/or quota for some portion of the fishery, reduce commercial harvest, or prohibit harvest of flounder (or all species) using some or all forms of gill nets. Although much less common, multiple comments contained support for one or more of the following: a season closure for some or all gears that harvest flounder, a moratorium of some type on pound nets, use commercial trip limits, reduce size limits for recreational and/or commercial sectors, raise size limits above 15 inches, reduce the recreational bag limit, use best available science and/or complete a new stock assessment, use the amendment process instead of the supplement process, reduce or prohibit pound nets and/or gigging, prohibit the Recreational Commercial Gear License, increase net mesh sizes to reduce bycatch, or take any kind of action that will benefit the resource. There were a small number of comments that suggested there was no problem with the stock. A large number of comments preferred no new regulations for the recreational fishery and many of these comments cited declining catches. A small number of comments preferred no changes to

regulations for one or more commercial gears.  A variety of other suggestions or concerns were expressed in other emails and letters.

# Marine Fisheries Commission Public Meeting Minutes
# Riverfront Convention Center, New Bern, North Carolina
# June 17, 2015

The commission met at 1 p.m. on June 17, 2015 at the Riverfront Convention Center in New Bern, N.C. to take public comment on management proposals being considered for a supplement to the Southern Flounder Fishery Management Plan Amendment 1.

The following commission members were in attendance: Sammy Corbett-Chairman, Anna Beckwith-Vice Chair, Mikey Daniels, Mark Gorges, Chuck Laughridge, Joe Shute, and Mike Wicker. Kelly Darden and Alison Willis were absent.

Chairman Corbett called the meeting to order and reminded the commission of its conflict of interest requirements and reviewed the guidelines for public comment.
Following is a summary of comments that related to southern flounder and the supplement proposals:

**Paul Walker** from Hampstead supported Proposal 1, except he felt that large mesh gill nets should be removed from coastal waters immediately, rather than waiting until Jan. 1, 2016.

**Ron McCoy** from Hampstead supported Proposal 1and urged the commission to find common ground for growth of fisheries.

**Paula Cannon** from Hampstead provided comments for for-hire guide Capt. Dave Timpy, who supported Proposal 1, stating it would lead to the fastest recovery for flounder.

**Earl Ward, Jr.** from the Albemarle Sound area did not support any changes, saying commercial fishermen had been cut enough.

**Riley Williams**, member of the commission's Northern Regional Advisory Committee, did not support the supplement, saying any changes to southern flounder should be through an amendment to the fishery management plan.

**Ray Brown,** from Goldsboro and former commission adviser, supported using the supplement process to restore southern flounder stocks to abundant levels.

**Hain Ficken** from Wayne County wanted to restore flounder by getting rid of big nets, instituting a total allowable catch limit and having a 15- inch size limit for everyone.

**Doris Morris** from Plymouth did not support any of the proposals, saying the data did not indicate a problem because flounder catches had stayed constant, even though fishing effort and fishing time decreased.

**Phil Rose** from Gaston County and Arapahoe talked about declining catches in western Pamlico Sound and wanted gill nets to be licensed by area as a mechanism to more effectively manage the fishery and to help restore stocks.

**David Bush**, a biologist with the N.C. Fisheries Association, said there is no data to show an amendment to the fishery management plan would not be sufficient to address the issues with southern flounder.

**Jerry Schill** with the N.C. Fisheries Association said changes to southern flounder management should be through an amendment to the fishery management plan, not a supplement.

**Jerry James** from Duplin County and member of the commission's Finfish Advisory Committee supported Proposal 1, except for the gig and pound net aspects of the recommendation.

**Tim Hergenrader** of Pamlico County supported a large mesh gill net ban, a total allowable catch limit for pound nets and commercial gigging, a 15-inch size limit for everyone and a six-fish bag limit for recreational fishermen.

**Mitchell Sawyer** from New River felt the General Assembly needed to make this decision on flounder, not the Marine Fisheries Commission.

**Alan Faircloth** of Surf City did not support limiting the number of days for commercial gigging because weather decided when you could gig. He supported a 15-inch size limit for both recreational and commercial, an eight-fish recreational bag limit and a 100-fish commercial trip limit.

**Art Smith** from Belhaven said fast-tracking flounder measures through the supplement process was wrong and should not proceed.

**Donald Willis** from Craven County said in the past the commission had been too wrapped up in saving jobs rather than saving fish and urged the commission to do what was right and bring back the resource.

**T.O. Hudgins** from Pamlico County did not support management changes and said the problem in Pamlico County was from pollution.

**Bruce MacLachlan** from Onslow County supported a total allowable catch limit, a 15-inch size limit for both recreational and commercial fishermen and elimination of large mesh gill nets.

**Lauren Morris** with the N.C. Fisheries Association said the commission should follow its processes and address needed changes for southern flounder through an amendment to the fishery management plan.

**Jon Whitehurst** from Minnesott Beach felt large mesh gill nets needed to be removed from inland waters.

**Jimmie Goodwin, Jr.** said changes to flounder restrictions should go through the amendment process, that pound nets are a clean fishery, that pollution is a problem and that flounder should be grown in hatcheries.

**Terry Pratt** with the Albemarle Sound Fisherman's Association did not support the supplement process saying consideration of southern flounder restrictions should go through an amendment to the fishery management plan.

**Stanley Warlen** of Carteret County and retired scientist with the National Marine Fisheries Service said any restrictions for southern flounder should be based on good data and that a coast-wide stock assessment is needed to determine the stock status.

**Chris Elkins**, former Marine Fisheries Commissioner, supported a total allowable catch limit with a 50 percent decrease in harvest for the commercial fishery, closing large mesh gill nets, a 15-inch size limit for everyone, a moratorium on new pound nets and permits, and no changes in recreational harvest.

**Ray Howell** supported a total allowable catch limit with a 50 percent decrease in harvest for the commercial fishery, a 15-inch size limit for everyone and eliminating large mesh gill nets.

**Emily Jordan**, a college student who said she was speaking for young people, said how much she enjoyed fishing with her dad and urged the commission to ensure there are fish for future generations.

**David Sneed** with the Coastal Conservation Association – N.C. supported the supplement process, saying southern flounder was overfished and that too many juveniles were being harvested and that if the commission would take care of the fish, fishing will take care of itself.

**Keith Johnson** from Wake County supported the supplement process and said large mesh gill nets are why southern flounder have not recovered.

**Ron Zielinski** from Oriental supported Proposal 1, but said the total allowable catch limit for the commercial fishery should be a 40 percent reduction from 2013 landings, closures needed to be added from Proposal 2 if needed, and that the recreational bag limit should be reduced from six to five fish if necessary.

**John Hudnall** said fish run in cycles and that the last two to three years have been good and if a 15-inch size limit was implemented it would put him out of business.

**Hodge Jordan** from Onslow County said the supplement is needed, that large mesh gill nets should be removed from state waters and there needs to be a commercial total allowable catch limit.

**Paul Biermann** supported going through the fishery management plan amendment process to address issues with southern flounder.

**Bradley Styron**, former Marine Fisheries Commissioner, said changes to southern flounder management should be through an amendment to the fishery management plan, not a supplement.

**Joe Romano** from Wilmington said the supplement was circumventing the process, that there was not an emergency with southern flounder and we need positive, creative solutions and not political maneuvering.

**Bud Abbott**, President of the Coastal Conservation Association – NC, supported Proposals 1 and 2, and recommended using money that was designated for the Observer Program to help retrain fishermen for other jobs.

**Randy King** felt no changes were needed to existing flounder restrictions.

**Bert Owens** from Beaufort said the commission was focused on jobs and not the resource and encouraged the members to take courage and step across the line for the resource.

**Ken Seigler**, member of the commission's Finfish Advisory Committee, urged the commission to use the amendment process and sound science to address flounder issues, rather than going forward with a supplement.

**John Hislop** from Bear Creek thought the Fisheries Reform Act was a good process, but said the states seems to be moving backwards; he encouraged the commission to support the resource.

**Bob Dillard** from Oriental supported Proposal 1, eliminating large mesh gill nets from estuarine waters and creating a subsidy for commercial fishermen that were put out of work and/or providing their children a free education at community colleges.

**Ricky Rose** from Harkers Island supported a 15-inch size limit for everyone, but did not support limiting giggers to just four nights a week, saying the weather already limited the number of nights they could fish.

**Hal James** with the Coastal Carolina Tax Association supported minimum government, maximum freedom and free enterprise and urged the commission not to put commercial fishermen out of business.

**Lonnie Brown** said there were plenty of little flounder and there was no depletion of the stock.

**Rena Jenkins** supported a 15-inch size limit for everyone, but did not want a limit the number of nights they could flounder gig.

**Raynor James** from Craven County said that studies were inconclusive and that extraordinary decisions should not be made without sound data, saying user groups should decide what was best.

**Joshua McGhee** from Craven County said supplement proposals are rash and the commission was not looking at the data – that 2013 landings were the highest in 12 years. He urged the commission consider the economic impact of both commercial and recreational fisheries.

**Jimmy Nobles** from Greenville and former commission adviser opposed the supplement and talked about political agendas.

**Adam Tyler**, member of the Finfish and Sea Turtle advisory committees, called for a new stock assessment and an independent review to determine if a supplement is justified. He said the stock

has been viable for 30 years and it was trending in a conservative direction, and expressed a lack of confidence in the Division of Marine Fisheries' ability to do stock assessments.

**Sally Jo Glendenning**, member of the Recreational Fishing Alliance, supported Proposal 1 saying banning gill nets would allow flounder to reach breeding size to help the stock recover.

**James Reilly** from Newport supported Proposal 1, except for the four-day limit on gigs. He doesn't want to get rid of commercial fishermen, but wants to ban destructive gear like large mesh gill nets and feels fishermen using this gear should transition to other jobs.

**Chad Davis**, a for-hire guide, supports the need for a supplement and called for a total allowable catch limit, removal of large mesh gill nets, a 15-inch size limit, a moratorium on pound nets and no changes to recreational size or bag limits.

**Gurney Lee Collins, III** from Beaufort felt the supplement was not appropriate and that the commission should move forward with an amendment to the Southern Flounder Fishery Management Plan.

**Mike Blanton** with the Albemarle Sound Fishermen's Association supported status quo for commercial fishermen and a 14-inch size limit for recreational anglers, saying most of the state is closed to gill nets and that fishermen don't need to lose any more flounder. He said 14- and 15-inch fish go in the ocean to spawn and don't return based on tagging data.

**Andrew Czanderna** did not support the supplement process and felt an amendment should be pursued. He wants to see a real stock assessment based on science.

**John Stone** from Newport gigs flounder to feed his family and friends now, but he used to gill net. He said the larger flounder aren't caught in gill nets, but that they swim off.

**Myron Smith** did not support the supplement and supported a smaller size limit like eight inches, fishing seven days a week, gill nets set year-round, fishing until the quota is met and that trawlers needed to use TEDs to protect turtles. He did think there was an emergency with southern flounder.

**Tyler Brewer** did not agree with any of the proposals for the supplement.

**Jarrett Moore** said the recreational size limit should be 14 inches to reduce animosity between the user groups and that banning large mesh gill nets will increase predators like gar, sharks and grass carp.

**Tim White** from Blounts Creek did not support some of the proposals that limited weekend gigging because it would put him out of business.

**Tom Roller**, President of the N.C. Guides Association, supported Proposal 1, except that giggers should be able to fish seven days a week. He said the southern flounder stock was depleted and that gill nets are efficient at catching fish and that the stock cannot be rebuilt as long as gill nets are in the water.

**Janet Rose** from Moyock said that valid data was lacking for all six proposals and that a new stock assessment needed to be done. She said gill net closures due to turtles had reduced landings and that no changes were needed. She encouraged the commission to consider the impact its decisions could have on the ability to get fresh fish to consumers.

**Fred Fulcher** from Pine Knoll Shores did not support the supplement and felt many of the proposals would cause an increase in imported seafood. He said data and peer reviews were needed to identify a problem and solution and felt upstream polluters were causing water quality problems.

**Jonathan Fulcher** from New Bern said the supplement proposals would be devastating and recommended reducing the size limit from 15 inches to 13 inches.

**Lee Craddock** from Dare County said he had flounder fished for 45 years and last year he caught the prettiest fish he had ever caught. He did not see a reason for the proposals and felt they were just a way to get large mesh gill nets out of the water.

**Johnny Stallings** said no changes were needed.

The meeting adjourned.

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

**MEMORANDUM**

TO: N.C. Marine Fisheries Commission

FROM: Will Smith, Stock Assessment Scientist
Division of Marine Fisheries, NCDENR

DATE: Jan. 30, 2015

SUBJECT: 2014 southern flounder stock assessment executive summary and summary of peer reviews

EXECUTIVE SUMMARY

The N.C. Fisheries Reform Act requires that fishery management plans be developed for the state's commercially and recreationally important species to achieve sustainable levels of harvest. Stock assessments are the primary tools used by managers to assist in determining the status of stocks and developing appropriate management measures to ensure the long-term viability of stocks.

The 2014 N.C. Division of Marine Fisheries southern flounder stock assessment was developed after a thorough review of available data and current southern flounder research as well as careful deliberation by the Southern Flounder Plan Development Team. The stock assessment represented the best science and data available for the N.C. stock, while maintaining continuity with earlier assessments of the N.C. stock. For consistency with the previous 2009 southern flounder stock assessment, the same statistical catch-at-age model was used; however, a more robust program capable of handling a wider range of data sources was selected, Stock Synthesis. Several updates to the assessment data were also incorporated, based on new southern flounder research.

The assessment model used catch data from five fisheries—gill nets, pound nets, all other commercial fisheries, inshore recreational, and ocean recreational. The model was length-based, and all inshore fisheries and surveys were allowed to have declining selectivity for larger fish, to account for possible emigration from inshore waters as fish mature. The ocean recreational fishery was assumed to have asymptotic selectivity. Two fishery-independent indices of juvenile abundance were developed from the Estuarine Trawl Survey (Program 120) and Pamlico Sound Survey (Program 195), and two fishery-independent indices of general abundance were developed from Pamlico Sound Independent Gill-Net Survey (Program 915) and Albemarle Sound Independent Gill-Net Survey (Program 135). Natural mortality ($M$) was age- and sex-specific and was estimated by scaling a growth-based natural mortality model to age-1 estimates, $M_{female}$ = 0.36 and $M_{male}$ = 0.45.

The stock assessment was reviewed by a panel of three independent reviewers, representing experts in stock assessment or southern flounder biology. The peer review process assures that data and methodologies used to assess N.C. stocks represent the best possible science and information.

Reviewers indicated that all appropriate data sources were considered and that the model selection was appropriate for the available data; however, reviewers also noted that the biology of the species and available data did not permit the use of traditional stock assessment models for determining stock status of southern flounder in N.C. waters. Most importantly, each reviewer noted recent evidence for stock mixing throughout the South Atlantic and unknown movement rates. The use of traditional stock assessment models requires that all losses from the stock be accounted for, but emigration rates from N.C. waters have not been quantified; furthermore, the fraction of N.C. recruits originating from South Carolina, Georgia, or Florida waters is unknown. These concerns cannot be addressed with a stock assessment that only includes southern flounder in N.C. waters and would require a regional assessment approach. Another significant problem was that fishery-independent indices of abundance showed no trend over the time period assessed, 1991–2013, and some indices appeared to show conflicting patterns. Since traditional stock assessment models rely on fishery-independent indices of abundance to track population status over time, conflicting survey information and low data contrast made it difficult to accurately fit a traditional model. The 2014 southern flounder stock assessment was not accepted for management by the N.C. Division of Marine Fisheries due to legitimate and substantial concerns raised by the peer reviewers, concerns with which the division agreed.

The full draft stock assessment is available upon request.

SUMMARY OF PEER REVIEWS

The stock assessment was reviewed by a panel of three independent reviewers, representing experts in stock assessment or southern flounder biology. The peer review process assures that data and methodologies used to assess North Carolina stocks represent the best possible science and information. Three experts reviewed the 2014 southern flounder stock assessment, Drs. Steve Midway (assistant professor, Coastal Carolina University), Erik Williams (chief, Sustainable Fisheries Branch, National Marine Fisheries Service, Beaufort), and Genny Nesslage (senior stock assessment scientist, Atlantic States Marine Fisheries Commission). After carefully considering the results of the peer review, the North Carolina Southern Flounder Plan Development Team and Management Review Team decided that the stock assessment could not be approved for management.

*Dr. Steven Midway Review*

Dr. Midway evaluated the stock assessment on the merits of the treatment of biological information and deferred to comment on the quantitative aspects of the stock assessment. Since Dr. Midway is an ecologist and expert in southern flounder biology, not a stock assessment scientist, this was an appropriate role. Dr. Midway approved of the data used in the assessment and noted that the diversity of data sources used in the assessment was a strength. He also noted that the stock assessment represented an improvement over previous N.C. stock assessments both in terms of biological and quantitative considerations. Although he recommended that the assessment be used for management based on biological considerations, Dr. Midway was concerned that important model outputs did not appear to respond to changes in the fishery, noting high sustained fishing mortality and little corresponding change in stock biomass, and he was concerned that the migratory dynamics of the southern flounder stock were as of yet unquantified. In spite of these concerns, Dr. Midway recommended that the assessment be used for management.

*Dr. Erik Williams Review*

Dr. Williams identified several weaknesses in the description of the data used in the stock assessment, noting that several important graphs and tables were missing and that some aspects of the use of the data in the stock assessment were not clearly described in the text. He speculated that age-based selectivity might also provide useful information for the assessment model due to the highly variable size at age that characterize southern flounder populations, although the assessment only fit length-based selectivities. He suggested an alternate approach to estimating natural mortality, and suggested that two aggregate indices be used to track juvenile and general abundance rather than four. Most importantly, Dr. Williams identified the lack of model fit to survey data and the high level of mixing of the South Atlantic stock as major issues for fitting a traditional stock assessment model to N.C. data alone.

While Dr. Williams did indicate that the assessment was useful for management, he suggested that the data were useful, not the assessment output. Furthermore, he suggested that alternate assessment approaches be explored, such as trend analysis.

*Dr. Genevieve Nesslage Review*

Dr. Nesslage commented that appropriate data sources were used and treatment of the data within the model was correct given the biology of southern flounder. Many of Dr. Nesslage's comments corresponded to Dr. Williams' comments. She noted that further details regarding model structure and justification for model parameterization were needed, recommended that aggregate survey indices be used rather than individual indices of abundance, and suggested an alternate method to estimate natural mortality. In addition to comments corresponding to Dr. Williams', Dr. Nesslage also suggested a different treatment of uncertainty in the indices of abundance in order to achieve a better model fit and testing a different selectivity model. Finally, Dr. Nesslage concluded that the assessment was not useful for management because trends in data did not seem to be informative, model outputs did not appear to respond to changes in the fishery, and the stock was not limited to N.C. waters. She recommended that a longer time period be considered and that the stock be assessed on a regional level.

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

**MEMORANDUM**

TO: Marine Fisheries Commission

FROM: Dr. Louis Daniel
Division of Marine Fisheries, NCDENR

DATE: Jan. 22, 2015

SUBJECT: 2014 Southern Flounder Stock Assessment

The 2014 southern flounder stock assessment was developed after a thorough review of available data and current southern flounder research as well as careful deliberation by the division's Southern Flounder Plan Development Team. The stock assessment represented the best science and data available for the N.C. stock, while maintaining continuity with earlier assessments of that stock. For consistency with the previous southern flounder stock assessment, the same statistical catch-at-age model was used; however, a more robust program capable of handling a wider range of data sources was selected. Several updates to the assessment data were also incorporated, based on new southern flounder research related to reproductive ecology, and data (genetic, otolith morphology, and tagging information) that show significant mixing throughout the South Atlantic population that likely occurs during spawning and recruitment. Available modelling approaches could account for stock mixing during recruitment, but no satisfactory approach was found to account for adult mixing during spawning, as adult movement rates are unknown.

Division stock assessments are reviewed by a panel of three independent reviewers. These reviewers are each experts in stock assessment or the biology of the species in question, and the peer review process assures that data and methodologies used to assess N.C. stocks represent the best possible science and information. Three experts reviewed the 2014 southern flounder stock assessment: Drs. Steve Midway (assistant professor, Coastal Carolina University), Erik Williams (chief, Sustainable Fisheries Branch, National Marine Fisheries Service, Beaufort), and Genny Nesslage (senior stock assessment scientist, Atlantic States Marine Fisheries Commission). Dr. Midway accepted the assessment for management based on the treatment of the species' biology; however, he noted that he was unable to evaluate the stock assessment model itself because he is not a stock assessment scientist. Reviewers indicated that all appropriate data sources were considered and that the model selection was appropriate for the available data; however, Drs. Williams and Nesslage noted that the biology of the species and available data did not permit the use of traditional stock assessment models for determining stock status of southern flounder in N.C. waters. Most importantly, each reviewer noted the recent evidence for stock mixing throughout the South Atlantic and unknown movement rates. The use of traditional stock assessment models requires that all losses from the stock be accounted for, but migration rates to and from N.C. waters

have not been quantified; furthermore, the fraction of N.C. recruits originating from South Carolina, Georgia, or Florida waters is unknown. These concerns cannot be addressed with a stock assessment that only includes southern flounder in N.C. waters and would require a regional assessment approach. Another significant problem noted by Drs. Williams and Nesslage was that fishery-independent indices of abundance showed no trend over the time period assessed, 1991–2013, and some indices appeared to show conflicting patterns. Since traditional stock assessment models rely on fishery-independent indices of abundance to track population status over time, conflicting survey information and low data contrast made it difficult to accurately fit a traditional model. Therefore; the 2014 southern flounder stock assessment was not accepted for management by the division due to legitimate and substantial concerns raised by the peer reviewers, concerns with which the division agrees.

The original Southern Flounder Fishery Management Plan was adopted in 2005 to end overfishing and rebuild the stock. The purpose of the 2014 stock assessment was to determine if those goals had been met in the set time frame. The fact that the stock assessment was not accepted for management provides no answer as to whether those 2005 goals were appropriate or met. Consequently, in the absence of a quantified estimate of the overfished and overfishing condition, N.C. Division of Marine Fisheries Management Policy 2014-1, "Rebuilding Schedules, implementing G.S. 113-182.1 (b)5) and (b)(6)" does not apply. This policy addresses the statutory requirements to set a time period to end overfishing within two years and to set a time period to rebuild the stock within 10 years from the time a fishery management plan is adopted.

While the current southern flounder stock assessment model cannot be used for management and timelines cannot apply, much information exists to manage southern flounder in North Carolina, and some of that information is troublesome. Of particular concern is the combination of large numbers of immature fish in the catch and evidence of declining recruitment since the 1990s that may result in the need for further management measures.

Given the importance of the southern flounder fishery, alternate approaches will be developed in lieu of a traditional stock assessment. The division's Southern Flounder Plan Development Team is currently developing an analysis of trends in fishery performance, abundance, and stock productivity. The trend analysis will employ the Traffic Light approach, used in the current Blue Crab Fishery Management Plan, to provide guidance for management of southern flounder in N.C. waters.

# NCDMF Stock Assessment Program
# External Peer Review

**Assessment Information**

| | |
|---|---|
| Assessment Species: | Southern flounder (*Paralichthys lethostigma*) |
| Stock Assessment Report: | Stock Assessment of Southern Flounder, *Paralichthys lethostigma*, in North Carolina Waters—2014 |
| Date Sent: | November 10, 2014 |

Dear Reviewer-

Thank you for agreeing to review the 2014 stock assessment of the North Carolina southern flounder stock. The purpose of the external peer review process is to ensure that the assessment and results presented are scientifically sound and that decision makers are provided adequate advice. Peer reviewers are asked to address the terms of reference in the terms of reference report that follows. Please be as specific as possible in recording your comments and suggestions for revision and improvement. Any additional suggestions to improve the stock assessment are appreciated. Reviewers are also welcome to make comments directly in the assessment report using the Track Changes feature in Microsoft Word.

Please return this form, the terms of reference report, and any additional comments to laura.lee@ncdenr.gov. We would like to have your review by December 5, 2014. A copy of the final report will be provided after it has been presented to the North Carolina Marine Fisheries Commission.

Thank you,

Laura M. Lee
*Senior Stock Assessment Scientist*
North Carolina Division of Marine Fisheries

**TERMS OF REFERENCE REPORT FOR EXTERNAL PEER REVIEW**

**Reviewer Information**


| | |
|---|---|
| Reviewer Name: | Genevieve Nesslage |
| Business Mailing Address: | ASMFC 1050 N. Highland St, Suite 200A-N<br>Arlington, VA 22201 |
| Business E-Mail: | gnesslage@asmfc.org |
| Business Phone: | 703-842-0727 |


1) Evaluate the thoroughness of data evaluation and presentation including:
   a) Justification for inclusion or elimination of available data sources

To the extent of my knowledge, all available, reliable sources of landings, biosamples, and survey data were included in the assessment. There was no mention of SEAMAP, but I assume that is because that program's surveys do not catch southern flounder.

The analytical team was well justified in their decisions to use fishery-independent juvenile and adult survey data sources in place of the Beaufort Bridgenet ichthyoplankton survey and fishery-dependent CPUE indices.

The assessment report notes (page 48) that there is little correlation and possibly some conflict among surveys used in the assessment. Unless movement rates between regions within NC waters can be obtained to support a spatially explicit assessment model, the analytical team may want to consider more careful inclusion/exclusion criteria or a model-based combination of indices into stock-wide indices to provide the model with more coherent information about what the trends in overall stock abundance might be.

   b) Consideration of survey and data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, sample size)

Description of data collection was thorough and transparent with regard to both strengths and weaknesses.

   c) Calculation and standardization of indices and other statistics

The methodology described was appropriate for the treatment of surveys not designed to target southern flounder. No diagnostics were provided to evaluate GLM performance. Without additional information, this portion of the TOR cannot be evaluated thoroughly.

A plot of all JAI and adult surveys in the same (respective) figures would have been useful for comparing trends.

Also, an overall description and visualization of landings trends (both total and by fleet) would have been helpful to include in the report as well.

2) Evaluate the adequacy, appropriateness, and application of data used in the assessment.

Focusing on the use of lengths (the most reliable type of data widely available for this species) was appropriate. The calculation/estimation of length-based maturity and selectivity curves was the best approach given the data.

Instead of averaging natural mortality estimates across all available approaches, would careful consideration of the assumptions of each model in relation to southern flounder biology help eliminate some of the options? Incorporating expert judgment into the selection of natural mortality estimators may result in values more suitable for the species.

As mentioned above, it might be worthwhile considering the application of a set of specific, explicit inclusion/exclusion criteria when selecting indices. Alternatively, a model-based combination of regional indices into stock-wide indices might provide the assessment model with more coherent information about what the trends in overall stock abundance might be. The model is likely struggling to make sense of differences among what may be (in some cases) sound- or river-specific trends.

Overall, I found description of the data and data treatment outside the model to be outstanding; however, details regarding how data were treated in the model were lacking. Much of this information is obtainable in the Stock Synthesis dat and control files, but justification for the values chosen is not outlined in the report. For example, the SEs applied to fishery catch and the errors assigned to annual index values were not discussed. How were effective samples sizes determined? Also, justification for fishery selectivity time blocks was not apparent. These are important decisions that affect model performance and results. More extensive description and justification is needed.

3) Evaluate the adequacy, appropriateness, and application of method(s) used to assess the stocks.

The analytical team should be applauded for adopting a modern, sophisticated (yet not overly complicated) approach to assessing this stock. Continued development and use of an integrated model is encouraged. Additional comments on methods by subtopic are provided below.

*Model fit*:

Plots of model fit to fleet landings were not provided. I assume they fit well; otherwise, the model should have been deemed highly unreliable and not used. However, I was surprised that such standard output was missing from the report. I suggest including the core, standard r4SS figures in future assessments that utilize SS as a modeling platform.

Poor fits to the Program 915 and 135 surveys were not surprising given they were highly constrained by the small specified SEs (<0.2) shown in the SS data file. The model should not be expected to be able to fit the high values for Program 135's index in the 1990s unless the SEs are loosened up. Even if annual SEs from GLM models were used (which I am assuming…a description is not in the report), it is almost impossible to believe that those indices track stock trends that well. Using a higher, ad hoc level of variance would allow the model the freedom to balance all the data sources in the model better and still try to fit those higher data points if at all possible.

As the report states, the model produced poor fits to indices and length composition fits were not stellar. The magnitude of retrospective pattern was disconcerting as well. Again, it is unclear

how well the model fit total landings. In general, the model does not appear to be performing well given the data and current configuration.

*Migration and selectivity*:

The issue of emigration outside NC waters is troubling. However, the analytical team expertly included several structural decisions to account for the movement and emigration of larger/older fish as best they could, including the use of dome-shaped selectivity for inshore fisheries and the use of annual recruitment deviations in place of a stock recruitment function. These model configuration decisions allowed for a more realistic portrayal of stock dynamics and avoided overestimation of fishing mortality on larger/older fish for inshore fisheries that target smaller/younger fish.

I question, though, the forcing of ocean fleet selectivities to be asymptotic given known emigration. If length data are available from the returned tagged fish, could they be used in some way to inform specification or partial estimation of the descending limb of the selectivity curve for this fleet?

Ultimately, these issues and others raised in the report (e.g., recruitment potentially being subsidized by SC/GA/FL spawners) cannot be addressed well or at all by the available data. In the absence of better tagging and migration studies, a regional assessment approach is recommended.

*General selectivity:*

In the interest of reducing the number of parameters, could the inshore recreational and commercial time blocks be dropped from the assessment? Figures 27 and 28 indicate they are not changing fishery selectivity that much. Perhaps I missed the justification for these time blocks and the need for them. If so, please disregard this comment.

The shift in ocean fleet selectivity to larger fish made sense given regulation changes; however, that issue should be discussed and used to bolster time block decisions in the report.

An alternative selectivity function that is more flexible in shape may improve model fit. The double normal forces the curve to adopt a particular shape and that may be causing some of the apparent length composition fitting issues. Although it requires more parameters, I suggest trying the spline option if you have not done so already.

*Growth*:

On page 43, the report states that conditional ages at length are used, but the control file has -1s in the Low and High Bin columns for the first fleet (commercial gill net?). The explanation for this was not clear.

To help improve fit to length composition data, I highly recommend loosening up (increasing) the specified CVs on your vonB parameters. These CVs may not be large enough to accommodate the true variation in the observed data. This may lead to overestimation of fishing mortality and patterning in the length composition fits.

*Model components:*

A table of likelihood components showing the relative contribution of each data source for the base and alternate models would have been helpful for comparison with the text in Sections 3.2.7 and 3.3.

4) Evaluate the methods used to estimate stock status determination criteria. Evaluate the adequacy and appropriateness of recommended stock status determination criteria.

The justification for a management target and threshold of 25–35% SPR was not provided and alternate reference points were not recommended. It is unclear to me why southern flounder management would differ from summer flounder which (unless I am mistaken) uses a threshold of $F_{35\%}$ and target $SSB_{35\%}$. Why a lower %MSP for a similar fish that grows and matures quite rapidly and displays relatively low variability in recruitment for a finfish?

5) Does the stock assessment provide a valid basis for management for at least the next five years given the available data and current knowledge of the species stock dynamics and fisheries?

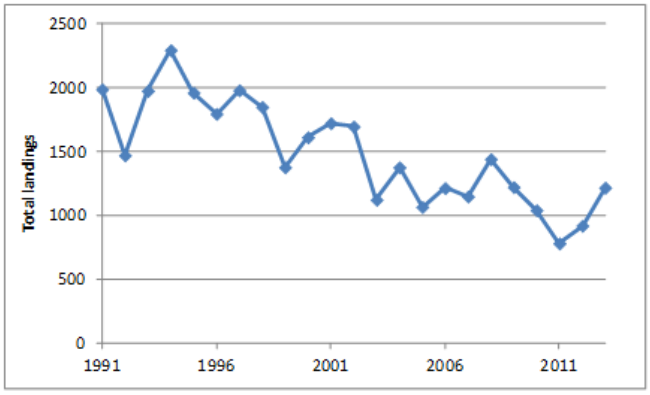
○ Yes

◉ No

Comment on response.

Despite the outstanding efforts of the analytical team, this assessment suffers from either uninformative data or too short a time series to detect trends in the stock. The model has great difficulty fitting contradictory and/or trendless data. It is quite possible that the data sources are actually informative but there have been no major changes (large declines or increases) in the stock since 1991.

My concern with stock status stems from counterintuitive data and results. If I interpreted Table 12 correctly, estimated landings have halved since 1991, but there has been no marked increase in survey trends or expansion of length or age structure in the catch. [Note: population length structure was not plotted, but the report did not make note of an estimated expansion in length structure of the stock so I assume none was noticeable.] Estimated discards have risen, but most discards appear to come from the recreational fishery which is still a small percentage of the overall catch.

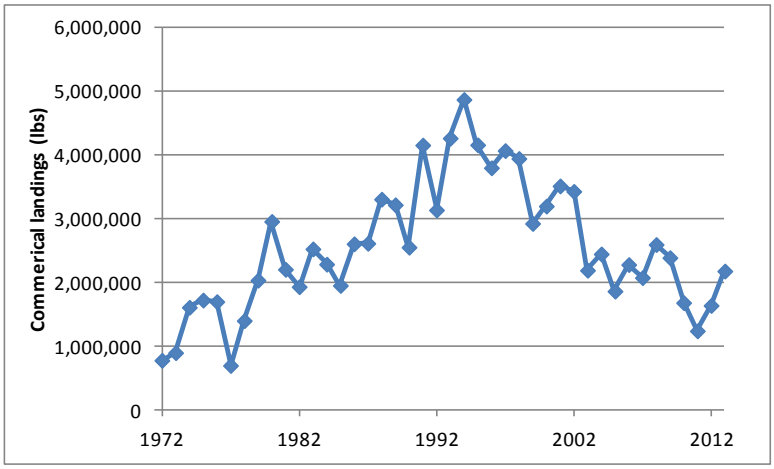



Estimated recruitment has declined, but I worry that is an artifact of the model trying to maintain some fit to stable length composition data in the face of halved landings and largely trendless surveys.

In short, it does not make sense that the stock has been experiencing overfishing across the entire time series if there has been no marked response to halving the catch. I think the model simply

cannot construct a coherent story about how the stock is responding to fishing mortality without a longer time series, more informative surveys trends, and more informative length structure changes.

I suggest placing the 1991+ data in the context of the history of the fishery to the maximum extent possible. A quick plot of total commercial landings of southern flounder since the 1970s (http://portal.ncdenr.org/web/mf/statistics/comstat/floundersou) indicates there has been significant contrast in the landings data if the time series could be extended back farther.




My naïve interpretation is that regulations limiting the gillnet fishery (particularly in Pamlico Sound) in the late 1990s and early 2000s may have contributed to a decline landings (Table 10). However, NC fisheries biologists and the analytical team would know best how to interpret these data.

I suggest the analysts consider supplementing their current SS model runs with alternate configurations that incorporate historical catch data and the statewide Program 120 survey extended back to the early 1980s (if the survey data can be standardized for changes in design and implementation). Estimates of total commercial and recreational harvest statistics appear to be available that far back as well. Use of the Program 120 survey would provide the model with information on recruitment without having to specify (or estimate) a stock-recruitment relationship. I am not familiar enough with the data to know if this is feasible, but, if it is, it might be worth trying and comparing with results from the 1991+ base run.

It is also possible that the NC portion of the stock is at the northernmost tip of the species' range and it may not be possible to assess this stock with confidence without adopting a more regional approach. At a broader spatial scale, trends in indices and stock responses to fishing and environmental influences may become apparent.

Given my reservations about the model's interpretation of the available data, I am concerned that the stock status determinations made in the assessment may be poorly informed by the short time series of available data relative to the history of the fishery. I suggest more exploration of historical data and growth parameterization be conducted before a final stock status determination be made and used for management.

6) Evaluate appropriateness of research recommendations. Suggest additional recommendations warranted, clearly denoting research and monitoring needs that may appreciably improve the reliability of future assessments.

Research recommendations are appropriate given the monitoring and modeling challenges presented by this stock. I am particularly concerned with recommendation #2 given application of gill net discard frequencies to recreational data may not be appropriate (especially for the offshore recreational fishery). If post-release mortality for some of these fisheries/gears is truly at or near 100%, this is an important recommendation to address.

I suggest the following addition to *Analysis* recommendations:

- Develop additional model runs in SS using all available historical catch and survey time series, if possible.

7) Are you aware of any reference material not cited in this report that should be included?

No.

8) Would you be willing to act as an external peer reviewer for a future NCDMF stock assessment?

(●) Yes

( ) No

9) Do you have any additional comments?

Please consult tracked edits and comments in the document for additional (minor) content and editorial comments.

# NCDMF Stock Assessment Program
# External Peer Review

## Assessment Information

| | |
|---|---|
| Assessment Species: | Southern flounder (*Paralichthys lethostigma*) |
| Stock Assessment Report: | Stock Assessment of Southern Flounder, *Paralichthys lethostigma*, in North Carolina Waters—2014 |
| Date Sent: | November 10, 2014 |

Dear Reviewer-

Thank you for agreeing to review the 2014 stock assessment of the North Carolina southern flounder stock. The purpose of the external peer review process is to ensure that the assessment and results presented are scientifically sound and that decision makers are provided adequate advice. Peer reviewers are asked to address the terms of reference in the terms of reference report that follows. Please be as specific as possible in recording your comments and suggestions for revision and improvement. Any additional suggestions to improve the stock assessment are appreciated. Reviewers are also welcome to make comments directly in the assessment report using the Track Changes feature in Microsoft Word.

Please return this form, the terms of reference report, and any additional comments to laura.lee@ncdenr.gov. We would like to have your review by December 5, 2014. A copy of the final report will be provided after it has been presented to the North Carolina Marine Fisheries Commission.

Thank you,

Laura M. Lee
*Senior Stock Assessment Scientist*
North Carolina Division of Marine Fisheries

**TERMS OF REFERENCE REPORT FOR EXTERNAL PEER REVIEW**

**Reviewer Information**


| | |
|---|---|
| Reviewer Name: | Steve Midway |
| Business Mailing Address: | Bio Dept., Coastal Carolina University, Conway, SC 29528 |
| Business E-Mail: | smidway@coastal.edu |
| Business Phone: | Office 843–349–6404; Cell 919–793–5386 |


1) Evaluate the thoroughness of data evaluation and presentation including:
   a) Justification for inclusion or elimination of available data sources

      Overall I thought the use of data was well presented and all efforts were made to include relevant data. Obviously when merging several data sources into one assessment there will be questions, but I have no major comments on the data sources and refer to my minor comments and questions in the text.

   b) Consideration of survey and data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, sample size)

      The main strength I see is the diversity of sampling programs that capture southern flounder, which not only helps describe a wider size/age range, but also permits increased inference (even when some programs, like larval sampling, are excluded). Obviously a weakness is the lack of (survey) data for offshore adults who have either moved offshore seasonally or are permanent offshore residents (and the distinction is important, too). Clearly this demographic will need future efforts toward description to address major questions about life history, habitat use, and spatial dynamics beyond the unit stock.

   c) Calculation and standardization of indices and other statistics

      I'm less familiar with standard methods for calculation of indices, and would defer to the comments of other reviewers. However, I have made some minor comments throughout the text where I was unclear or uncertain about a specific aspect of estimation or statistical procedures.

2) Evaluate the adequacy, appropriateness, and application of data used in the assessment.

   Again, the offshore adults is a lingering question for this species; however, I was impressed with the changes made from the previous assessment. I think based on the existing sampling programs used and substantial improvements made in this assessment, the data are adequate and appropriate for an improved assessment of southern flounder.

3) Evaluate the adequacy, appropriateness, and application of method(s) used to assess the stocks.

   Coming into this review I was unfamiliar with Stock Synthesis. However, based on the description of this method (both in the assessment text and from the citations) it appears to be

a good choice for this species, namely in its generation of uncertainty and accommodation of selectivity patterns for multiple sampling programs, which is clearly the case. The flexibility of Stock Synthesis (i.e., use with varying amounts and types of data) also would appear to be something that is a strength as southern flounder assessment could potentially stay with this model in future assessments (as opposed to changing assessment models each assessment).

4) Evaluate the methods used to estimate stock status determination criteria. Evaluate the adequacy and appropriateness of recommended stock status determination criteria.

   Obviously based on the information and rates presented in Section 4, the designation of overfished with overfishing occurring makes sense. However, I would like to see more effort made to reconcile the historically high *F* values and extremely low SPR with the fact that biomass has not appreciably varied over 2 decades. For at least 10 years, *F* was 2–3x the threshold value, yet biomass did not perceptibly respond (decline), nor has it in the most recent decade of continued overfishing. (And most of the abundance indices are variable, but not strongly declining.) I have thought about this before, and would direct you to Chapter 4 (http://sites.psu.edu/fishresearch/wp-content/uploads/sites/10599/2014/03/Midway-Dissertation.pdf). I don't think the answer is explicit in this chapter, but without a reliable stock-recruit relationship some type of larval subsidy is perhaps the most parsimonious answer regarding the persistence and stability of biomass in the face of very high harvest. (I will also note that this chapter is in preparation for submission to a peer-reviewed journal, and I should soon be able to provide a revised version of the population modeling presented in the dissertation.) So, to circle back to the question, I think the stock status determination is analytically defensible, but needs continued thought.

5) Does the stock assessment provide a valid basis for management for at least the next five years given the available data and current knowledge of the species stock dynamics and fisheries?

   ○ Yes

   ○ No

   Comment on response.

   I have selected Yes, but the circle does not fill in electronically. While questions remain, I see this assessment as both the best available information for managing the NC unit stock of southern flounder, as well as advancement from previous assessments.

6) Evaluate appropriateness of research recommendations. Suggest additional recommendations warranted, clearly denoting research and monitoring needs that may appreciably improve the reliability of future assessments.

   Overall, the research recommendations are comprehensive and appropriate. One minor recommendation I might put forth would be to consider the squash-mount maturity preparations/slides that were extremely precise in classifying maturity stages in southern flounder (see Midway et al. 2013). In addition to the utility of the method presented in the paper, I have had discussions with multiple biologists at SCDNR who are successfully

exploring this approach for other species. This method does not rely on histology, yet produces near-histological quality data with minimal effort.

Continuing to elucidate patterns of inshore habitat use, demographics, and harvest (and discards, etc.) is important, but I think that focusing on recommendations 7–9 will serve the critical mission of completing the understanding of the southern flounder life cycle and inform the assessment process more than other areas. (That being said, I know these are likely the most difficult research objectives in addition to the fact that they have been recently worked on.) I would also encourage you to reference the dissertation chapter linked above for my attempt at your Analysis recommendation. In the coming weeks/months as I prepare this chapter for submission, I would be happy to have a discussion with NCDMF for your thoughts on my approach, and how it might be improved and potentially used in this assessment document.

7) Are you aware of any reference material not cited in this report that should be included?

References seem comprehensive and largely match the literature I have used for southern flounder.

8) Would you be willing to act as an external peer reviewer for a future NCDMF stock assessment?

○ Yes

○ No

Again, Yes, but the bubble is not active.

9) Do you have any additional comments?

Overall, I wish I were able to comment more thoroughly on the assessment model; however, my knowledge of assessment models is more academic than practical. I trust other reviews are more assessment-minded and have provided good comments. I do feel qualified to comment on the biology of the species, and in general this assessment, to me, presents a significant step forward with respect to integrating biology into the assessment.

# NCDMF Stock Assessment Program
# External Peer Review

**Assessment Information**

| | |
|---|---|
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Please return this form, the terms of reference report, and any additional comments to laura.lee@ncdenr.gov. We would like to have your review by December 5, 2014. A copy of the final report will be provided after it has been presented to the North Carolina Marine Fisheries Commission.

Thank you,

Laura M. Lee
*Senior Stock Assessment Scientist*
North Carolina Division of Marine Fisheries

**TERMS OF REFERENCE REPORT FOR EXTERNAL PEER REVIEW**

**Reviewer Information**


| | |
|---|---|
| Reviewer Name: | Dr. Erik H. Williams |
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| Business E-Mail: | Erik.Williams@noaa.gov |
| Business Phone: | 252-728-8603 |


1) Evaluate the thoroughness of data evaluation and presentation including:
   a) Justification for inclusion or elimination of available data sources

      The report seems to focus on data that were included, with not much being considered, but ultimately rejected. It is not clear how the age data are being used in the assessment model. It seems this whole document relies on a person with some experience with Stock Synthesis. The document says the age data are entered into the model, yet the growth parameters are fixed and the selectivity curves are estimated as functions of length, not age. This leaves me wondering if the age data is being used for anything in the assessment model. Are there annual age composition fits? None are shown in the document. This is a major weakness of this document and potentially the stock assessment.

      Generally the justification for including data seems appropriate. Aside from the concerns mentioned above about the age data, there are some concerns about the index data being used (see below).

   b) Consideration of survey and data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, sample size)

      Stock Definition:

      The documentation for the stock definition is clear. The limited tagging data are presented and used in an appropriate manner. The issue remains that this is clearly an open population being modeled in this stock assessment.

      Movement and Migration:

      Section 1.2.2 in the report should include more detail. The 15% emigration rate is mentioned later in the report, but not in this section, where it clearly belongs. This is a critical issue for this stock assessment and I would expect the write-up to reflect that with much more detail and discussion of available data, alternate hypotheses, anecdotal information, etc.

      Age, Size, Growth:

      The age and length data for this species seems fairly extensive based on the sample size tables presented in the document, yet it is completely unclear how all this data is being used or not used in the assessment. There is extensive discussion about stratifying the length data into six month periods, but only one overall growth curve is presented for

each sex. Were six month growth curves fit? The model uses two seasons, but the same growth curve for each season? It appears that the growth curves were fixed in the model.

The sampling design, or lack of sampling design for collecting length and age samples could use some more detail. Are the age data useless because of the biased sampling design? I am not clear on this. Are the lengths biased in some way? How exactly were the fishery specific length composition data put together? Are there fishery specific age composition data available? I realize later in the report that there is a statement about the age sampling being non-random. But, were there any attempts to correct the data for use in the assessment?

Maturity:

The maturity data seems fairly well documented and one of the few sections of the report that was actually clear and concise.

Mortality:

The choice of natural mortality values for an assessment is usually one of the most important choices made. In this report a single paragraph is devoted to this topic. That is woefully inadequate. The choice of M estimators needs to be discussed and justified. It looks as if the analyst just picked a few formulae off the shelf and then averaged them all, without regard to their utility for this species. For instance, the Ralston estimator is almost never used and should be discarded. The Jensen estimator is just one estimator and should not appear twice in the averaging. Basically these M estimators should be cast into categories of estimators, such as max age based (Hoenig), life-history invariant (Jensen, Charnov), and size based (Lorenzen). The strengths and weaknesses of each should be discussed, with particular note to the species at hand. Which methods may have more utility for Southern Flounder? Why?

Habitat:

It seems clear from the document that the knowledge about movement and habitat is limiting, as it can be for many fish species. However, it would have been nice to see a little more data from GA and SC to see if anything from those regions can be gleaned for this assessment. Perhaps that was done and it is not clear to me. There is mention of tagging studies from GA and SC, but not much detail about what is known in those areas about Southern Flounder.

Descriptions of Fisheries:

This is very clear and understandable. It seems that getting better discard estimates should be a high priority for research.

Fishery-Independent Data:

It would have been nice to see a summary table comparing the Program 120, 135, 195, and 915 data side by side. Perhaps indicating months of data collection, amount of area covered, number of stations, etc. In any event, the documentation seems clear enough to understand the data, but what is unclear is why the choices were made for inclusion or exclusion of the data, and why the data was subset in the ways that it was for Southern Flounder. For example, Program 120 seems inferior to Program 195, which seems to cover more time and space, yet two indices, carrying equal weight in the model are used

from these programs. Why? And, May and June months were used for Program 120 data, yet the Program 195 data was limited to September. They are both measuring age-0 Southern Flounder. Why the discrepancy in months used?

The Program 135 and 915 data are both measuring adult Southern Flounder, but I see no length composition data. This leaves me wondering how this data is being treated in the model. Maybe if I was able to read Stock Synthesis input files I might be able to find it, but if that was an expectation for this review, then you called upon the wrong reviewer. More discussion of the indices is below.

c) Calculation and standardization of indices and other statistics

There are several issues with the indices that were produced for this assessment that warrant further consideration or explanation. The document is limiting in its description of why index data were subset and ultimately selected. For instance, there is no clear linkage between the months chosen for modeling index data and the months during which one would expect to see Southern Flounder. There is discussion of taking the months with the highest catch rates, but how high and what percentage of the catch is excluded in the months that were dropped? This point obviously does not apply to all the index data, because some of the fishery-independent sampling was already limited by design.

The potential biases and uncertainties sections of the index reports are incomplete and border on the useless. Saying that a survey is not designed for the species in question and not explaining how that might affect the relationship between survey abundance and true abundance is a dereliction of duty. I would guess that 95% of surveys used in fisheries are never designed for the species index that is being calculated. What is more important is to discuss the spatial and temporal overlap of the species and survey. This is not done very effectively in this assessment.

The justification for choice of indices to be put into the model is not clear. These indices should be compared in two ways, (1) relative to each other and (2) based on the properties of how well they capture abundance. Having more than one index that measures the same thing should not be put into the model. The model does not have a good means to sort out the differences, especially when no age data is being used. I do not understand the reason for including both program 120 and 195 data since they both are measuring age-0 Southern Flounder. Either combine them into a single index or select the better one. Because the length and age composition data is not presented for any of the indices, I am not sure whether the same goes for program 135 and 915 index data. If they have the same selectivity (or even roughly the same), then combine them or select the best.

The documentation and diagnostics for the indices is too little for me to offer any advice about how reflective they are of abundance. The Mann-Kendall analysis in section 2.3 is pointless. The pairwise correlation analysis is good, but those results showing very little correlation are the very results you are looking for to question the choice of indices for inclusion in the model, yet none of that is done in this report. Lack of correlation among your indices (assuming they are lagged appropriately) should be a big red flag and warrants further investigation, discussion, and justification than what is in this report.

2) Evaluate the adequacy, appropriateness, and application of data used in the assessment.

A stock assessment relies on the accuracy of each input data source. In order to have a useful model you must at a bare minimum have an understanding of the total removals from the stock. In the case of Southern Flounder, there is a good set of landings estimates, but the discards are highly uncertain, or even ignored in the case of shrimp trawl bycatch. Nonetheless, that is a common problem for many stock assessments. The best way to address this is through sensitivity runs and uncertainty estimates.

The next critical piece of information for a size/age-structured model is size and age structured data. In this case length composition data is being used and it remains unclear to this reviewer what is being done with the age data. In any event this data needs to be plotted and visually examined to determine if (1) year class strengths/weaknesses can be observed moving through the data, (2) if shifts in the smaller ages/sizes correspond to changes in minimum size regulations, and (3) if there are notable shifts in the maximum size/age of fish over time. None of this appears to have been done in this assessment. It should have been noted upon examination of the length composition data that there is no sign of year classes and that there seems to be little response in the data to changes in the minimum size limit. These are concerns when going forward with a size/age-structured model like Stock Synthesis. It may have suggested that a surplus-production model was more appropriate, but I caveat that statement with the issue of not being able to adequately evaluate the age data. The age data may have been more valuable in this case. It is often the case that age data contains far more important population dynamic information in it compared to length data, especially when the variation in size at age is as great as it seems to be for Southern Flounder.

Of course a very critical piece of information for any assessment, especially one that seeks to provide long-term, equilibrium benchmarks is abundance data, usually in the form of relative CPUE indices. In this case there appears to be both juvenile (age-0) and adult (age range not documented) indices. Unfortunately there are two of each and they appear to conflict. This is a problem for any stock assessment and usually needs to be resolved by the analyst by either combining the data or eliminating an index. Forcing the model to choose between the indices just adds noise and potential bias to the model and results.

3) Evaluate the adequacy, appropriateness, and application of method(s) used to assess the stocks.

The stock synthesis assessment model is a powerful model that must be applied with care and full understanding of the underlying processes. For the set of data, which includes landings, discards, size composition, age composition (???), and indices, this model is appropriate. Unfortunately the way this report is written, determining more precisely how various settings were structured for this model is near impossible without being able to read stock synthesis input files, which I cannot read. Some details that I am left wondering about include: how are the discard selectivity curves (retention curves) being estimated? What selectivity function is being used for all the curves? What selectivity is being used for the adult indices? How is the age data being fit in the model? What are the likelihood components being estimated? What are the values of those likelihood components? What are the sample size inputs for the multinomial components? What are the CV values being used in the lognormal

likelihood components? There is a lot left unknown to me because of poor documentation and the inability to interact with the analyst during a desk review.

If I could read stock synthesis input files I might be able to find some of this information, but I cannot do that.

The choice of dome-shaped selectivity curves is a tricky one. In all assessment models like this one there is a confounding between the degree of doming in the curve (the descending limb of the selectivity curve) and the fishing mortality rate. I would have liked to see sensitivity runs with alternate hypotheses about selectivity shape and form.

The likelihood components are very poorly documented in this report, more specifically the error levels assumed for each data set. What are the multinomial n's and the index and landings CV's? The model is set with all likelihood multipliers at 1.0. This assumes that all error levels are specified correctly, which is almost never the case. Recent trends in the literature (see Francis 2011) suggest that likelihoods should be re-weighted such that residuals conform to assumptions of N(0,1). At a minimum some other likelihood weighting scheme should have been explored. The typical pattern seen in these models is that the multinomial composition components are over-weighted, which by the looks of the index fits, seems to be the case in this model. But, again the poor documentation makes this insight difficult.

Uncertainty is characterized through sensitivity runs. This is inadequate, especially if the range of sensitivity values is not directly tied to the amount of uncertainty in the input data. What is the uncertainty in the F level that corresponds to $F_{35\%}$? This is probably the most critical output, yet there is no specified level of uncertainty. Sensitivity analyses are really meant to determine behavior of the model to different assumptions, not characterize uncertainty. The author(s) should look into delta-method, bootstrap, Monte Carlo, and MCMC approaches to characterizing uncertainty.

4) Evaluate the methods used to estimate stock status determination criteria. Evaluate the adequacy and appropriateness of recommended stock status determination criteria.

   Because of the open nature of this stock assessment, equilibrium based stock status criteria are not appropriate. The SPR rates are useful, but the uncertainty about selectivity, natural mortality, and even maturity should be factored into this calculation.

5) Does the stock assessment provide a valid basis for management for at least the next five years given the available data and current knowledge of the species stock dynamics and fisheries?

   (•) Yes

   ( ) No

   Comment on response.

   Although this stock assessment has its issues, as almost any stock assessment does, it is important to realize that like most stock assessments it represents a compilation of all available data for the fishery and species. Because it is a compilation of all information, it is ultimately useful for management. The question and concern is what type of management

can be justified with this assessment? As a scientist and reviewer of this assessment, I do not want to offer management advice, as it clearly is not my place. Instead what I will try to do is highlight some of the important results and data that reflect on the population dynamics/sustainability of the stock, while keeping an eye on the associated level of uncertainty with each. The best way to think of this is as indicators of stock condition, with some being clearer than others.

First, it should be clear that the first major shortcoming of this stock assessment is the modeling of an open population, which means there is uncertainty in the feedback between spawning stock, recruitment, and ultimately fishing mortality rates. The assessment assumes there is no stock-recruit relationship, which means that it assumes recruitment is essentially constant (with some environmental noise around it). Of course that is never the case because ultimately a stock must have some level of spawning to produce some recruits, they don't just appear out of thin air. So, we know that at some low levels of spawning stock, recruitment must become impaired. The question is how low? Because of the open population we have of Southern Flounder in NC, another layer of uncertainty is added to the whole system. Certainly this type of situation is not conducive to estimating long term sustainability benchmarks, and managers should take note of that.

In the absence of long term sustainable benchmarks there are some things that managers can continue to keep an eye on for sustainability issues. For instance what are recent trends in the abundance indices, what are the recent trends in recruitment and fishing mortality, what are the recent trends in age/length composition? Downward trends in abundance indices, downward trends in recruitment, increases in fishing mortality, and truncation of the older/bigger fish from the age/length composition should trigger concern from managers. Other changes in the data should be noted as well, like shifts in maturity or size-at-age.

What I am suggesting here is that this assessment is not going to help with any traditional benchmarks because the open population renders them useless. But, the recent trends in the data and assessment model output are useful. In evaluating these trends it is important to try and understand the root cause if possible. For instance, if recruitment is declining, we must ask why? Is there increased fishing from the other areas? Is there increased fishing in NC? Is there a change in the environment? Find the most credible explanation and this will help in deciding what can be controlled and what is uncontrollable. But recognize that controllable or uncontrollable signals may still require action on the part of managers.

What do I see in these results? Fishing mortality is showing an overall long term decline, with a recent upturn in the last few years. This is largely a reflection of the landings trend, which means any direct actions on landings levels should result in changes in fishing mortality. SPR and F are directly inversely related. Recruitment is showing a general long term decline, with a recent upturn. This could be concerning, especially since the most recent estimates of recruitment are the most uncertain. The total biomass trend is essentially flat which suggests things are fairly sustainable, but recognize that the flat trend in biomass came during a period of decreasing landings. If the decreased landings were having really positive results, we should have seen biomass trend upward. Of course recruitment has been trending downward, hence it balances out into a seemingly flat biomass time series.

The length frequency (composition) data is amazingly consistent over time, showing very few shifts or modes due to year classes. This is likely a result of the apparent large variation

in size-at-age in the growth curve data. Unfortunately this also points out a severe limitation in the utility of the length data. It does not reflect any year classes moving through the population and does not show any shifts in structure due to changes in fishing mortality or even due to changes in regulations. I would expect to see a little more shift in the small fish being kept, reflecting the increase in minimum size limits over time. It almost appears that the minimum size limits are simply being ignored.

However, the most unexpected and concerning trend in the data is the apparent shift in the age data toward younger fish. This is during a time of increasing size limits (which seem to be ignored) and stable length compositions. The catch since 2008 seems to be predominated by age-1 fish, with an increasing fraction of age-0 fish. This is of concern from a long term sustainability perspective. The reason for this needs to be explored and management measures should attempt to reverse this trend.

6) Evaluate appropriateness of research recommendations. Suggest additional recommendations warranted, clearly denoting research and monitoring needs that may appreciably improve the reliability of future assessments.

   The research recommendations seem appropriate.

7) Are you aware of any reference material not cited in this report that should be included?

   No references that should have been cited, but plenty of material that should have been considered, applied, and possible cited. Without looking up the exact references, I would direct the author(s) to work on selectivity estimation (Sampson, Legault, and a recent Fish Res issue), adjusting age comps for biased sampling (Chih), likelihood re-weighting (Francis), and index selection (Hilborn, Walters).

8) Would you be willing to act as an external peer reviewer for a future NCDMF stock assessment?

   (•) Yes

   ( ) No

9) Do you have any additional comments?

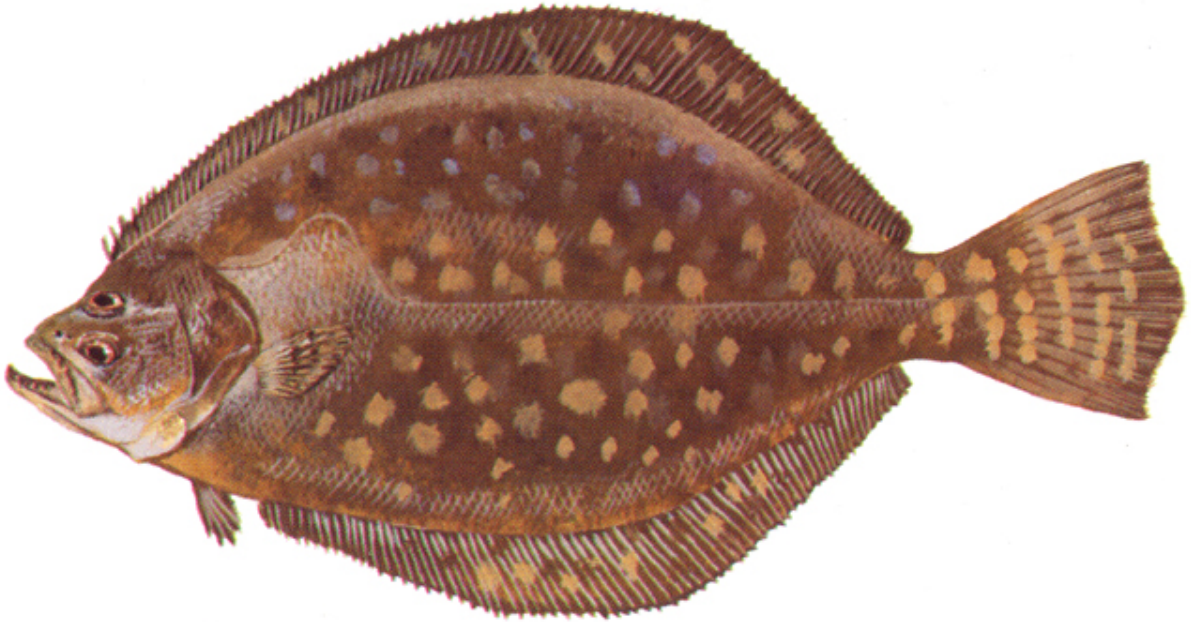
   Because the review of this stock assessment is being conducted as a desk review, which does not allow for interaction between the reviewers and stock assessment analyst, it is incumbent that the documentation be very thorough and inclusive. I find that not to be the case for this assessment. It is a major shortcoming of this assessment and severely impinges my ability to adequately review it. Half the document is attachments of Stock Synthesis (SS) files. By themselves they serve no utility for non-SS users. Therefore I am left to rely on the Tables and Figures alone, which are very incomplete. For future reviews, consider a face-to-face review, or have a much more thorough set of documents. I appreciate the need to keep a stock assessment report that is readable and understandable, but there are many supplemental things that are needed for a good technical review.

   For instance, almost all input data should appear in Table form, with some appearing in Figure form as well. Consider actually including a spreadsheet of the assessment input data and even the files and software for running the model. Or provide some digital copies of the

input and output files, not just copy and pasted versions in the report. Diagnostics and more details are needed for index GLM analyses and data subsetting.

It is amazing that this assessment report has a single equation in it for maturity and nothing else. I recognize that the SS documentation is referenced, but at the same time that does not provide enough information to know how preliminary data may have been processed, nor does it allow the reviewer the details necessary to know exactly which equations are being used for selectivity, how F's are being estimated, and other important details.

# 2014 Southern Flounder Draft Stock Assessment



Presented to the Marine Fisheries Commission

Feb. 19, 2015

# Major improvements from 2009 southern flounder stock assessment

- New computer program
  -Stock Synthesis, wider range of data
- Length-based
  -better use of very extensive length data
- Included males and females
- Did not use Beaufort Bridgenet Survey data
  -limited spatial extent (only one place)
- New information
  -size at maturation
  -South Atlantic stock mixing
- Inshore gear selectivity lower for larger fish
  -partial accounting for spawning migration
- Explored model sensitivity to losses of adults

# 2014 southern flounder stock assessment data

- Five fisheries
  -commercial: gillnets, pound nets, all other commercial
  -recreational: inshore, ocean
  -catch, length frequencies, sex ratios, discards/catch-and-release
- Two seasons (January–June, July–December)
  -account for rapid growth, change in size at age
  -account for seasonal discard/catch-and-release mortality
- Four fishery-independent surveys
  -juveniles: Estuarine Trawl (P120), Pamlico Sound (P195)
  -adults: Albemarle (P135) and Pamlico (P915) Sound Independent Gill-net Surveys
  -relative abundance, length frequencies, sex ratios

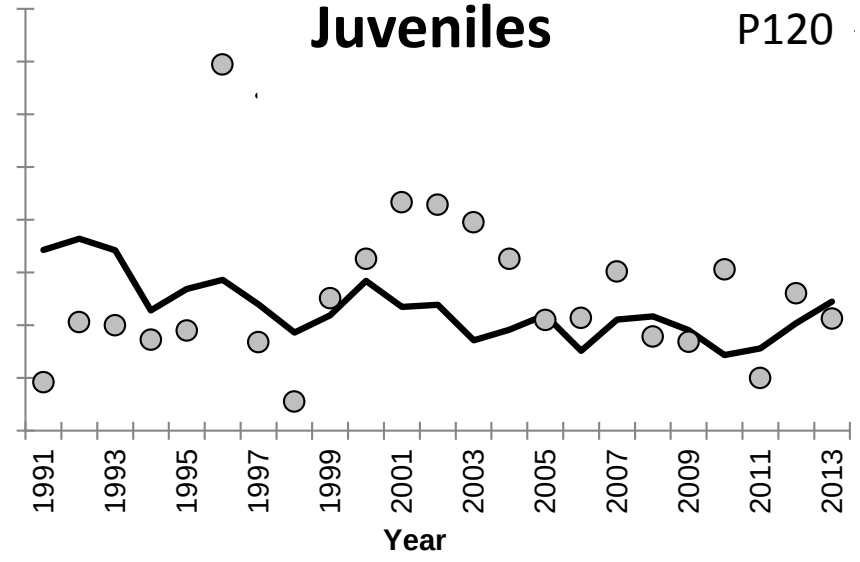
# Major problems with 2014 southern flounder stock assessment

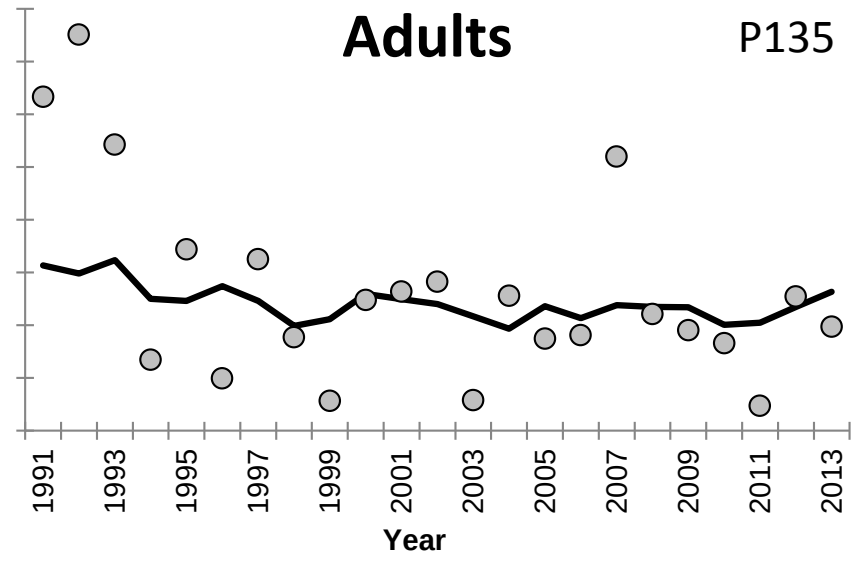
- Despite major improvements, insurmountable problems for traditional model
  -identified by two of three reviewers

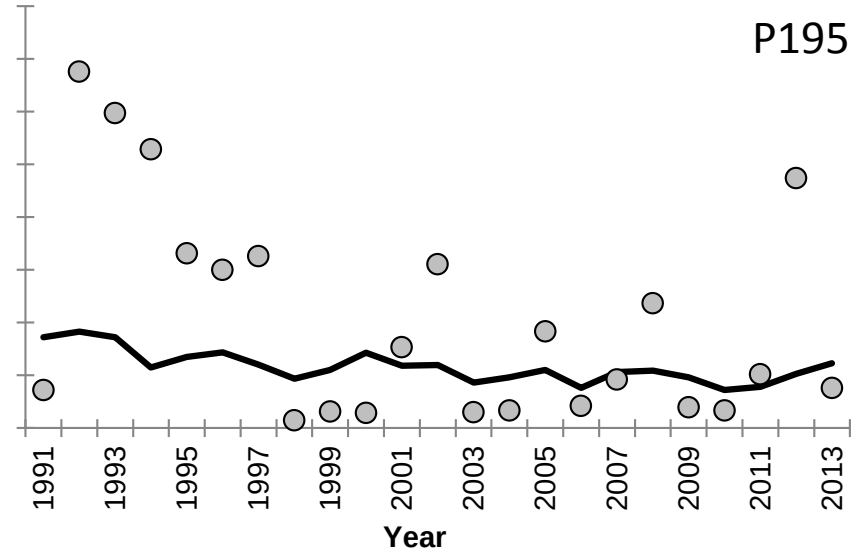
- Poor model fit to survey data
  -conflicting information
  -source of model “confusion”

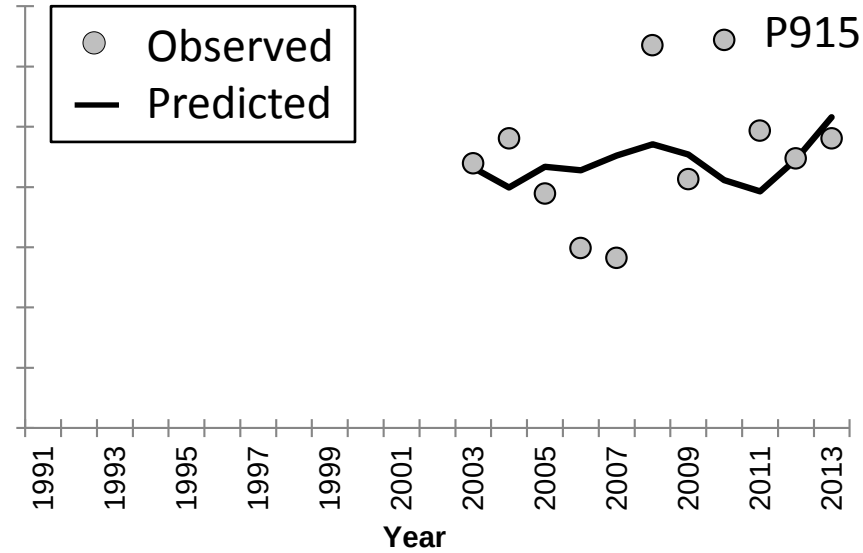
- Movement into and out of North Carolina waters
  -how many NC fish were spawned in South Carolina, Georgia, and Florida? UNKNOWN
  -how many NC adults emigrated to South Carolina, Georgia, and Florida? UNKNOWN
  -cannot “balance” our account

# Poor model fit to survey data



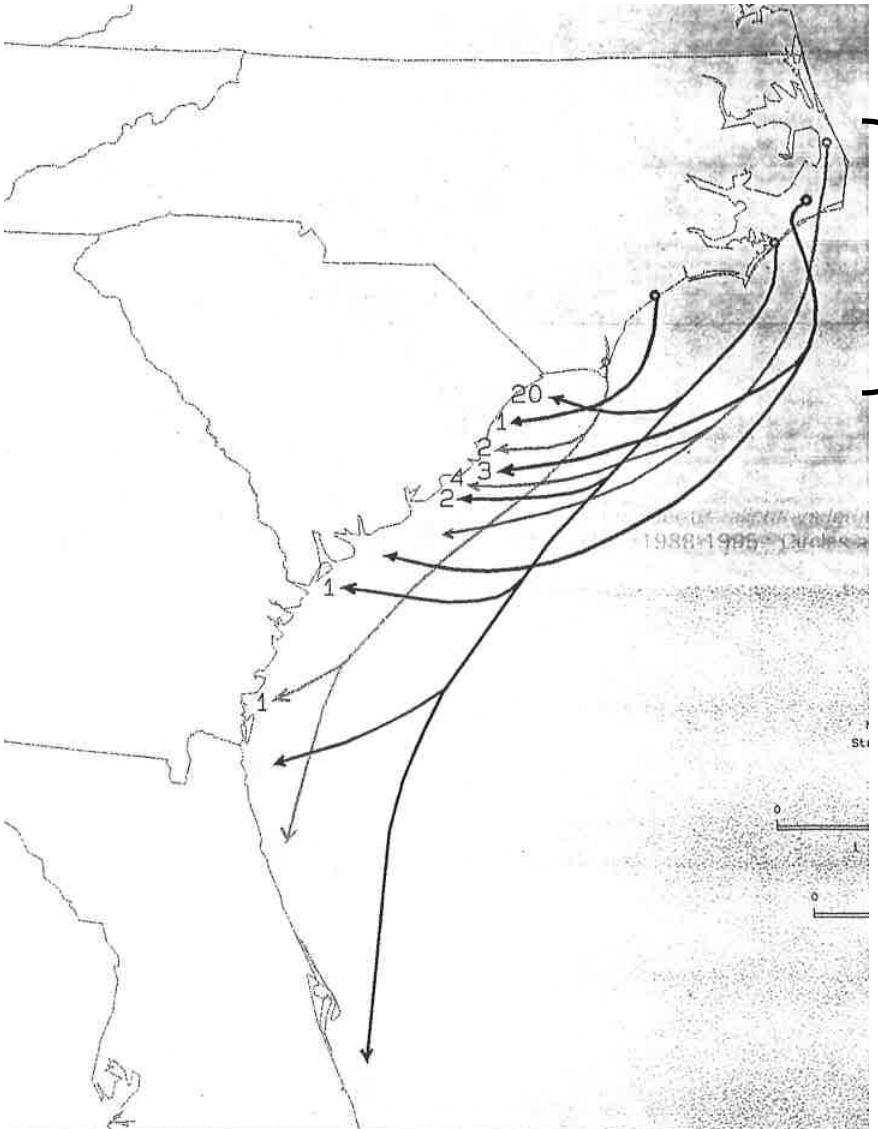
# Southern flounder migration and maturity background

- Offshore spawning, larval ingress to estuaries
- Juveniles remain inshore one to two years
- Maturation by second or third year, offshore spawning migration
- Some return to North Carolina waters, others do not
- Stock mixing from North Carolina to Florida

# Evidence for significant stock mixing in South Atlantic

- Genetic
  -Anderson and Karel (2012); Anderson et al. (2012); Wang et al. (*In review*)
- Otolith morphometric
  -Midway et al. (2014)
- All genetic and otolith studies show a difference between Gulf and Atlantic basins, but little difference within basins
- Tag-return studies in North Carolina

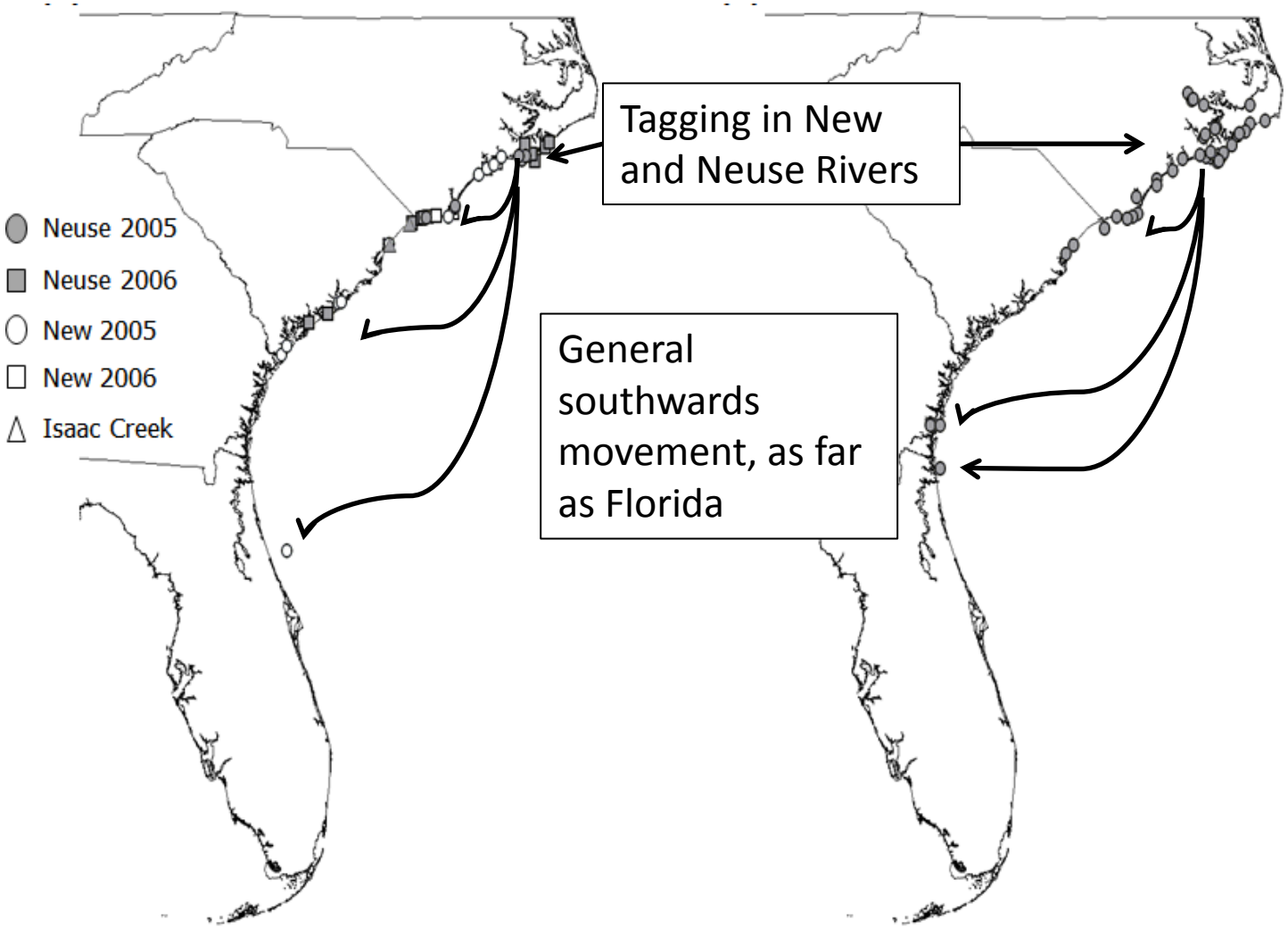
# Tagging: Division studies (1980-90s)




Tagging throughout North Carolina

General southwards movement, as far as Florida

# Tagging: Sea Grant studies (2000s)



# Peer review details

- Dr. Steve Midway (Coastal Carolina University)
  -"Yes", valid basis for management
  -based on treatment of biology, not the statistical framework that was used
- Dr. Genny Nesslage (University of Maryland)
  -"No", not a valid basis for management
  -based on quantitative/statistical aspects
- Dr. Erik Williams (National Marine Fisheries Service)
  -"Yes", DATA may provide a valid basis for management
  -however, "No", model output (fishing mortality, abundance, spawning stock biomass) does not provide a valid basis for management
  -major problems cannot be corrected with current knowledge

***<u>NO ONE</u> thought the statistical results were valid***

# How are peer reviews used by the Division?

Peer reviews are used as guidance for the Division to evaluate stock assessments.

The Division decides whether a stock assessment can be used as a basis for management.

The Division determined that the 2014 southern flounder stock assessment was not usable for management.

# Why was the outcome different in 2014 than in 2009?

- Despite major changes, results were nearly identical

- New information about migration

- Improved peer review process
  -reviewers were asked to describe why or why not the assessment “provides a valid basis for management”

# Potential future assessment strategies

1. Trend analysis
   -short-term
2. Data-limited assessment models
   -short-term
3. Tag-return estimates
   -mid-term
4. South Atlantic regional assessment
   -long-term

Questions?

# Timeline

1. Southern Flounder Fishery Management Plan Amendment 1
   -approved February 2013

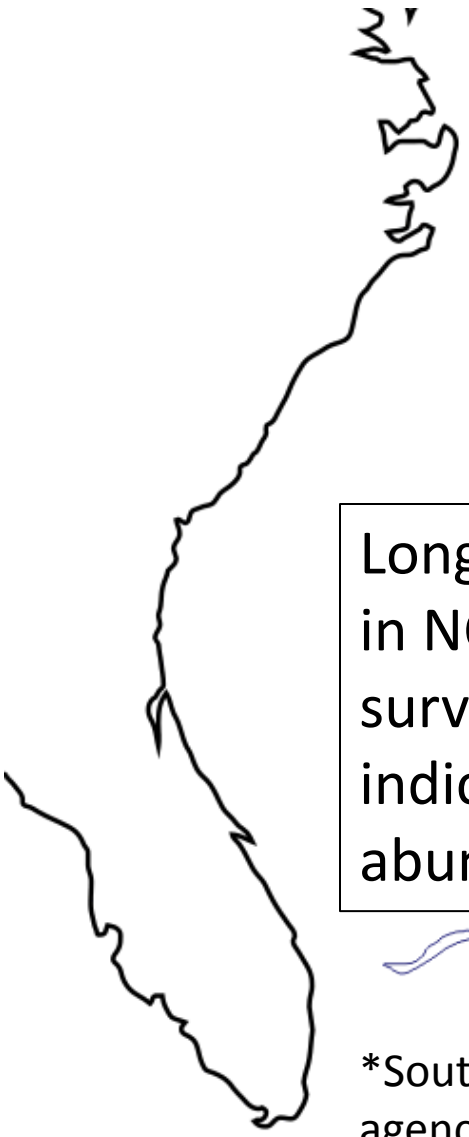
2. Next review of Southern Flounder Fishery Management Plan
   -scheduled to begin in 2018

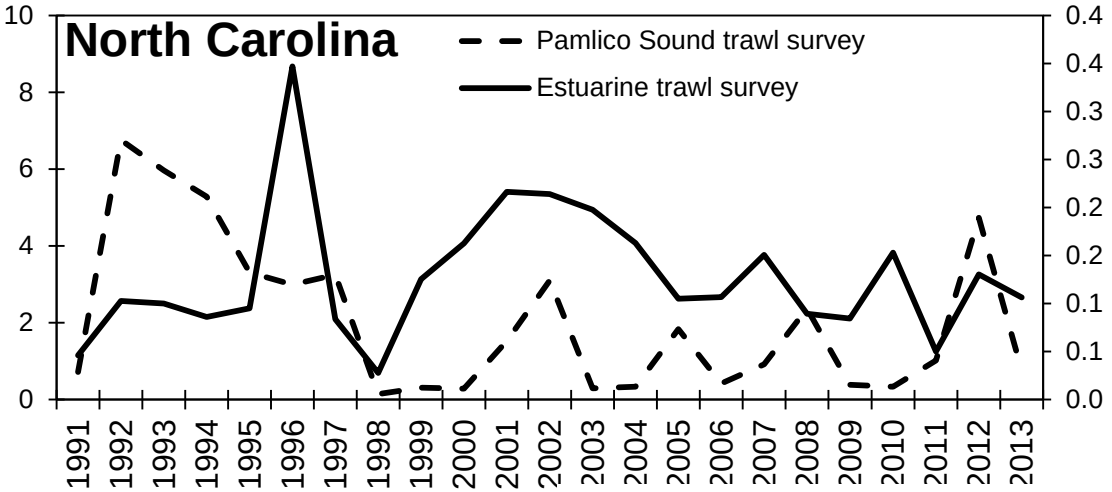
# Causes for concern

Without an approved stock assessment, the Division has no quantitative basis for management changes; however, we are seeing concerning patterns.

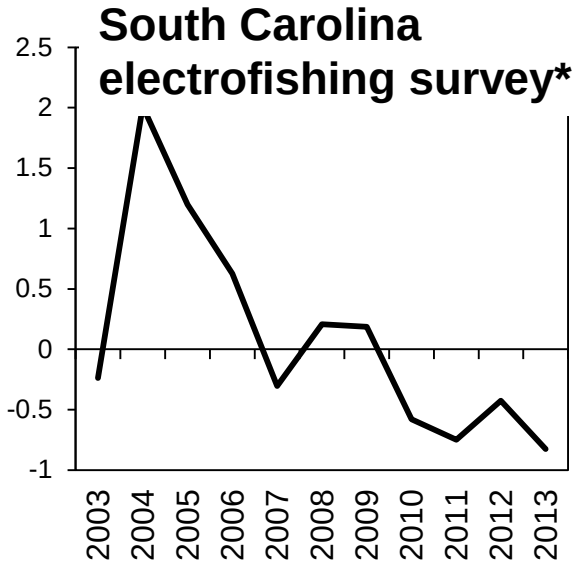
1. Coastwide, decadal decline in indices of abundance
2. Large number of immature fish in the catch

# Causes for concern: Juvenile abundance



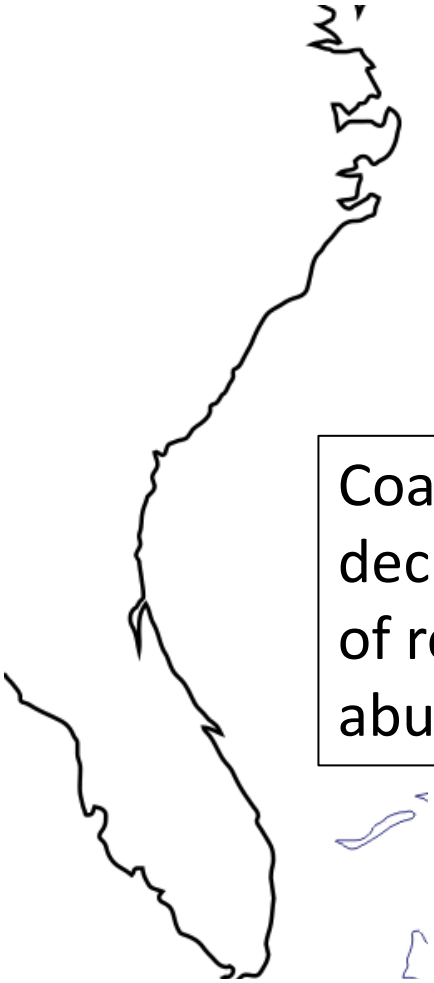



Long-term declines in NC (Pam S. survey) and SC indices of relative abundance

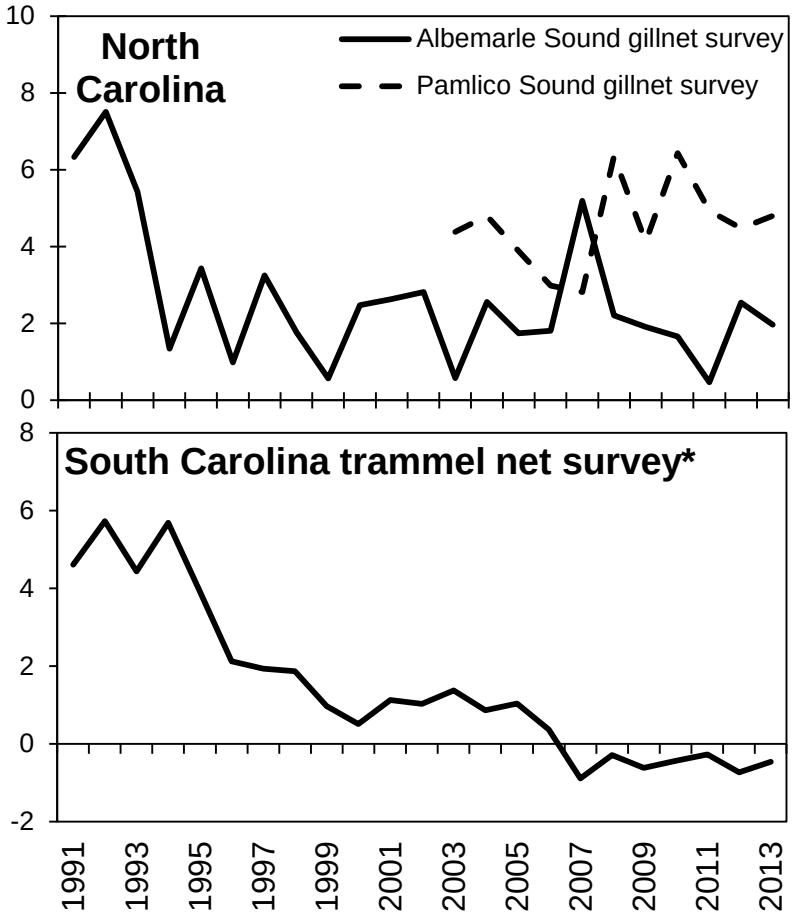



*South Carolina data were prepared by the natural resources agency in that state and do not represent Division analyses.

# Causes for concern: General abundance

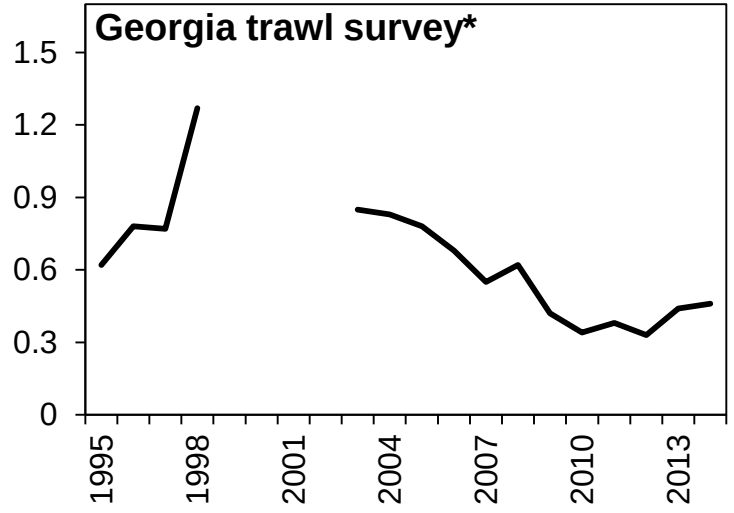


Coast-wide declines in indices of relative abundance



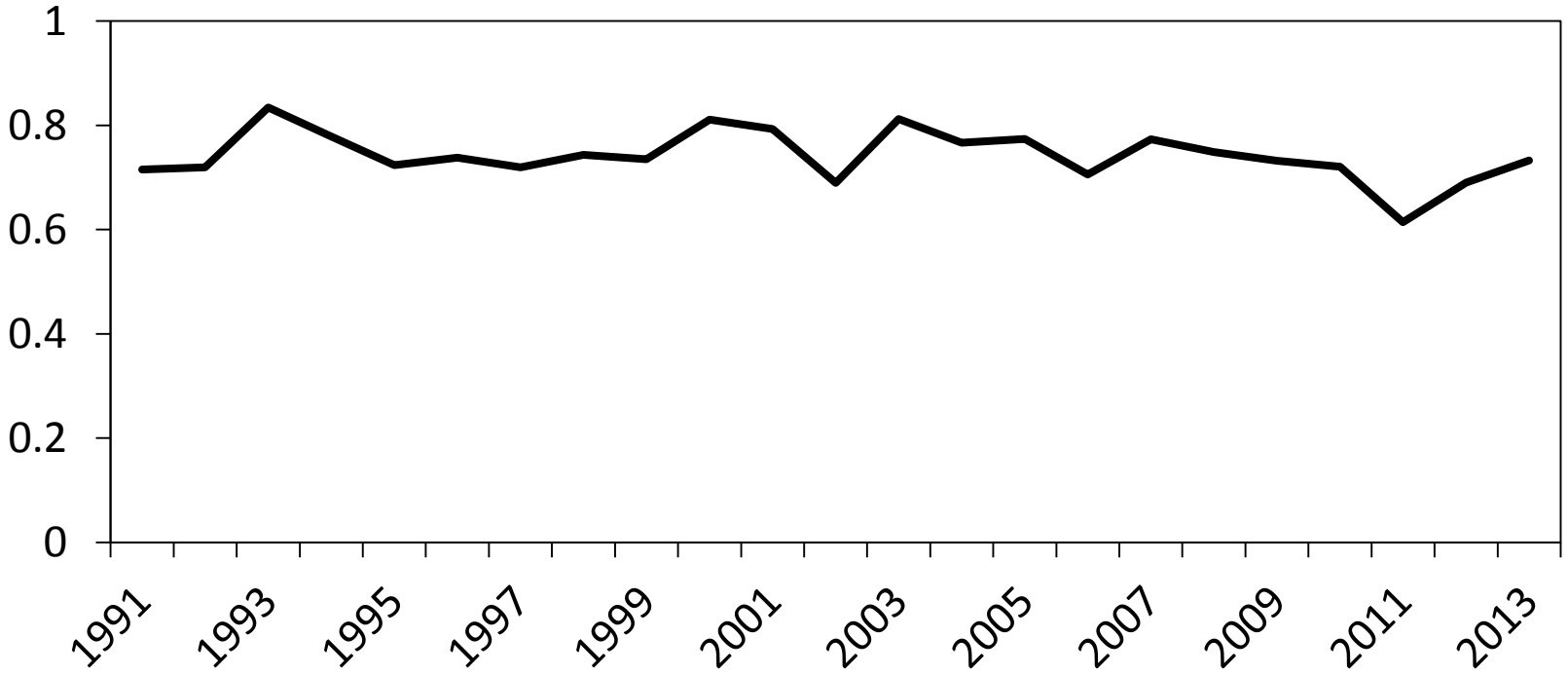







*South Carolina and Georgia data were prepared by the natural resources agencies in those states and do not represent Division analyses.

# Fraction of immature fish in the catch

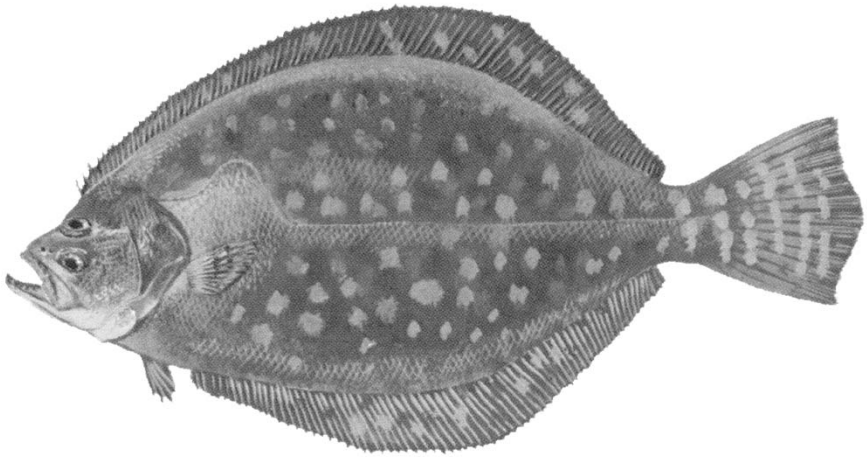



- Little change over time
- Range: 0.62–0.83

# Potential future management options

- Reduce immature fish in catch
  -15- or 16-inch size limits
- Improve escapement of spawners
- Other options?

# Draft Supplement A to Amendment 1 of the N.C. Southern Flounder Fishery Management Plan



Marine Fisheries Commission

May 21, 2015

# Issue and Origination

- Due to stock concerns, the commission requested a supplement to reduce catch of southern flounder by 25 to 60 percent.
- Supplement would allow for management actions to be implemented by fall 2015.
- Increasing escapement may improve spawning potential and recruitment.

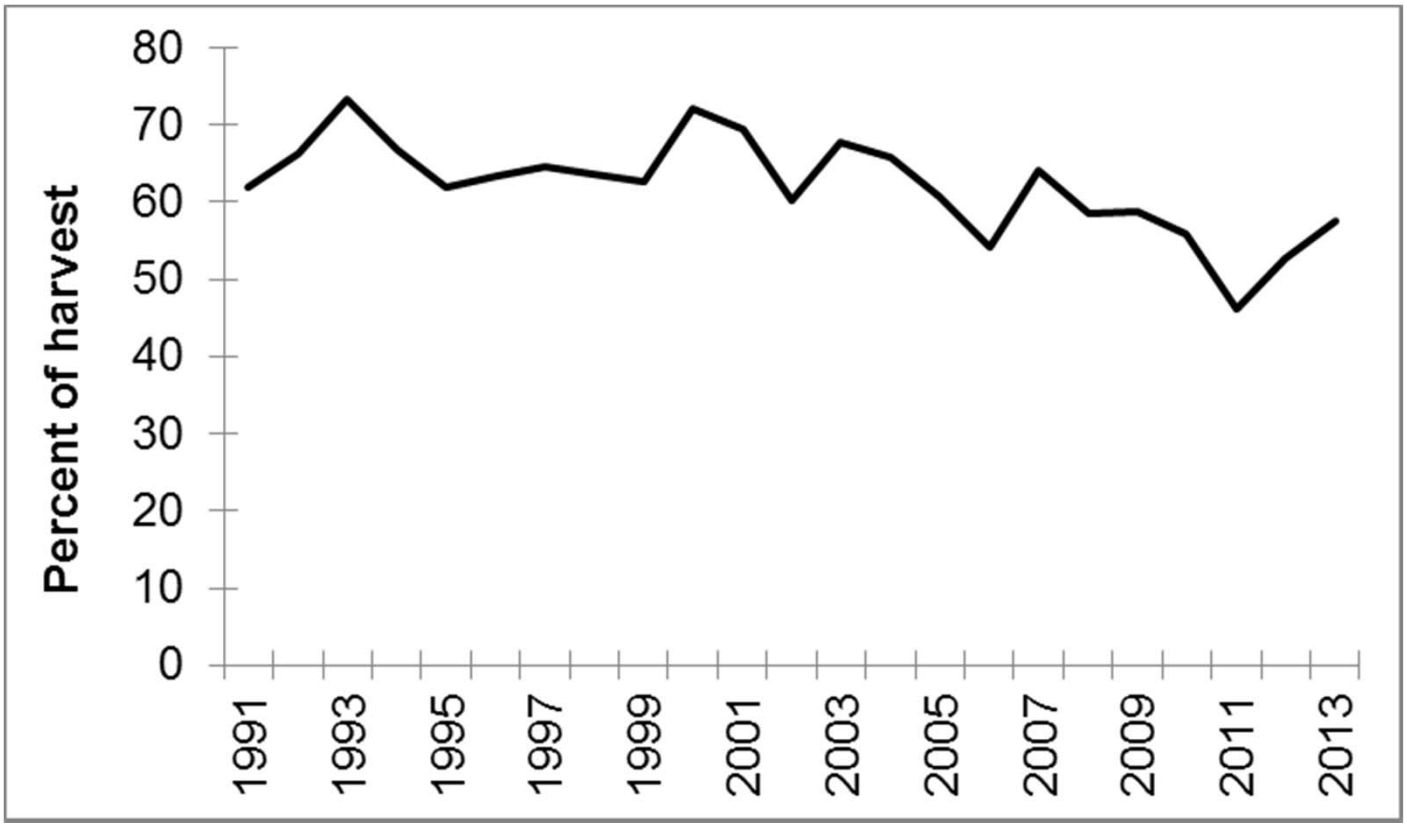
# Recent Management and Assessment History

- Southern Flounder Amendment 1 adopted 2013

- 2014 southern flounder stock assessment not approved for determining stock status
  - Regional stock
  - Peer-reviewers considered most data inputs valid for management

# Stock Concerns:

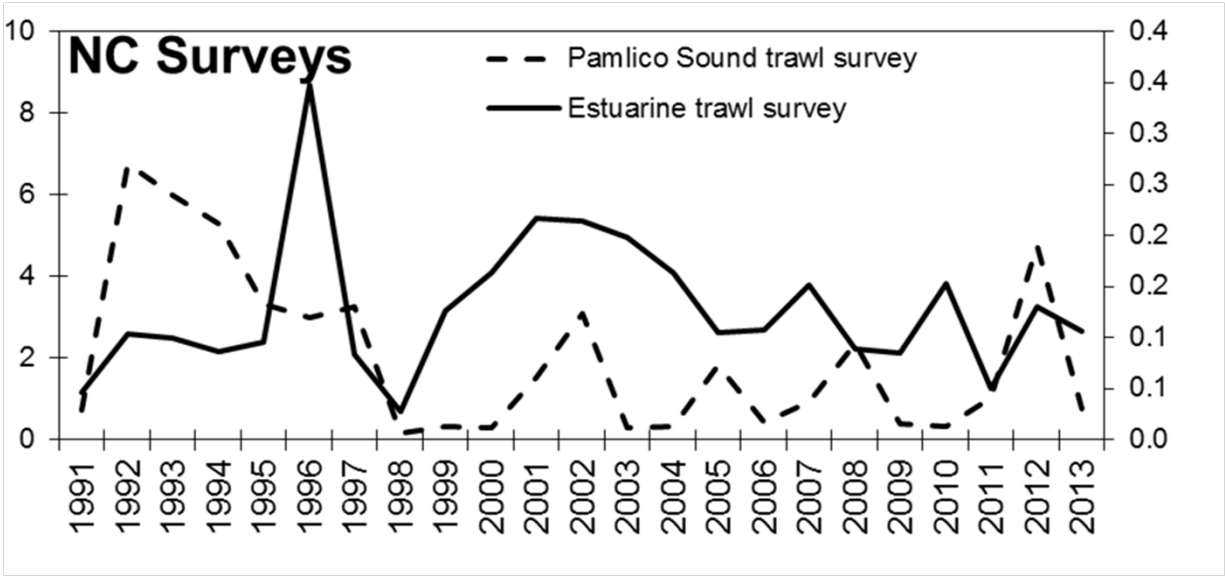
Percentage of immature fish in the harvest



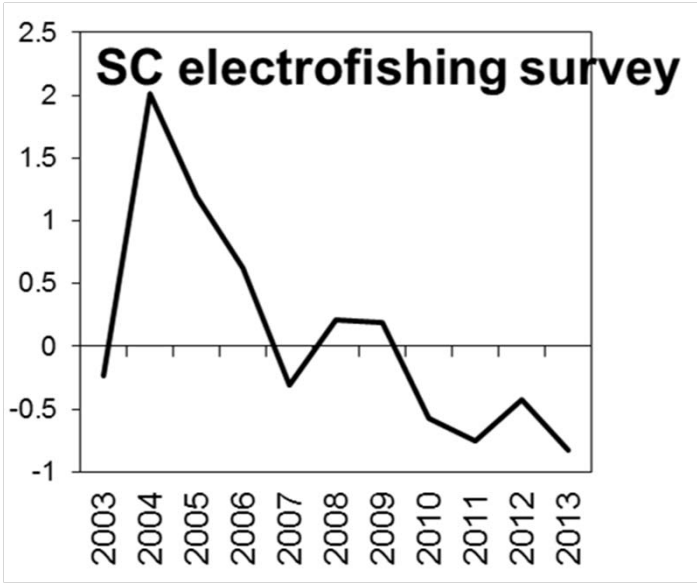

- Range: 46 to 73 percent
- 1991-2004 average: 66 percent
- 2005-2013 average: 57 percent

# Stock Concerns:

## Juvenile abundance

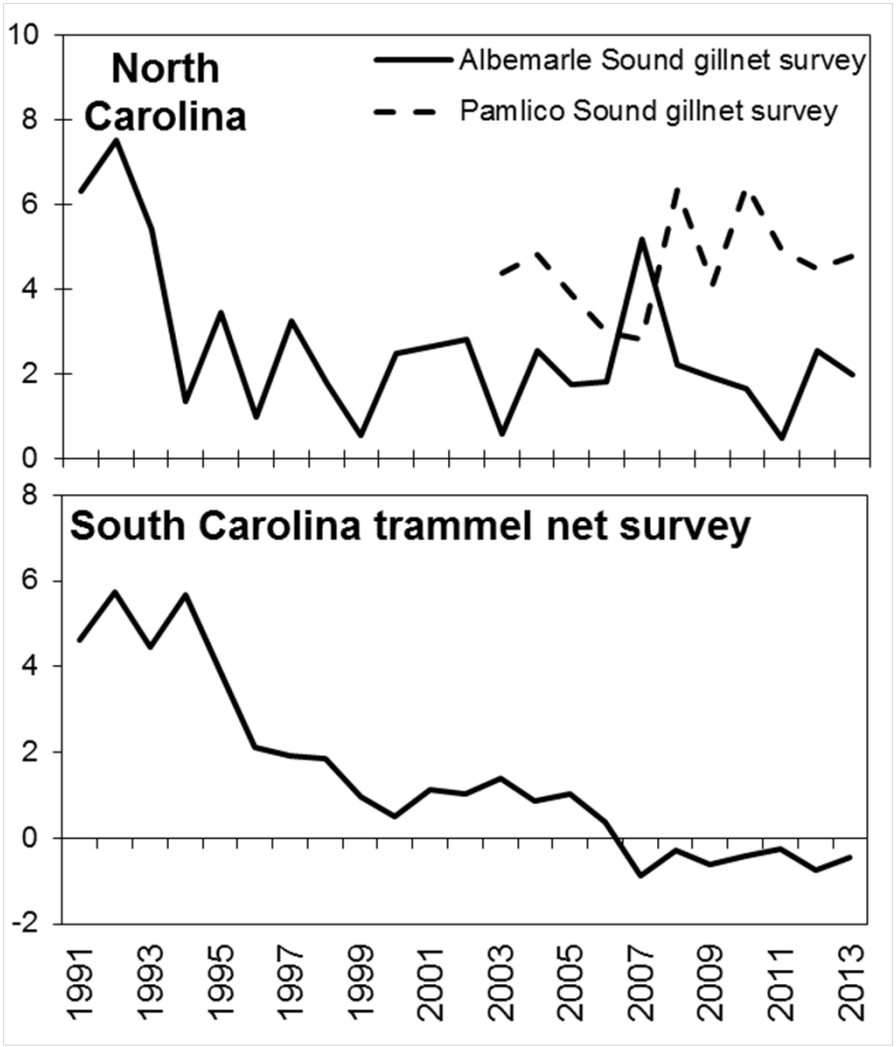



Coast-wide, multi-decadal decline in recruitment

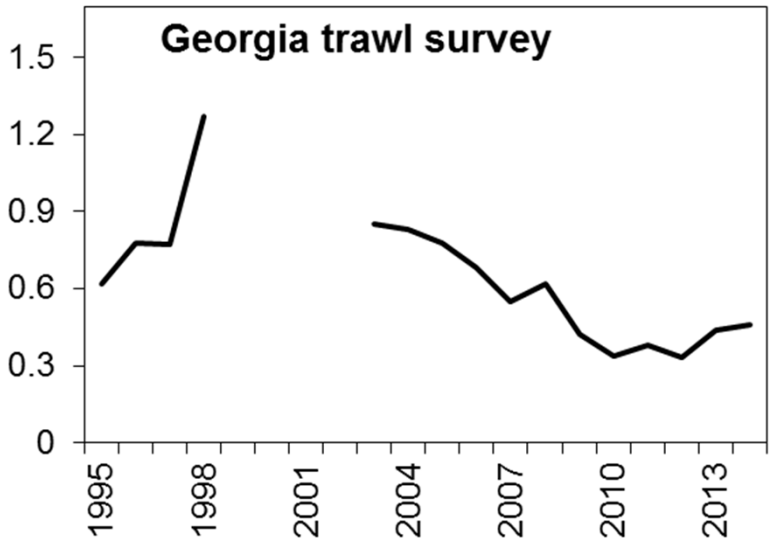


# Stock Concerns:

## General abundance




General coast-wide, multi-decadal decline in abundance



# Fishery Characterization

## 2011-2013 Commercial fishery average

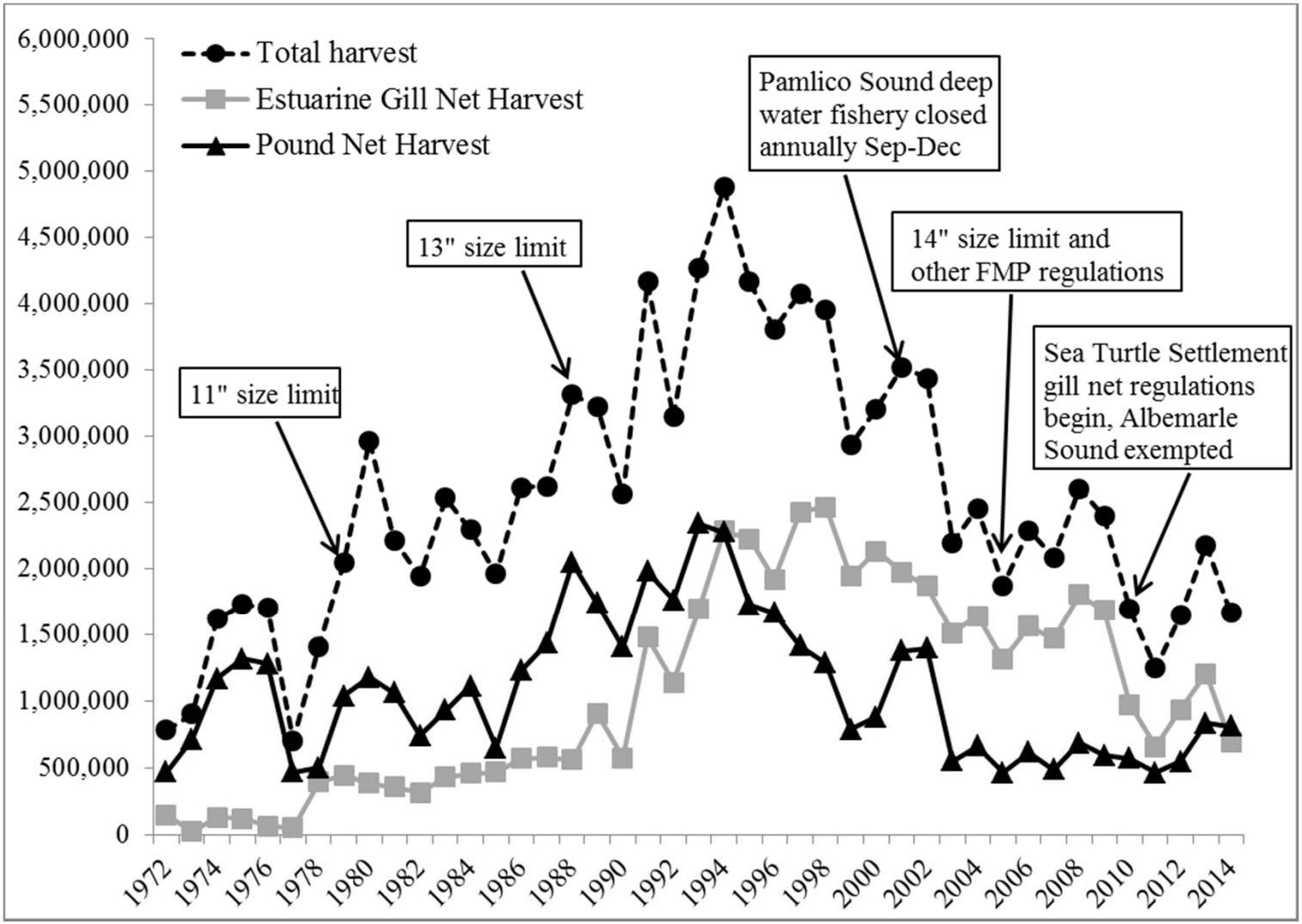
| Gear | Trips | Participants | Dealers | Ex-vessel value | Pounds | % of Comm. harvest | % of Total harvest |
|---|---|---|---|---|---|---|---|
| Gill Net | 14,638 | 854 | 165 | $2,305,055 | 932,792 | 55.2 | 43.4 |
| Pound Net | 1,649 | 75 | 34 | $1,621,415 | 614,899 | 36.4 | 28.6 |
| Gig | 2,503 | 258 | 100 | $322,605 | 127,413 | 7.5 | 5.9 |
| Other | 1,282 | 282 | 98 | $34,377 | 14,541 | 0.9 | 0.7 |
| Total | 20,069 | 1,175 | 237 | $4,283,451 | 1,689,645 | 100.0 | 78.6 |

## 2011-2013 Recreational fishery average

| Gear | Trips | Pounds | % of Recreational harvest | % of Total harvest |
|---|---|---|---|---|
| Gig | 24,477 | 96,748 | 21.1 | 4.5 |
| Hook & Line | 471,208 | 362,429 | 78.9 | 16.9 |
| Total | 495,685 | 459,177 | 100.0 | 21.4 |

# Fishery Characterization:

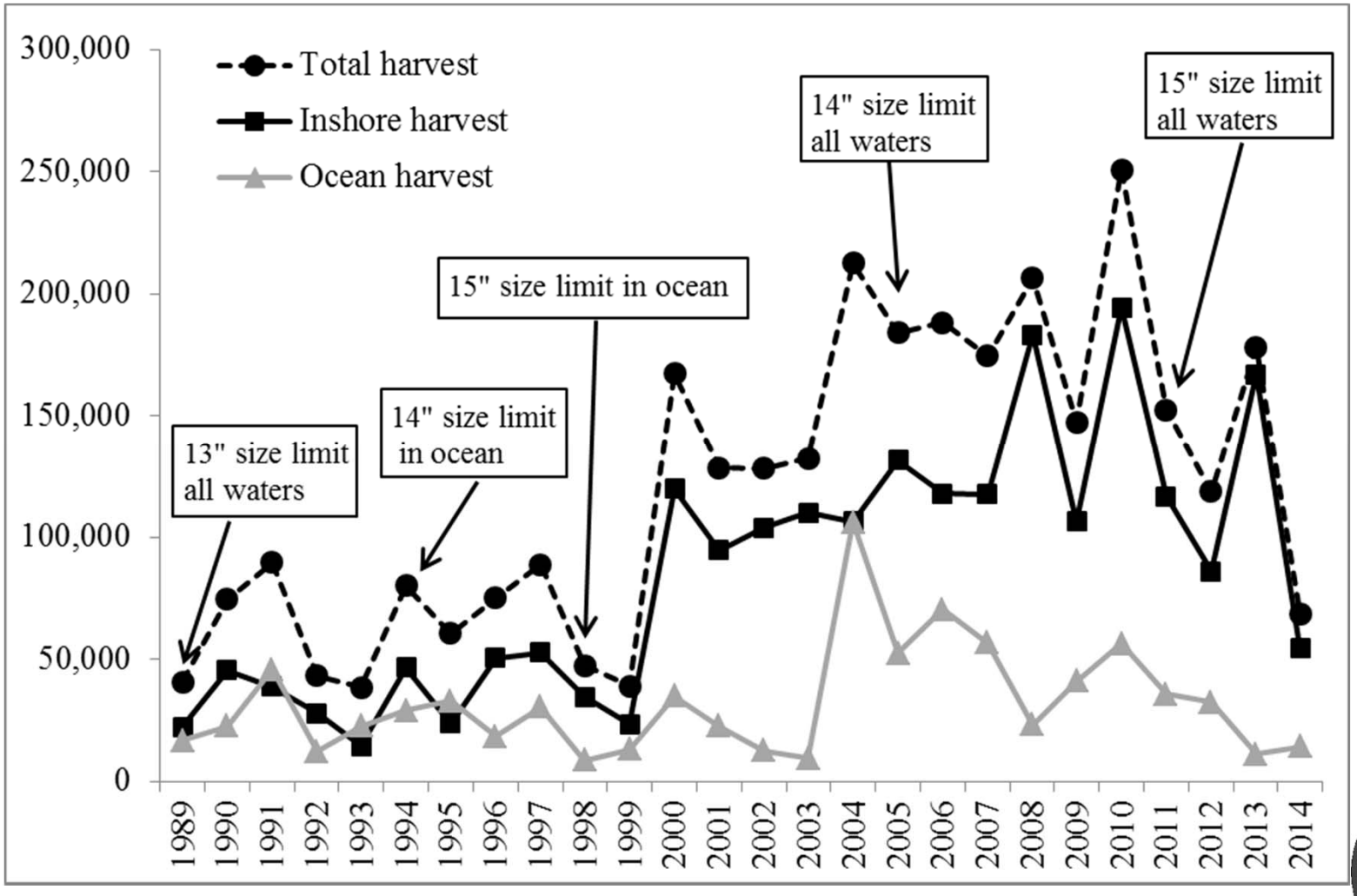
## Commercial fishery trends




Note: 2014 data are preliminary

# Fishery Characterization:

## Recreational fishery trends




Note: 2014 data are preliminary

# Management Measures Not Analyzed for Reductions

- Quota
  - Not feasible to implement in the short-term
- Maximum size limit
  - Reductions would likely be minimal
- Area closures
  - Extensive research needed, recoupment likely

# Catch Reduction Methods

- Catch = harvest + dead discards
- Commercial harvest = N.C. Trip Ticket Program
- Commercial gill net discards = observer data
- Recreational hook and line data = Marine Recreational Information Program
- Recreational gig data = mail-based survey

# Catch Reduction Methods

- Reductions were from the total fishery (commercial plus recreational)
- Numbers of fish averaged for 2011-2014
- 2014 data used but incomplete
- No discard or post-release mortality estimates for some gears
- Calculations are complex and include many assumptions

# 1. Season Closure

- Only considered continuous, end of season closures
- Assumed no flounder harvest allowed by any gear
- Assumed major gears closed, except hook-and-line
- Assumed typical hook-and-line harvest will be discards during closed season
- Season closures of half-month blocks starting Aug. 1

# 1. Season Closure

Estimated fishery catch reductions (percent)

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Closure | Gill net | Pound net | Gig | Other | Total | Hook & line | Gig | Total | Total |
| Oct 16-Dec 31 | 9 | 15 | 1 | < 1 | 26 | 1 | 1 | 2 | **28** |
| Oct 1-Dec 31 | 16 | 22 | 1 | < 1 | 39 | 2 | 2 | 3 | **42** |
| Sept 16-Dec 31 | 23 | 27 | 1 | < 1 | 51 | 2 | 2 | 4 | **55** |
| Sept 1-Dec 31 | 26 | 27 | 2 | < 1 | 55 | 2 | 2 | 4 | **60** |

- Reductions higher for commercial than recreational
- Pound nets greatest portion of reduction among gears
- Only closures with reductions 25 to 60 percent shown

# 2. Increase Minimum Size Limit

- Further reductions are expected from commercial gear modifications to decrease discards
  - These fall between catch and harvest reductions
- Gill net post-release mortality rate used for all gears except hook-and-line
- Size limit starts Jan. 1

# 2. Increase Minimum Size Limit

Estimated total fishery catch reductions (percent)

| | Commercial | | | | | Recreational | | | All |
|---|---|---|---|---|---|---|---|---|---|
| Size limit | Gill net | Pound net | Gig | Other | Total | Hook & line | Gig | Total | Total |
| 15-inch | 9 | 4 | 1 | < 1 | 14 | 0 | 0 | 0 | 14 |
| 16-inch | 14 | 9 | 2 | < 1 | 25 | 2 | < 1 | 3 | **28** |

Reductions higher for commercial than recreational

# 3. Decrease Recreational Bag Limit

Estimated total fishery catch reductions (percent)

| Bag limit | Hook & line | Gig | Total |
|---|---|---|---|
| 1-fish | 3 | 2 | 5 |
| 2-fish | 1 | 1 | 2 |
| 3-fish | 1 | < 1 | 1 |
| 4-fish | < 1 | < 1 | < 1 |
| 5-fish | < 1 | < 1 | < 1 |

Does not achieve requested fishery reductions

# 4. Season Closure and Increase Minimum Size Limit

Estimated total fishery catch reductions (percent)

| Closure | 15-inch limit | 16-inch limit |
|---|---|---|
| Dec 16-Dec 31 | 14 | **28** |
| Dec 1-Dec 31 | 14 | **28** |
| Nov 16-Dec 31 | 18 | **31** |
| Nov 1-Dec 31 | **25** | **37** |
| Oct 16-Dec 31 | **38** | **48** |
| Oct 1-Dec 31 | **50** | **58** |

Only season closures with reductions
25 to 60 percent shown

# 5. Season Closure, Increase Size Limit, and Decrease Bag Limit

Estimated total fishery catch reductions (percent)

| | 15-inch limit | | 16-inch limit | |
|---|---|---|---|---|
| Closure | 1-fish bag | 2-fish bag | 1-fish bag | 2-fish bag |
| Dec 16-Dec 31 | 19 | 16 | **32** | **30** |
| Dec 1-Dec 31 | 19 | 16 | **32** | **29** |
| Nov 16-Dec 31 | 22 | 19 | **34** | **32** |
| Nov 1-Dec 31 | **29** | **27** | **41** | **39** |
| Oct 16-Dec 31 | **41** | **39** | **50** | **49** |
| Oct 1-Dec 31 | **52** | **51** | **60** | **59** |

Only season closures with reductions 25 to 60 percent shown

# 1. Season Closure

## Major positive and negative impacts

+ Estimated to achieve requested reductions
+ May increase spawning stock biomass
+ May increase escapement
+ May increase fishery harvest long-term
- Decreases fishery harvest in short-term
- Inequity in reductions by gear and area
- Effort may increase during open seasons
- Recoupment occurs if harvest allowed for any gear
- Potential discard mortality unless all fishing stops
- Continues harvest of primarily immature fish

# 2. Increase Minimum Size Limit

## Major positive and negative impacts

+ 16-inch size limit estimated to achieve reduction
+ May increase spawning stock biomass
+ Decreases proportion of immature fish in harvest
+ May increase escapement
+ May increase fishery harvest in the long-term
+ Current fishing season unchanged
- Increased discards of all flounder species
- Decreases fishery harvest in short-term
- Inequity in reductions by gear and area
- Recoupment may occur due to fish growth

# 3. Decrease Recreational Bag Limit

Major positive and negative impacts

+ May increase the spawning stock biomass
+ May increase fishery harvest in the long-term
- Does not achieve reduction in requested range
- Increased discards of all flounder species
- Decreased fishery harvest in short-term

# 4. and 5. Measure Combinations

## Major positive and negative impacts

+/- Same impacts as each measure alone

+ Reduces length of the season closure needed to achieve desired reduction level

+ Will distribute the reductions more equally between sectors (method 5)

# Conclusions

- Certain reduction methods may benefit stock more
- Catch reduction calculations are complex and include many assumptions
- Likely not possible to determine if estimated catch reductions are achieved
- Fishery trends in South Atlantic impact the stock and chances for achieving reductions

# Summary of Reduction Methods

1. Seasonal closure

2. Increase minimum size limit

3. Decrease recreational bag limit

4. Seasonal closure and increase size limit

5. Seasonal closure, increase size limit, and decrease recreational bag limit

# Next Steps

- Commission develops specific option(s) at this meeting for public comment
- Guidelines provide the division observes a 30-day public comment period; if the commission wants to do more they need to provide guidance
- Commission reviews public input and selects preferred options at August meeting

# Questions?

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

**MEMORANDUM**

TO: Marine Fisheries Commission

THROUGH: Division of Marine Fisheries, Management Review Team

FROM: Louis Daniel

DATE: July 20, 2015

SUBJECT: PDT comments and estimated reductions for MFC proposals for Southern Flounder Supplement A to Amendment 1

The Southern Flounder FMP PDT met on June 5th primarily to discuss the proposals put forward by the MFC at the May 2015 business meeting in New Bern in regard to Southern Flounder FMP Supplement A to Amendment 1. The PDT found that clarification was needed for each proposal to be sure the intention was well understood. The PDTs comments are summarized below and the relevant proposals are listed for each.

1. Clarify whether pound net regulations (permit restrictions, escape panel mesh size) are for all pound nets (bait, shrimp, crab) or flounder pound nets only. Currently only flounder pound nets are required to have escape panels. (Proposals 1, 2, 3, 5, 6)

2. Clarify whether regulations apply to all flounder species, not just southern flounder. Note that most fishermen cannot readily distinguish the different flounder species. (Proposals 1-6)

3. Clarify whether regulations apply to all coastal and joint fishing waters or only internal coastal waters. Currently, different regulations are used for the commercial flounder fishery in the ocean vs. internal waters. In the recreational fishery, regulations currently apply to flounder equally in internal and ocean waters. (Proposals 1-6)

4. For pound nets we do not have discard estimates so we would not be able to monitor a TAC (total allowable catch). Also we need to be sure that a TAL (total allowable landings) will suffice for Proposal 1.

5. In reporting for TAC/TAL in Proposal 1, clarify if the requirement is for the fishermen or dealers to report. Currently, responsibility for permits is with fishermen and it would require a rule change to have dealers responsible for reporting. For other species monitored with daily quotas, dealers are responsible for the reporting. Limiting quota monitoring to electronic dealers could be a short-term approach to simplifying the process.

6. Gigging is highly dependent on the weather and tide, so the impact of limiting days will be unclear (Proposals 1 and 2).

7. Trip limits assigned for gigging may not accomplish what is intended. A trip ends when the vessel gets to shore so a fisherman could take multiple trips per day or night. Alternative wording (used in proclamation for flounder proclamation FF-29-2011): [number of fish] per person per day or per trip if trip occurs over more than one calendar day. (Proposals 1 and 2)

8. If multiple gears (including gigs and other gears such as nets) are used on a boat, clarify how trip limits would apply. (Proposals 1 and 2)

9. Retired Standard Commercial Fishing License (RSCFL) should be included when mentioning Standard Commercial Fishing License (SCFL) in Proposal 1.

10. In Proposal 1, Commercial Gig Option 2, clarify if the intention is to require one SCFL/RSCFL per limit (at least two) with a maximum of two limits per operation.

11. For regulations on large mesh gill nets clarify which mesh sizes are referred to and which mesh sizes would be prohibited (e.g., mesh sizes between 4 and 5 inches). The current rule prohibits mesh sizes between 5 and 5 ½ inches from Apr. 15- Dec. 15. Need to clarify if the mesh size prohibitions would apply to all gill nets and only for Apr. 15 – Dec. 15. (Proposals 1, 2, 3, 5, 6)

12. In Proposal 1 and 2, large mesh gill nets could be used for harvesting other species besides flounder (e.g., sharks, black drum, sheepshead, American shad, striped bass) when harvest is closed for flounder. This may result in large mesh being used along with small mesh and it would not be possible for enforcement to tell which gear caught flounder once they are removed from the nets.

13. Some proposals do not specify whether regulations on large mesh gill nets are limited to anchored gill nets or apply to all types of sets. Additionally, in Proposal 1 regulations are limited to anchored gill nets so fishermen may use large mesh run-around nets or other types of gill net sets to harvest flounder unless otherwise specified (Proposals 1, 2, 3, 5, 6).

14. In Proposal 2 we will need further clarification on the dividing line for separating northern and southern areas for the gill net closure.

15. In Proposal 2, it is unclear what the appropriate reductions are and what would trigger regulations for the recreational fishery.

16. In Proposal 2 clarify several items for the pound net moratorium, including: if it would be just for new sets, if it would limit the number of pounds in a set, if the criteria would be that a permit must have been in place for the last five years and if so which years these would represent (e.g., 2009-2014), how a transfer process would work if a permit holder dies or becomes disabled, and how disabled is defined.

17. In Proposal 4 it is not clear that it would be status quo for the commercial inshore flounder fishery. This proposal would result in a catch increase and therefore appears to not be within the

bounds set for Supplement A by the DENR Secretary (i.e. reduction in catch up to 60%). Also the proposed 60-day comment period was not chosen at the May MFC meeting.

18. Consider using 'minimum' size limit to distinguish from maximum size limit. (Proposals 1-5)

19. In Proposal 5 clarify that the minimum size and bag limits apply to the recreational 'flounder' fishery.

20. For Proposal 1, anchored gill nets do not currently have a definition in rule or statute.

21. For season closures, clarify which gears are intended to be closed and whether gear must be removed from water (i.e., no fishing for other species). If gears that catch southern flounder are left in water, southern flounder discards would be expected. (Proposals 2, 3, 5, 6)

The Southern Flounder PDT also estimated reductions for each of the MFC proposals for Southern Flounder FMP Supplement A to Amendment 1. The proposals are presented below along with catch reduction estimates and explanation in bold. All estimated reductions are from total fishery (recreational plus commercial) average for 2011-2014. Estimates for some proposals were more certain than others, please see notes. All estimates assume no recoupment and no change in effort from 2011-14 average.

***Proposal 1*** **(Estimated maximum reduction is 48-50% for 2016. Range includes potential reduction from increasing minimum mesh size on pound net escape panels. Reductions from each component of the proposal were summed due to complexity, representing maximum estimated reduction. Reduction for 2015 would be smaller as there would be no impact to gill nets.**)

Pound Net Set Permits (**Total pound net catch reductions 5-7%**):

- 15-inch minimum size for southern flounder (**4% reduction**)
- Escape panels shall be a minimum mesh size of (**~0-2% defined as the range between the catch and harvest reductions at 15 inch minimum size limit**)
    - Option 1: 5 ¾ inch
    - Option 2: 6 inch

  (all other escape panel requirements remain)
- Immediately initiate a Total Allowable Catch that represents a 25 percent reduction of the 2013 landings (highest landings on record since 2005). The 2013 landings represent a 79 percent jump in landings from the 2005 Fishery Management Plan landings level of concern. (**1% reduction from total fishery catch**)
- Total Allowable Catch = 625,626 pounds (higher than all but one year between 2005-2012)
- Active pound net set permits may be renewed, but no new permit applications will be processed after June 1, 2015, until the completion of the next amendment. (**assume no change from current harvest**)
- No pound net set permit transfers will occur until the completion of the next amendment, except upon death of the permittee pursuant to 15NCAC O3J .0504. (**assume no change from current harvest**)

- Daily reporting as a condition of the permit for flounder pound nets (**assume no change from current harvest**).

Commercial Gig (**Total gig catch reductions ~5%)**:

- Commercial gigging will only be allowed four days per week, beginning Monday at sunrise and ending on Friday at sunrise. (**~3% assumes all days have equal effort and harvest**)
- 15-inch size limit (**1%**)
- Trip limit of 36 flounder per valid Standard Commercial Fishing License with maximum of one limit per operation, regardless of the number of valid Standard Commercial Fishing Licenses present. (**~1% based on average weights applied to trip ticket data for trips with harvest above trip limit estimated in pounds**)
    - Option 1: A maximum of one limit per operation regardless of the number of valid Standard Commercial Fishing Licenses present.
    - Option 2: A maximum of two limits per operation regardless of the number of valid Standard Commercial Fishing Licenses present.

Anchored Large Mesh Gill Nets (commercial and recreational) (**Total large mesh gill net catch reductions ~38%**):

- 2015 season will remain status quo.
- Effective Jan. 1, 2016, anchored large mesh gill nets will be a prohibited gear in the taking and possession of flounder in internal waters. (**42% of overall catch in numbers of fish is from gill nets and harvest from gill nets other than anchored large mesh are ~4% of overall harvest based on trip ticket data = ~38% reduction for large mesh assuming no discards or harvest by any type of large mesh set, regardless of target species**)

Commercial harvest by other gear (**Total catch reduction for other gears is <1%**):

- 15-inch size limit **(< 1%**)

***Proposal 2*** **(Estimated maximum reduction is 23-38%. Range includes potential reductions from increasing minimum mesh size on pound net escape panels. Reductions from each component of the proposal were added due to complexity, representing maximum estimated reduction. Does not include any reduction for the recreational fishery**)

- All commercial fishing will observe a 15-inch size limit. (**4% from pound nets; see 4th bullet for gig reduction; 9% reduction for gill nets but when combined with two season closures the range is approximately: 17% to 30%**)
- N.C. large mesh gill nets in the southern flounder fishery will close Sept. 16 north of Cape Hatteras and will not open until Jan. 16. South of Cape Hatteras the closure would be Oct. 16 to Jan. 1. (**Cannot split as described for reductions. There would be a 23% reduction for all areas, all gill nets for a Sept 16-Jan 16 closure and a 9% with a Oct 16-Jan 1 closure. When combined with minimum size limit increase the reduction range is approximately: 17% to 30%**)
- Pound nets will be subject to the 15-inch size limit and to a 5¾-inch or 6-inch escape panel. (**~0-2% defined as the range between the catch and harvest reductions at 15 inch minimum size limit**)
- Commercial giggers will be subject to a 15-inch size limit and a 35-fish trip limit per boat. (**~2% from trip limit and size limit combination**)

- Recreational hook-and-line and giggers will have no reductions unless a closure from Nov. 1 to Dec. 31 is considered necessary to meet appropriate reductions. (1**% - not included in total reduction for Proposal 2**)
- There will be a moratorium on pound net sets and permits based on the past five years of activity, until the next amendment is adopted, unless death or disability of the owner is an issue. (**assume no change from current harvest**)

***Proposal 3*** (**Estimate reduction is 18-25%. Range includes potential reductions from increasing minimum mesh size on large mesh gill nets and pound net escape panels**)

- Retain the 15-inch size limit and 6-fish bag limit for recreational.
- Increase the size limit to 15 inches for commercial, with a 6-inch stretched mesh for large mesh gill nets, and escape panels in pound nets.
- Close all southern flounder fisheries from Nov. 16 –Dec. 31.

***Proposal 4*** (**~1% catch increase. Based on MRIP harvest data from 2003-2007. Assumes fishery has not changed since that time; assumes a small decrease in dead discards. Recreational gig data were not available for 2003-2007.**)

- Maintain status quo for commercial.
- Decrease recreational size limit to 14 inches.
- Observe 60-day comment period, with stakeholder input.

***Proposal 5*** (**Estimate reduction is 15-23% Range includes potential reductions from increasing minimum mesh size on large mesh gill nets and pound net escape panels**)

- Retain 15-inch size limit and 6-fish bag limit for recreational.
- Increase the size limit to 15 inches for commercial with a 5¾-inch stretched mesh for large mesh gill nets and escape panels in pound nets. (**14-22% - 5 ¾ inch mesh size will make reduction closer to 14% than if 6 inch was used**)
- Close commercial and recreational fisheries from Dec. 1 – 31. (**1% - doesn't overlap with commercial reduction due to size limit so is additive**)

***Proposal 6*** (**small reduction, not quantifiable**)

- Minimum mesh size limit of 5¾ inch stretch mesh for large mesh gill nets and escape panels in pound nets (**not quantifiable based on current data**).
- Dec. 1 – 31 closure for all gear types, both commercial and recreational (**1%**).

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

**MEMORANDUM**

TO: Marine Fisheries Commission

THROUGH: North Carolina Division of Marine Fisheries, Management Review Team

FROM: Louis Daniel

DATE: July 24, 2015

SUBJECT: PDT comments on potential initiation of a review of the Southern Flounder FMP

The Southern Flounder Plan Development Team (PDT) met July 16th, 2015. The main topic of discussion for the meeting was the potential for reviewing the Southern Flounder Fishery Management Plan (FMP) prior to the next scheduled review in 2018. This review could result in the initiation of a new amendment to the FMP. The PDT's recommendation is to wait for the initiation of a review of the FMP until after a quantitative method is approved for use in determining stock status of southern flounder in the South Atlantic. This is the best way to determine what, if any, changes to the fishery should be required to achieve sustainable harvest. This recommendation was made under the assumption that Supplement A to Amendment 1 will be adopted at the MFC's August 2015 business meeting and that legislative changes will not restrict the use of the supplement.

There is no method for determining stock status of southern flounder in the South Atlantic in the short-term (i.e., by the end of 2015). In the long-term, there are several stock assessment options the PDT feels may be viable for use in management of southern flounder. While these methods are being pursued by the NCDMF, they will take time to develop and the earliest any results could be ready is summer 2016. However, some of the most robust long-term options may not be available until spring 2017 or later. The PDT noted that although options for long-term analytical methods are promising, there is no guarantee that external peer reviewers or the NCDMF will find them adequate for determining stock status or aiding in management of southern flounder.

The only short-term quantitative method the PDT has discussed for use in management is a traffic light analysis. This method provides an analysis of trends in the available data but does not provide information on stock status, requires subjective decisions about when to be concerned, and is limited in the guidance it can provide about appropriate management measures for sustainable harvest. Due to these concerns, the PDT prefers not to rely on results from a traffic light analysis for management of southern flounder in a new amendment unless more robust assessment methods are not available. Although the PDT has begun working on a traffic light analysis for southern flounder, this will require further development if it is intended to be used for managing southern flounder.

Despite limitations, the traffic light method can be useful for management of some species, especially if alternative assessment methods are not available. The ASMFC uses the traffic light method to monitor trends in Atlantic croaker and spot and the NCDMF uses the method for blue crab. Management action is triggered if sustained negative trends occur between benchmark reviews.

A potential advantage to initiating a review of the FMP would be updating the data (e.g. harvest data, discards, indices) which in most cases only extend through 2007 in Amendment 1. However, Supplement A to Amendment 1 includes much of this information through 2014 and only a limited amount of new data would be available for the MFC to consider if a new amendment was initiated in 2015. Another potential benefit of an FMP review is the incorporation of further input from stakeholders through an Advisory Committee (AC). However, without further quantitative analysis on a regional scale that might provide stock status, the PDT did not feel the AC would be able to make informed decisions about how the stock should be managed.

In recommending a review of the FMP be delayed until a new stock assessment method can be developed, the PDT acknowledges any preferred management strategy decided at the August 2015 MFC business meeting will remain in place until a new amendment (or supplement) is developed.

# NORTH CAROLINA GENERAL ASSEMBLY

LEGISLATIVE BUILDING
RALEIGH 27601

August 20, 2015

VIA HAND DELIVERY

Secretary Donald van der Vaart
Department of Environment and Natural Resources
217 W. Jones Street
Raleigh, NC 27601

Dear Mr. Secretary:

We write as a group of legislators to express our concern about reports of pending actions this week by the North Carolina Marine Fisheries Commission ("MFC"). Together, we call on you to rescind immediately the MFC's existing authority to supplement the Southern Flounder Fishery Management Plan ("FMP"). This is the prudent course to better balance the interests of our fishing stocks and our fishing fleets and to adhere to the letter and spirit of The Fisheries Reform Act of 1997.

It appears that the lack of a regional stock assessment has led to an incomplete, and potentially incorrect, understanding of North Carolina's flounder stock. Add to this a misunderstanding of the fishery management processes established by law, and we find ourselves facing a potential MFC vote on stock-reduction policies that could have grave economic consequences to commercial fishermen statewide.

While it is laudable to proactively manage the Southern Flounder stock, we understand that the MFC's February 2015 decision to move forward with a supplement was made against the recommendation of the Division of Marine Fisheries' staff. Nonetheless, in March 2015, pursuant to G.S. §113-182(e1), you authorized the MFC to adopt temporary management measures applicable to the fishery.

The authority you granted to the MFC extends only so far as is necessary to *supplement* the existing FMP until the full plan can be revisited after the ample public input required by other parts of G.S. §113-182.1. Relying on the limited statutory authority you granted, the MFC appears to be moving forward with a rewrite of the FMP that would ban or severely limit certain overboard gear (including gill and pound nets).

Neither the underlying statute nor your March 2015 grant of authority could have intended to permit the MFC to prohibit particular commercial fishing gear when the existing FMP imposes no such prohibition. Such a significant policy choice must be made by the General Assembly or the MFC using the fair and open process specified by G.S. §113-182.1.

We stand with you in addressing this complicated issue but call on you to rescind immediately the authority granted to the MFC. We believe this step will allow all stakeholders, including the MFC itself, to return to the table and ensure the long-term prosperity of both our fishing stocks and our fishing fleets.

Thank you for your attention to this matter and your service to the State of North Carolina.

Sincerely,

Sen. Bill Cook

Sen. Brent Jackson

Sen. Bill Rabon

Sen. Norm Sanderson

Sen. Jerry Tillman

Rep. George Cleveland

Rep. Frank Iler

Rep. Pat McElraft

Rep. Chris Millis

Rep. Phil Shepard

Rep. Michael Speciale

Rep. Bob Steinburg

Rep. Paul Tine

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

August 20, 2015

Chairman Corbett, Commissioners, and Staff:

I bring to your attention a letter that was hand delivered to my office earlier today. As you can see, there is ample concern within both houses of North Carolina's General Assembly regarding the processes being utilized with various options under consideration for the Southern Flounder Supplement.

After reviewing the legislative letter received earlier today, and in response to careful monitoring of the supplement process, I must share my concerns as well. In the letter, the signatories referenced the existing Fishery Management Plan (FMP) and the effect some of these options would have in changing the fundamental nature of the Southern Flounder FMP. They further noted that such significant alterations, if believed to be in the best interest of fishery, should be adopted through the process proscribed in G.S. §113-182.1, or the amendment process. I agree with this interpretation of the law.

Further and in addition to aforementioned letter, we must afford the newly appointed Marine Fishery Commissioners ample time to become fully educated on this complicated and important issue. All agree that the Southern Flounder is one of the most economically important estuarine species to our State for both the commercial and recreational fisheries. Before a vote of this magnitude is cast, those charged with regulating the fishery need the necessary time to achieve an informed vote.

Please be aware of these concerns and know that we support any measure to protect the fisheries of North Carolina. We are equally devoted, however, to protecting all those who rely on and enjoy our fisheries. We hope that with your leadership, and any future action taken by you, the Marine Fishery Commission, the appropriate balance will be struck between the management of our resources and the rights of the public.

Best Regards,

Donald R. van der Vaart

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