North Carolina
Southern Flounder (*Paralichthys lethostigma*)
Fishery Management Plan

Supplement A to Amendment 1

North Carolina Division of Marine Fisheries

North Carolina Department of Environmental Quality
North Carolina Division of Marine Fisheries
3441 Arendell Street
P. O. Box 769
Morehead City, NC 28557

August 2017

Feb. 19, 2015	MFC requested supplement
March 2, 2015	DENR Secretary approved development of supplement
May 21, 2015	DMF presented draft supplement to MFC; MFC approved six alternate proposals for public comment
June 10-July 10, 2015	Public comment period
June 17, 2015	Public meeting held in New Bern, NC
Aug. 21, 2015	Draft supplement removed from August MFC business meeting agenda
Nov. 19, 2015	Public comments provided to MFC; MFC approved final management measures and adopted supplement
Sept. 23, 2016	Complaint for Declaratory and Injunctive Relief filed
Sept. 30, 2016	Amended Verified Complaint for Declaratory and Injunctive Relief filed
Oct. 10, 2016	Preliminary Injunction filed
Aug. 17, 2017	Mediated Settlement Agreement finalized

1.0 CHRONOLOGY

The Division of Marine Fisheries (DMF) conducted a stock assessment for southern flounder in 2014. Based on external peer reviews of the assessment, the DMF determined the assessment could not be used for management. This was primarily due to incomplete data about the southern flounder stock that could only be addressed through a coastwide stock assessment. Limiting the unit stock to North Carolina was inappropriate, given current tagging and genetic data. The DMF explored how best to use the available data to determine if management measures were needed.

The results of the stock assessment were presented to the Marine Fisheries Commission (MFC) Feb. 19, 2015. The MFC passed a motion to pursue a supplement to reduce catch of southern flounder 25-60 percent. Approval was received March 2, 2015 from the Department of Environment and Natural Resources (DENR) secretary for development of a supplement to the NC Southern Flounder FMP Amendment 1. The DMF drafted the supplement and presented it to the MFC at its May 21, 2015 business meeting for approval for public comment.

At the MFC meeting, the DMF director relayed clarifying information from the DENR secretary that the supplement was for the purpose of reducing catch of southern flounder up to 60 percent. The MFC passed a motion to modify the supplement to add six alternate management proposals offered at the meeting by members of the MFC and approved the modified supplement for a 30-day public comment period. The comment period was from June 10-July 10, 2015, within which the MFC held a single public comment meeting in New Bern June 17.

The DMF compiled all comments received during the public comment period for presentation to the MFC for its consideration for final approval of the supplement at the MFC's August 2015 business meeting. Due to several factors, the MFC chair removed this item from the meeting agenda. The MFC took final action on the southern flounder supplement at its Nov. 19, 2015 business meeting. The MFC adopted a suite of management changes with varied effective dates ranging from Jan. 1 through Oct. 16, 2016.

Beginning in early 2016, the DMF and state fisheries biologists from South Carolina, Georgia, and Florida, along with university scientists worked on development of a coastwide stock assessment for southern flounder. The stock assessment is scheduled for completion in early 2018, after which the next review of the fishery management plan will commence.

On Oct. 10, 2016, a judge issued a temporary injunction against certain regulations adopted by the MFC as part of the southern flounder supplement. The temporary injunction remained in effect until a settlement agreement was reached Aug. 17, 2017. Per the settlement agreement, only certain provisions of the supplement remain in place and no new temporary management measures can be implemented until the adoption of the next amendment to the fishery management plan. An amendment to the plan can result from the next review of the Southern Flounder Fishery Management Plan.

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3.0 MEDIATED SETTLEMENT AGREEMENT

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NORTH CAROLINA
CARTERET COUNTY

IN THE GENERAL COURT OF JUSTICE
SUPERIOR COURT DIVISION
FILE NO.: 16-CVS-945

CARTERET COUNTY FISHERMAN'S ASSOCIATION, INC.; NORTH CAROLINA FISHERIES ASSOCIATION, INC.; COUNTY OF CARTERET; COUNTY OF DARE; COUNTY OF HYDE,

Plaintiffs

vs.

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY; DONALD R. VAN DER VAART, Secretary[1], N.C. Dept. of Environmental Quality; NORTH CAROLINA DIVISION OF MARINE FISHERIES; NORTH CAROLINA MARINE FISHERIES COMMISSION; BRAXTON DAVIS, Director, Division of Marine Fisheries; SAMMY CORBETT, Chairman, North Carolina Marine Fisheries Commission; MARK GORGES, North Carolina Marine Fisheries Commission; CHUCK LAUGHRIDGE, North Carolina Marine Fisheries Commission; JANET ROSE, North Carolina Marine Fisheries Commission; JOE SHUTE, North Carolina Marine Fisheries Commission; RICK SMITH, North Carolina Marine Fisheries Commission; MIKE WICKER, North Carolina Marine Fisheries Commission; ALISON WILLIS, North Carolina Marine Fisheries Commission.[2]

Defendants.

MEDIATED SETTLEMENT AGREEMENT

[1] Since the filing of this action, Mr. Michael S. Regan was appointed Secretary of the Department of Environmental Quality. Pursuant to Rule 25(f)(1) of the North Carolina Rules of Civil Procedure, Secretary Regan, in his official capacity, is deemed to have been automatically substituted for Secretary van der Vaart.

[2] Each of the individual Defendants are named in their official capacities.

This matter was mediated before the Honorable James D. Llewellyn, Certified Mediator, on the 11th day of May, 2017. Appearing for Plaintiff North Carolina Fisheries Association (NCFA) was Glenn Skinner. Appearing for Plaintiff Carteret County Fisherman's Association (CCFA) was Bradley Styron. Also appearing for Plaintiffs NCFA and CCFA were Hardy Plyler and John Hudnell, commercial fishermen. Representing the Plaintiffs were Stevenson L. Weeks of Wheatly, Wheatly, Weeks, Lupton & Massie, P.A. and Todd Roessler of Kilpatrick, Townsend & Stockton, LLP. Mr. Weeks also appeared for and represented the Counties of Carteret, Dare and Hyde.

Appearing on behalf of Defendant North Carolina Marine Fisheries Commission (Commission or MFC), as well as the members of the Commission named in their official capacities, were Sammy Corbett, Chairman of the North Carolina Marine Fisheries Commission, MFC Vice-Chairman, Joe Shute and MFC Commission member Mike Wicker. Appearing for the North Carolina Department of Environmental Quality (Department or DEQ), the Secretary of the Department in his official capacity, the Division of Marine Fisheries (DMF) and the Fisheries Director, in his official capacity, were Braxton Davis, Fisheries Director, Kathy Rawls, DMF Fisheries Management Section Chief, and Col. Dean Nelson, head of the North Carolina Marine Patrol. Representing the Defendants were Assistant Attorney General Phillip T. Reynolds, and Assistant Attorney General Scott Conklin.

SUMMARY OF ACTION GIVING RISE TO MEDIATION

This matter arose out of the Commission's adoption of certain temporary management measures supplementing Amendment 1 to the Southern Flounder Fishery Management Plan (FMP), pursuant to N.C. Gen. Stat. § 113-182.1(e1), at its November 18-20, 2015 meeting

(hereinafter, "temporary management measures"). Specifically, the Commission acted to approve the following motion with respect to the temporary management measures:

- All commercial fishing and recreational fishing will observe a 15-inch minimum size limit beginning Jan. 1, 2016
- Minimum mesh size for anchored large-mesh gill nets is 6 inches effective Jan. 1, 2016.
- Anchored large mesh gill nets and trammel nets in the southern flounder fishery will close Oct. 16 – Dec. 31 statewide. Gear removed from water.
- Flounder pound nets will be subject to a 5 ¾-inch escape panel and will operate under a Total Allowable Landings (TAL) of 38 percent reductions based on 2011-2015 pound net landings. The Total Allowable Landings will be based on the water body where the pound nets are set, as presented by DMF by February 2016 meeting (assumes that the Total Allowable Landings equals the Total Allowable Catch).
- Commercial gig fishery will close when TAL is met.
- Recreational hook-and-line and gig fisheries will close Oct. 16-Dec. 31.

Predicated on the Commission's adoption of the temporary management measures and pursuant to his delegated authority, the Fisheries Director issued Proclamation FF-68-2015, effective at 12:01am on January 1, 2016, making it unlawful to possess a flounder less than fifteen inches (15") in total length, and requiring a minimum mesh size of six inches (6") for anchored large mesh gill nets used in the taking of flounder. Proclamation FF-68-2015 was subsequently superseded by Proclamation FF-3-2016, which effectively contained the same restrictions related to the lawful minimum size limit for flounder and the minimum mesh size

limit for anchored large mesh gill nets. The Fisheries Director also issued Proclamation M-34-2015, effective at 12:01am on February 1, 2016, requiring a minimum mesh size limit of five and three-quarters inches (5¾") for all escape panels used in flounder pound net sets. Prior to the issuance of any proclamations related to the remaining temporary management measures, the Plaintiffs instituted this action for Declaratory Ruling and Injunctive Relief in Carteret County Superior Court on September 23, 2016.

On October 6, 2016, a hearing was held in Carteret County Superior Court before the Honorable John R. Jolly, Jr., Superior Court Judge, related to Plaintiffs' Motion for Preliminary Injunction. On that date, Judge Jolly granted in part and denied in part Plaintiffs' Motion. Specifically, the Order allowed the temporary management measures relating to the increase in minimum size limit for the commercial harvest of southern flounder to fifteen inches (15"), the increase in minimum mesh size used in anchored large mesh gill nets to six inches (6"), and the increase in mesh size for escape panels required for pound nets to five and three quarter inches (5¾") to remain in effect. The Order also preliminarily enjoined the Commission and the Division, through the Fisheries Director, from enforcing the remaining temporary management measures that had not yet been implemented through proclamation; however, the Order reinstituted the December 1 closure date for the commercial harvest of southern flounder, which had been in effect prior to the Commission's adoption of the temporary management measures. The Court declined to issue an injunction with respect to the Plaintiffs remaining claims for relief as described in their complaint, including those predicated on asserted violations of the Open Meetings Law (N.C.G.S. Chapter 143, Article 33C).

On March 3, 2017, this matter was ordered to mediation, and a mediated settlement conference was held on May 11, 2017, as described above. As a result of the mediated settlement

conference, and without any further hearing of law or of fact, the Parties reached an agreement-in-principle subject to approval by Defendants Marine Fisheries Commission and the Secretary of the Department of Environmental Quality. The representatives of the CCFA and NCFA were fully authorized to and did agree to the terms of the negotiated settlement. Mr. Weeks, representing the Counties of Carteret, Dare and Hyde, was authorized to reach an agreement-in-principle with the understanding that final authorization would be sought from the counties.

TERMS OF SETTLEMENT

1. In order to avoid the cost and delay of litigation, the Parties have entered into this Agreement and have agreed that all Parties have been correctly designated and that there is no question as to misjoinder or nonjoinder.

2. The temporary management measure applicable to the taking of flounder in a commercial fishing operation, by whatever means, in Internal Coastal Waters and which establishes the minimum allowable size limit for possession of flounder at fifteen inches (15") total length, currently enforced through Proclamation FF-3-2016, shall remain in effect in accordance with N.C. Gen. Stat. § 113-182.1(e1).

3. The temporary management measure applicable to the taking of flounder in a commercial operation in Internal Coastal Waters by means of anchored large mesh gill nets and that requires such anchored large mesh gill nets to be constructed with a minimum mesh size of six inches (6"), currently enforced through Proclamation FF-3-2016, shall remain in effect in accordance with N.C. Gen. Stat. § 113-182.1(e1).

4. The temporary management measure applicable to the commercial taking of flounder through the use of a pound net sets in Internal Coastal Water and that sets the minimum allowable mesh size required for all escape panels contained within each and/or all of the pounds at five and three-quarters inches (5¾"), currently enforced through Proclamation M-34-2015, shall remain in effect in accordance with N.C. Gen. Stat. § 113-182.1(e1).

5. No proclamations will be issued effectuating the temporary management measures establishing a closure date of October 16 through December 31 for the commercial harvest of southern flounder through the use of "anchored large mesh gill nets and trammel

nets," as well as for the harvest of southern flounder through "recreational hook-and-line and gig fisheries," before the Commission acts to adopt an amendment to the current Southern Flounder FMP, as described in paragraph 8, below.

6. No proclamations will be issued effectuating the temporary management measures establishing a total allowable landing quota for pound nets and establishing a closure for the commercial gig fishery when the total allowable landing quota for pound nets is reached, before the Commission acts to adopt an amendment to the current Southern Flounder FMP, as described in paragraph 8, below.

7. The Parties recognize and agree that, prior to the adoption of the temporary management measures described above, the Commission adopted Amendment 1 to the Southern Flounder FMP, which provides for a closure of the commercial harvest of southern flounder beginning December 1 and lasting through December 31 of each successive year ("December 1 closure"). The Parties agree that the "December 1 closure" will remain in effect as described in and in accordance with Amendment 1 to the Southern Flounder FMP.

8. In addition, Defendant North Carolina Marine Fisheries Commission agrees to not pursue the development of additional temporary management measures, as provided in N.C. Gen. Stat. § 113-182.1(e1), with respect to the Southern Flounder FMP before it acts to amend the current Southern Flounder FMP, which is currently being developed by the Division of Marine Fisheries, in accordance with N.C. Gen. Stat. § 113-182.1.

9. Plaintiffs agree to file a Dismissal with Prejudice as to all Defendants in the above captioned action no later than ten (10) days after this Agreement is executed by the Parties, as signified by the date of the last signature to this Agreement. The Parties agree that the filing of the dismissal constitutes a waiver and release of any and all claims that were or could have been brought against any or all of the Defendants in this action, whether in their official or individual capacities, by Plaintiffs CCFA and NCFA, and any of their respective members, any affiliated associations or their members, and/or any other associated entities or their members, as well as the Counties of Carteret, Dare and Hyde, including but not limited to all claims predicated on Article 33C of Chapter 143 of the North Carolina General Statutes (known as the Open Meetings Law). The Parties recognize that the filing of this action does not preclude or limit the Plaintiffs' ability to seek relief under the Open Meetings Law for any actions occurring after the date of

filing of the amended complaint (i.e. September 30, 2016) in this matter, which are asserted to constitute violations of the Open Meetings Law.

10. This Agreement is intended to resolve the claims and disputes at issue in the above referenced matter without admission of wrongdoing by any party. Nothing in this Agreement is intended to limit or diminish the duties or authorities of the Commission, the Department of Environmental Quality, or the Division of Marine Fisheries, or any representatives acting on their behalf, to regulate and manage the fisheries of North Carolina in accordance with the laws of this State, including any modifications thereto, beyond the specific terms of this Agreement. Further, nothing in this Agreement shall be interpreted to prevent the Department and/or the Fisheries Director from acting in accordance with State or federal law where such action is independent of the Commission's adoption of the temporary management measures described above.

11. Each party shall be responsible for his, her, its or their costs in this action.

12. The Parties commit and hereby agree to work in good faith toward approval of this Agreement by the entities in whom such action is legally vested. In the event that additional documents must be completed to effectuate this Agreement, the undersigned agree to execute such documents in a timely fashion.

13. This Agreement shall be binding upon the Parties, their successors and assigns, and is entered into knowingly, intelligently, and voluntarily upon execution by the undersigned, who represent and warrant that they are authorized to enter into this Agreement on behalf of the Parties hereto.

14. The undersigned further acknowledge that they have entered into this Agreement having first fully read and understood its contents, conferred with or had the opportunity to confer with their respective attorneys, and hereby consent to the settlement of the claims based on the terms set forth herein, having done so in reliance upon their own judgement and advice of their respective attorneys and not in reliance on any other representations or promises made by any other Party to this Agreement, or any other Party's representatives or attorneys.

[SIGNATURES CONTAINED ON THE FOLLOWING PAGE]

FOR THE PLAINTIFFS:

North Carolina Fisheries Association, Inc.

By: John A. Skinner, Jr. 6.21.17
Glenn Skinner, Executive Director

Date:

Carteret County Fisherman's Association, Inc.

By:
Bradley Styron, President

Date: 6/23/17

Carteret County

By:
Stevenson L. Weeks

Date: 6-26-17

Dare County

By:
Stevenson L. Weeks

Date: 6-26-17

Hyde County

By:
Stevenson L. Weeks

Date: 6-26-17

A TRUE COPY
CLERK OF SUPERIOR COURT
CARTERET COUNTY
BY Deborah Handley

FOR THE DEFENDANTS:

North Carolina Marine Fisheries Commission and its Commissioners

By:
Sammy Corbett, Chairman

Date: 7/14/17

North Carolina Department of Environmental Quality, Division of Marine Fisheries, and the Fisheries Director

By:
Michael S. Regan, Secretary

Date: 8/4/17

Honorable James D. Llewellyn, Mediator

Date: 8/17/2017

4.1 APPENDIX 1

MARINE FISHERIES COMMISSION PROPOSALS

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

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.

4.2 APPENDIX 2

DIVISION OF MARINE FISHERIES DRAFT SUPPLEMENT

PLEASE NOTE:

The Division of Marine Fisheries supplement remains in its DRAFT form as of May 4, 2015. Calculations were based on preliminary data and were the best approximation available at that time, thus are subject to have changed.

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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.

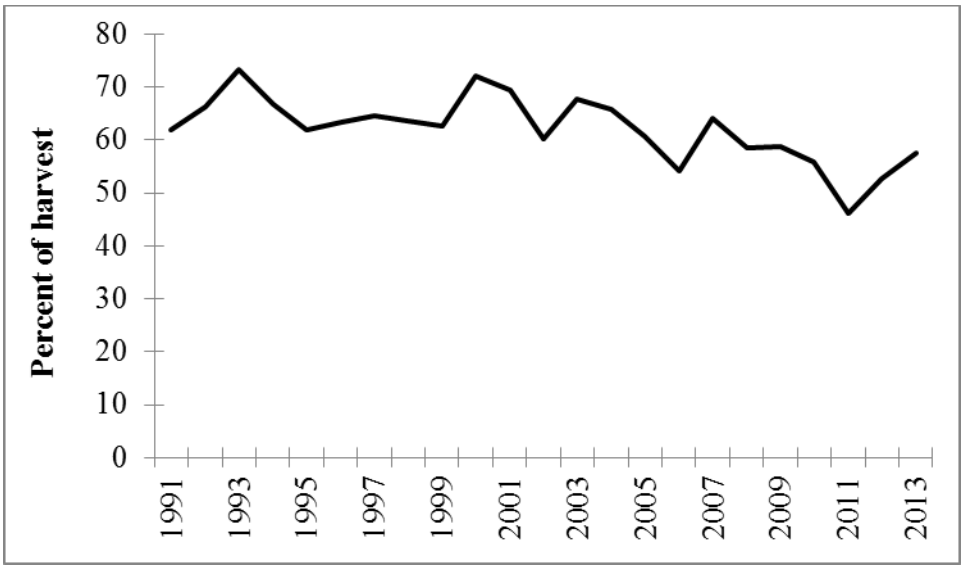

Figure 1. Percent of the annual harvest less than the length at 50% maturity (L50) for southern flounder. The L50 was approximated at 400 mm (15.8 inches) total length for this analysis. Note: all harvest, including sublegal harvest, except recreational gig harvest was included in this analysis.

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.

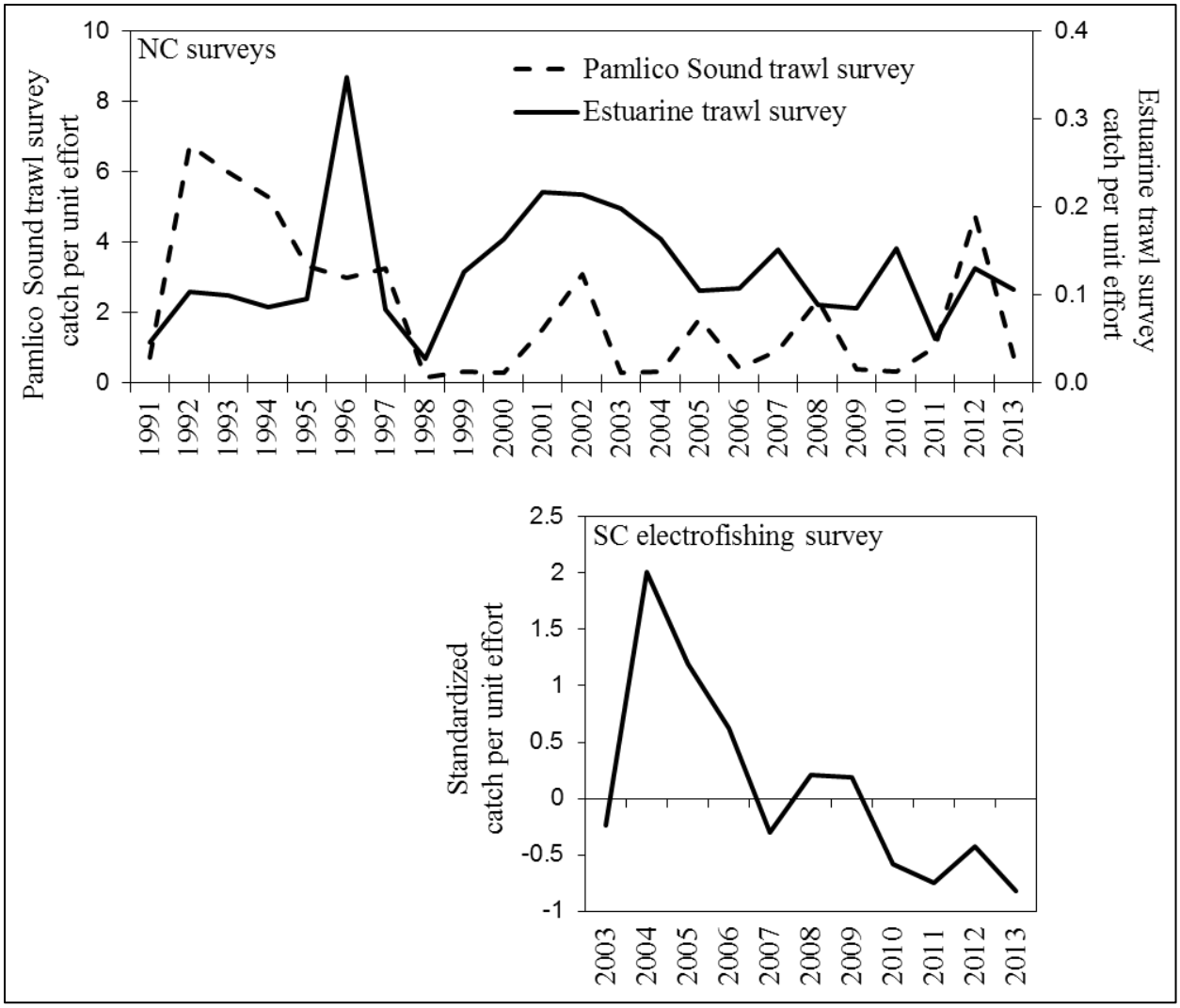

Figure 2. Indices of juvenile abundance developed from North Carolina Pamlico Sound and Estuarine Trawl Surveys and South Carolina Electrofishing Survey. North Carolina indices were developed by North Carolina Division of Marine Fisheries and the South Carolina index was developed by South Carolina Department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

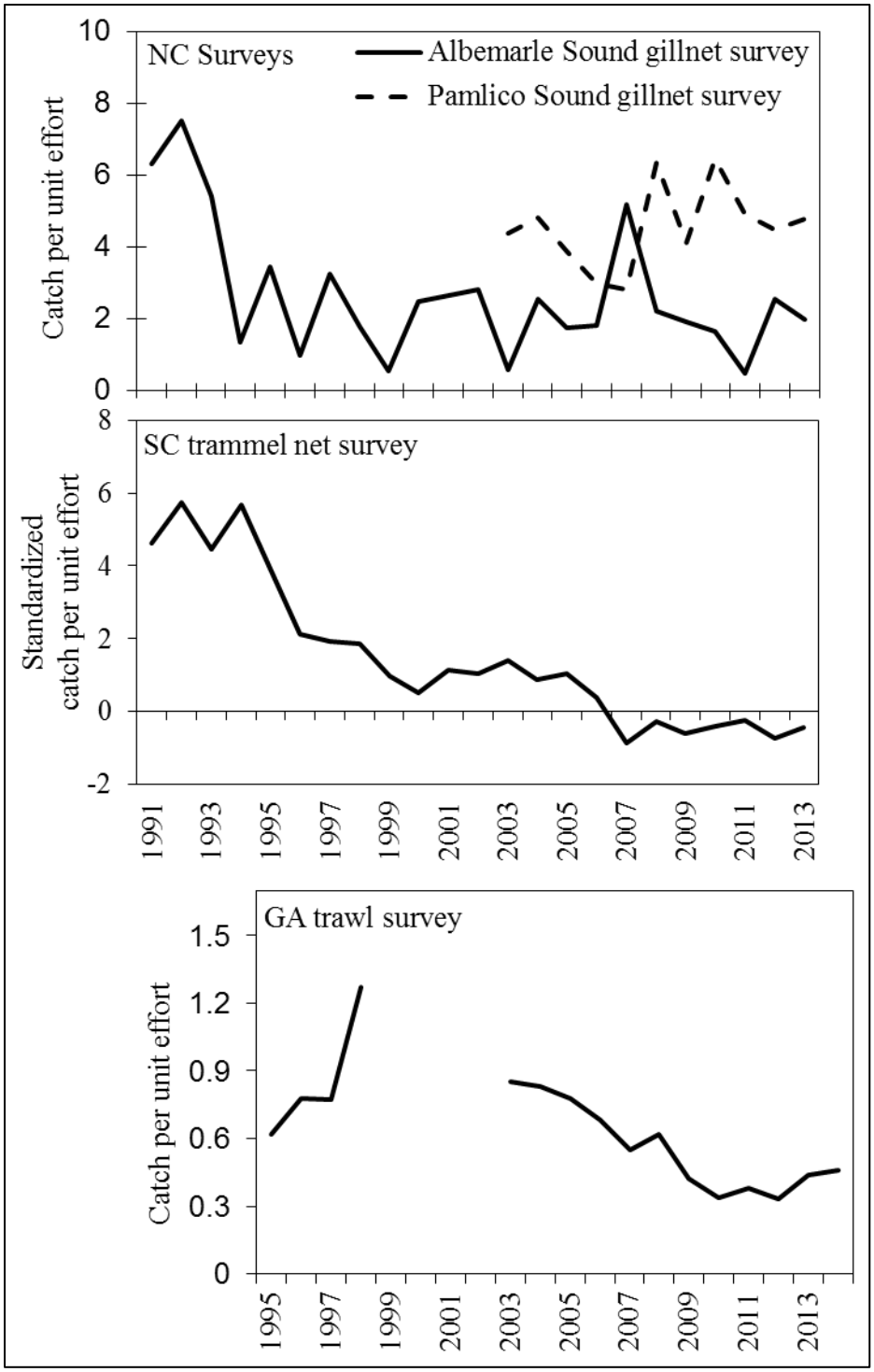

Figure 3. Indices of abundance of sub-adults and adults developed from North Carolina Albemarle Sound and Pamlico Sound Independent Gill Net Surveys, South Carolina Trammel Net Survey, and Georgia Ecological Monitoring Survey (GA Trawl). North Carolina indices were developed by NCDMF staff; the South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

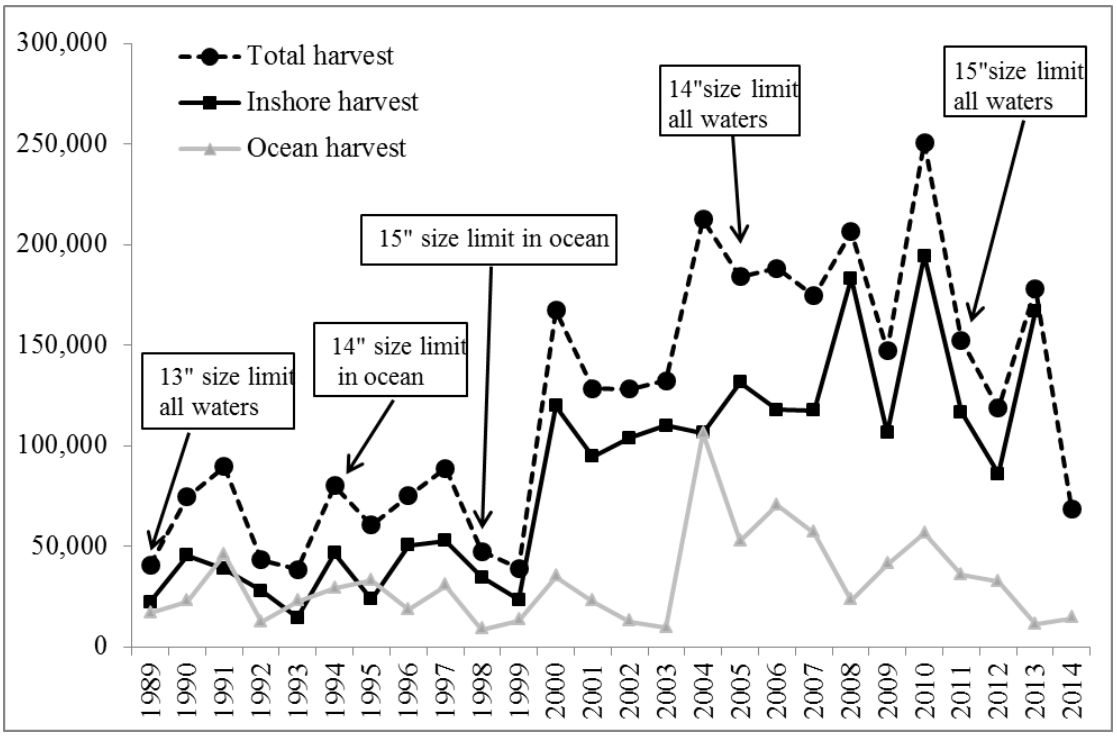

Figure 4. Recreational hook and line harvest from MRIP data 1989-2014 (2014 data are preliminary) and major fishery regulation changes.

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.

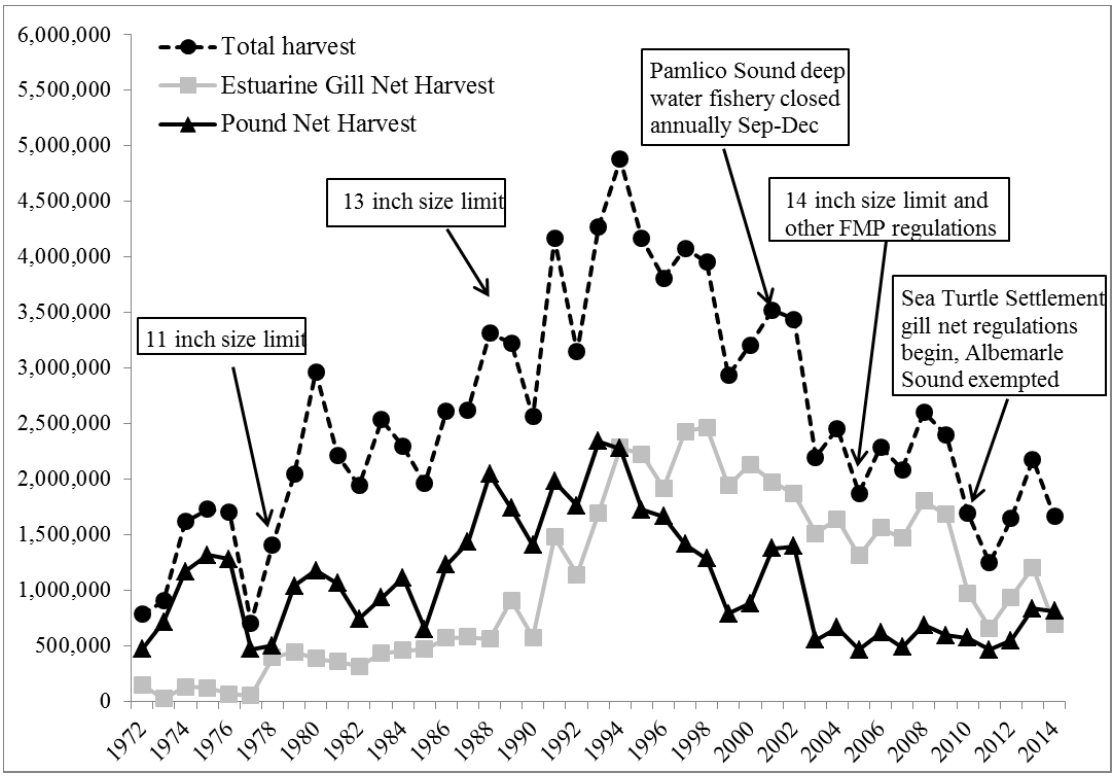

Figure 5. Commercial landings (lbs) from NCTTP 1972-2014 (2014 data are preliminary) and major fishery regulation changes

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

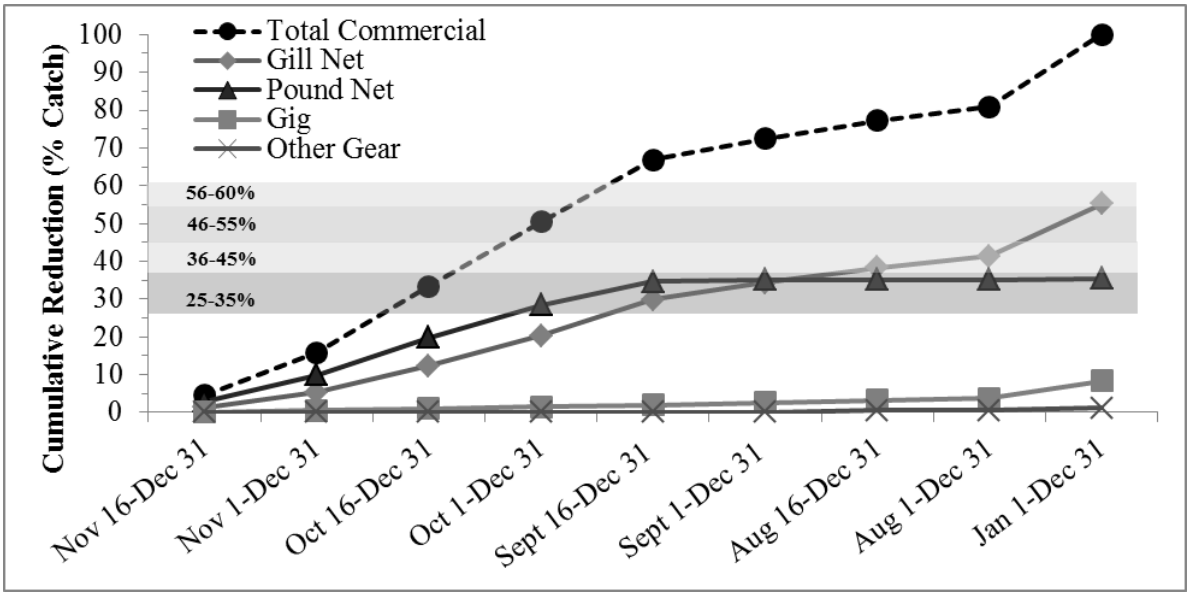

Figure 6. Commercial catch reductions (percent) from the total commercial catch for season closures based on a 2011-2014 average.

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

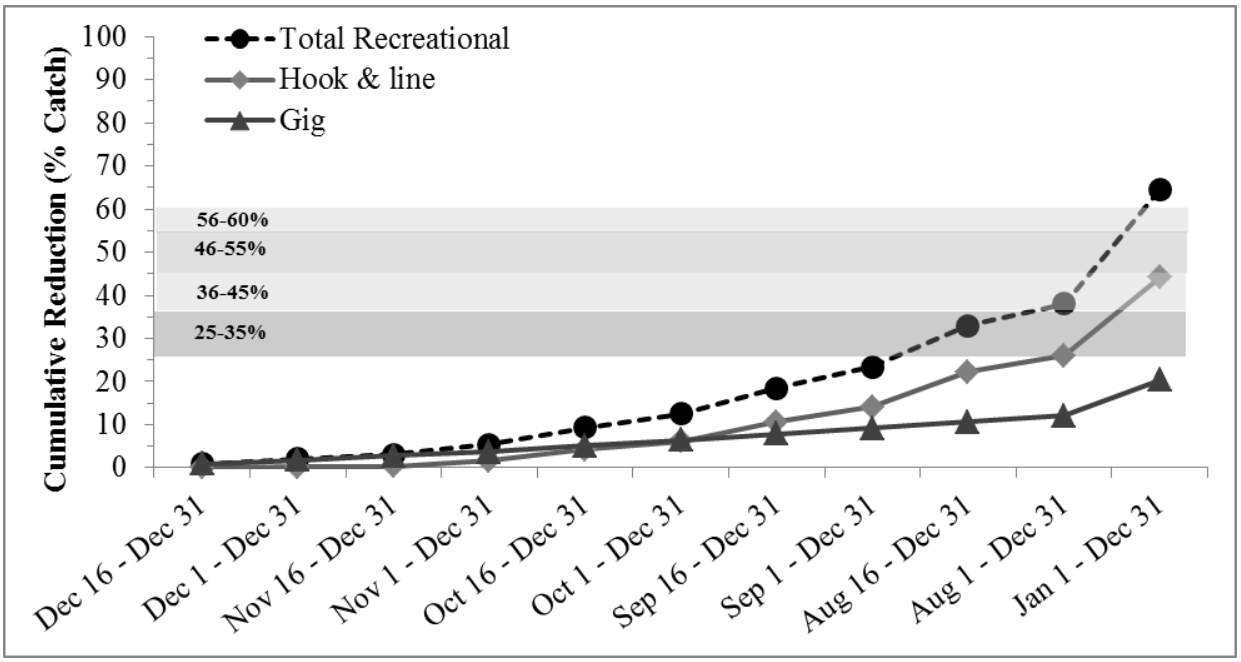

Figure 7. Recreational catch reductions (percent) from the total recreational catch for season closures based on a 2011-2014 average.

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

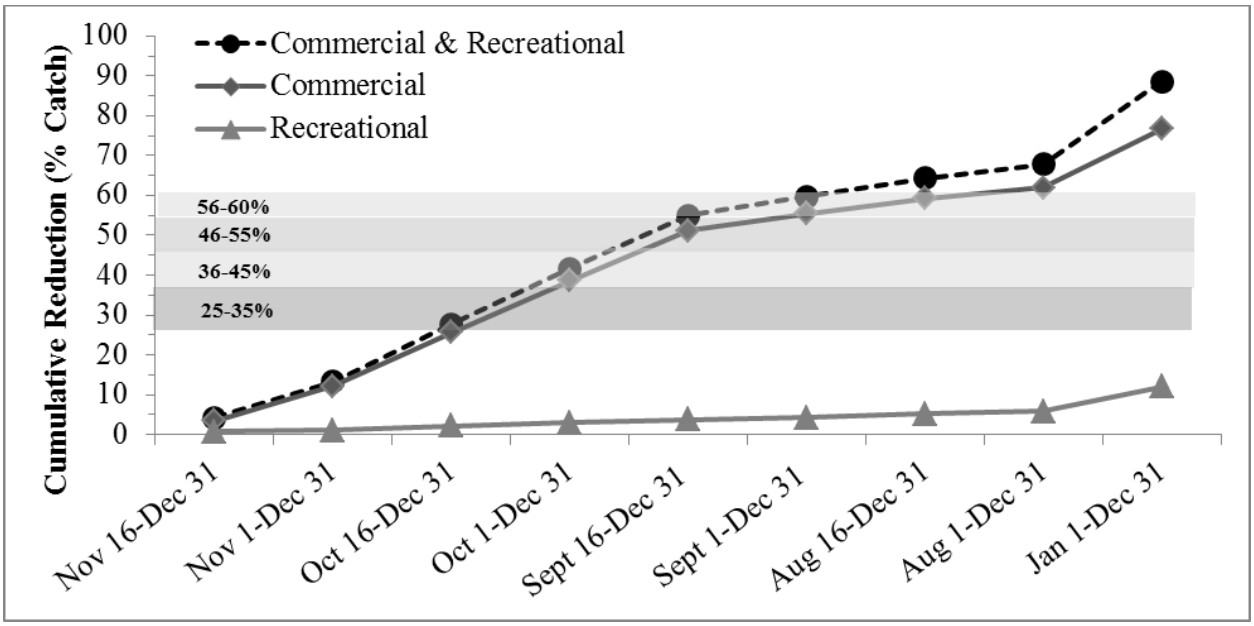

Figure 8. Catch reductions (percent) from the combined fishery catch for season closures based on a 2011-2014 average.

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

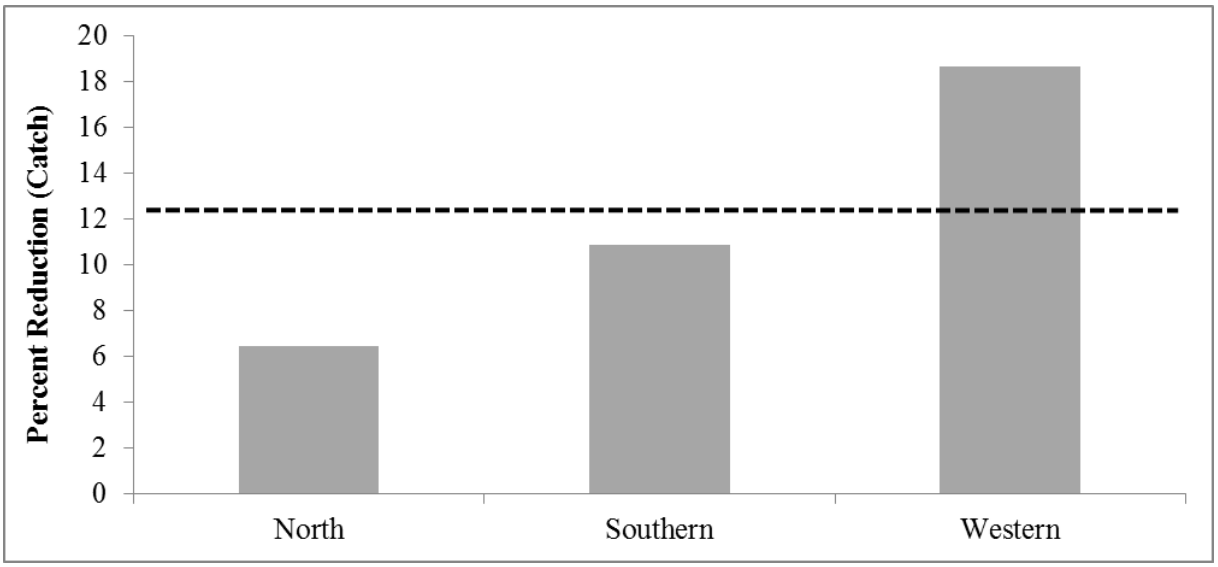

Figure 9. Reduction for recreational southern flounder hook and line fishery with 16-inch minimum size by region (North = Currituck-Carteret counties, Southern = Onslow-Brunswick counties, Western= counties on west side of Pamlico Sound). The dotted line is the mean reduction.

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

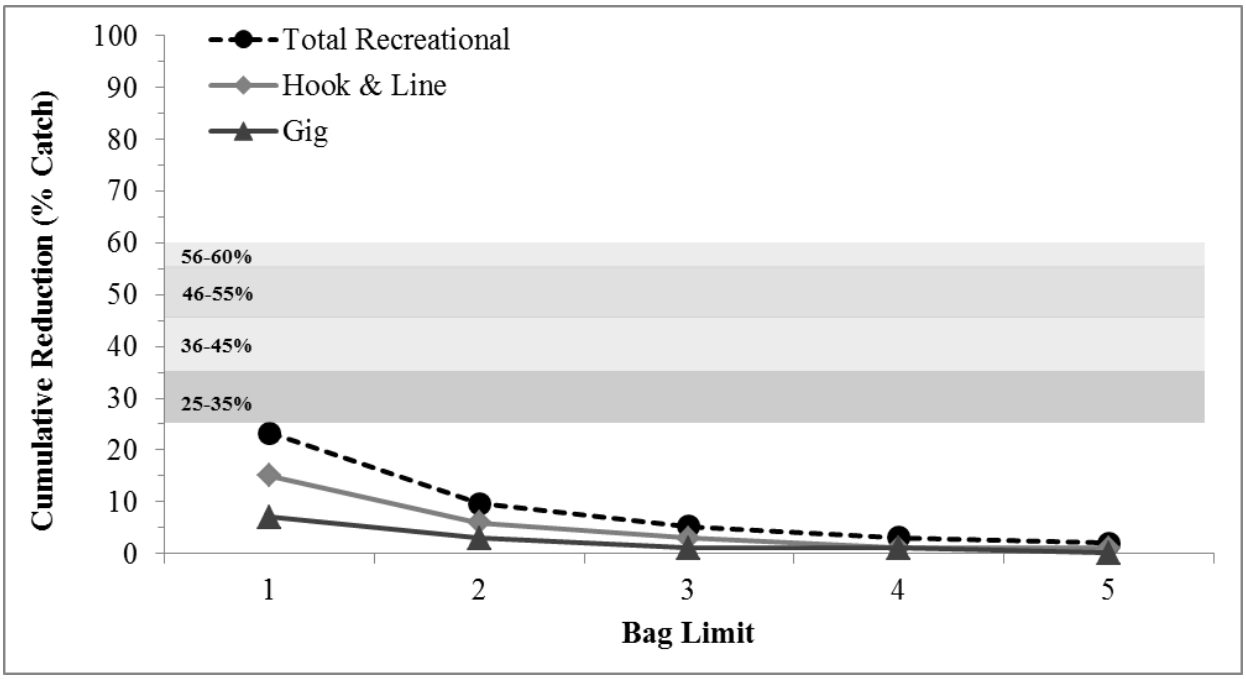

Figure 10. Catch reductions (percent) from recreational catch by gear for recreational bag limit decreases based on 2011-2014 average.

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

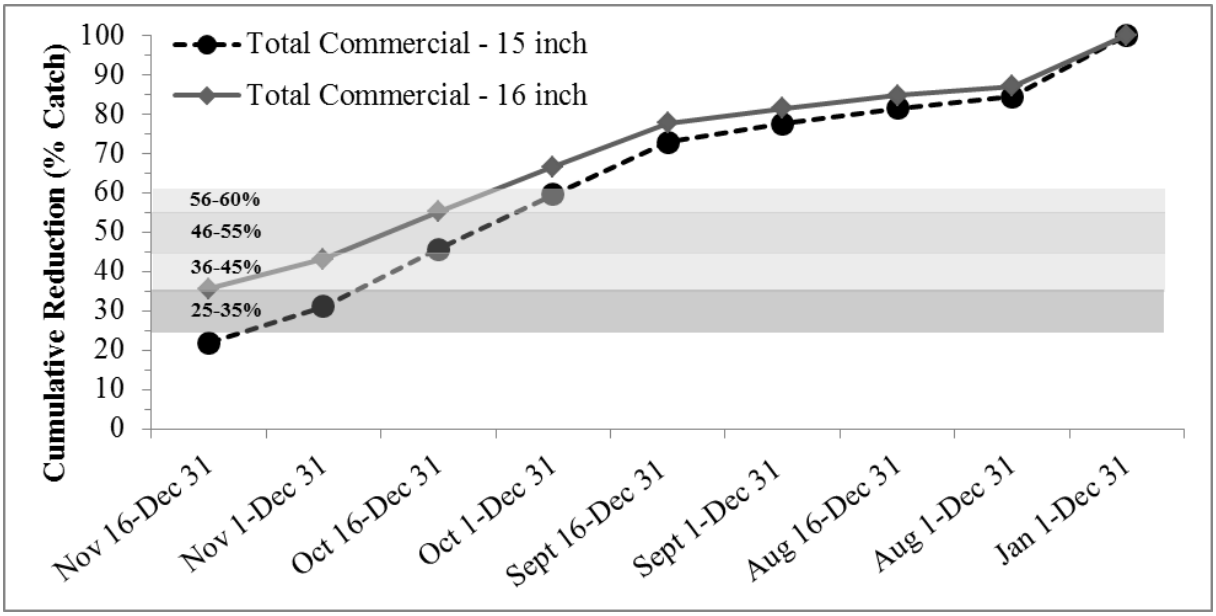

Figure 11. Commercial catch reductions (percent) from the total commercial fishery catch for season closures and minimum size limit increases based on 2011-2014 average.

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

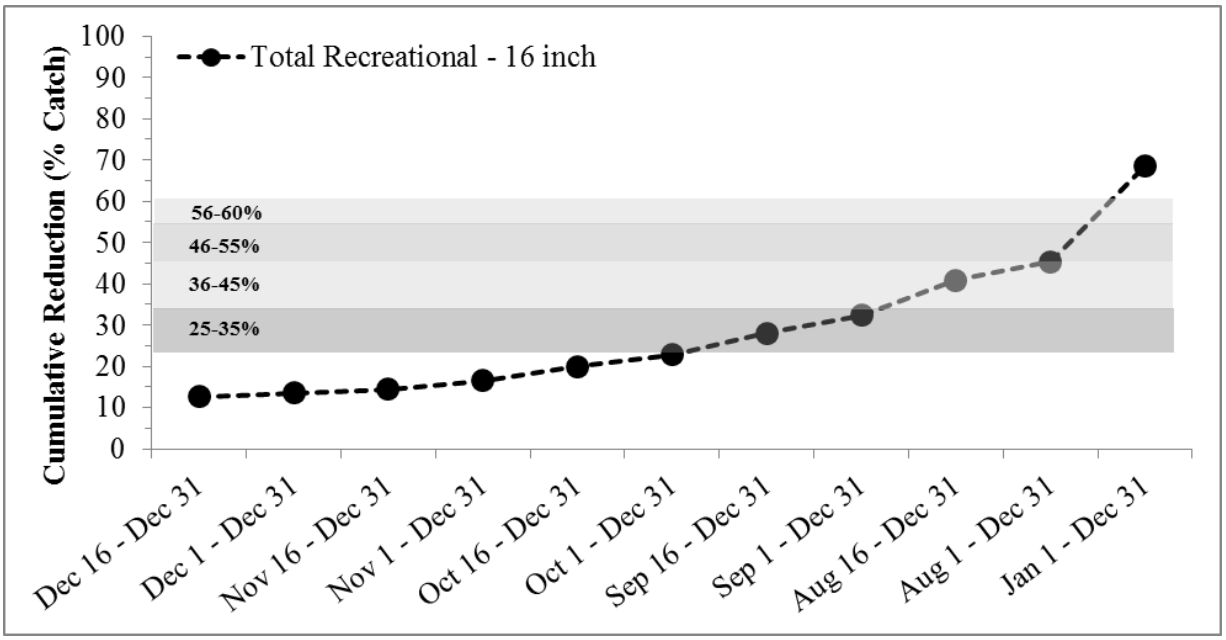

Figure 12. Catch reductions (percent) from the total recreational catch for season closures and a 16-inch minimum size limit based on 2011-2014 recreational average.

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,

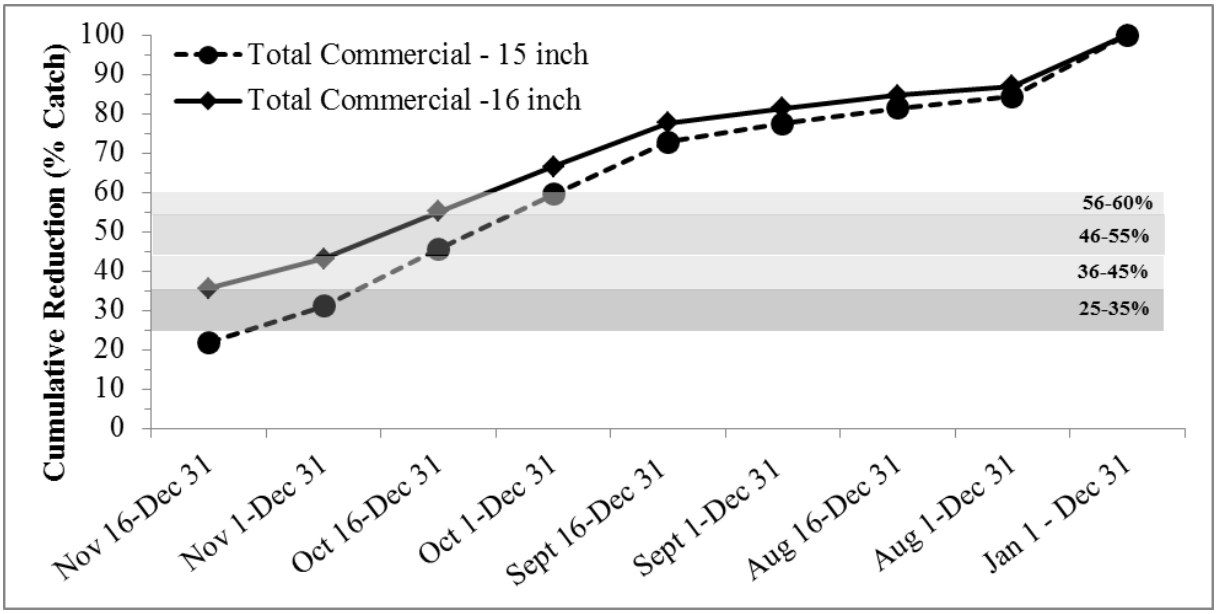

Figure 13. Catch reductions (percent) from the combined fishery catch for season closures and minimum size limit increases based on 2011-2014 combined fishery average.

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

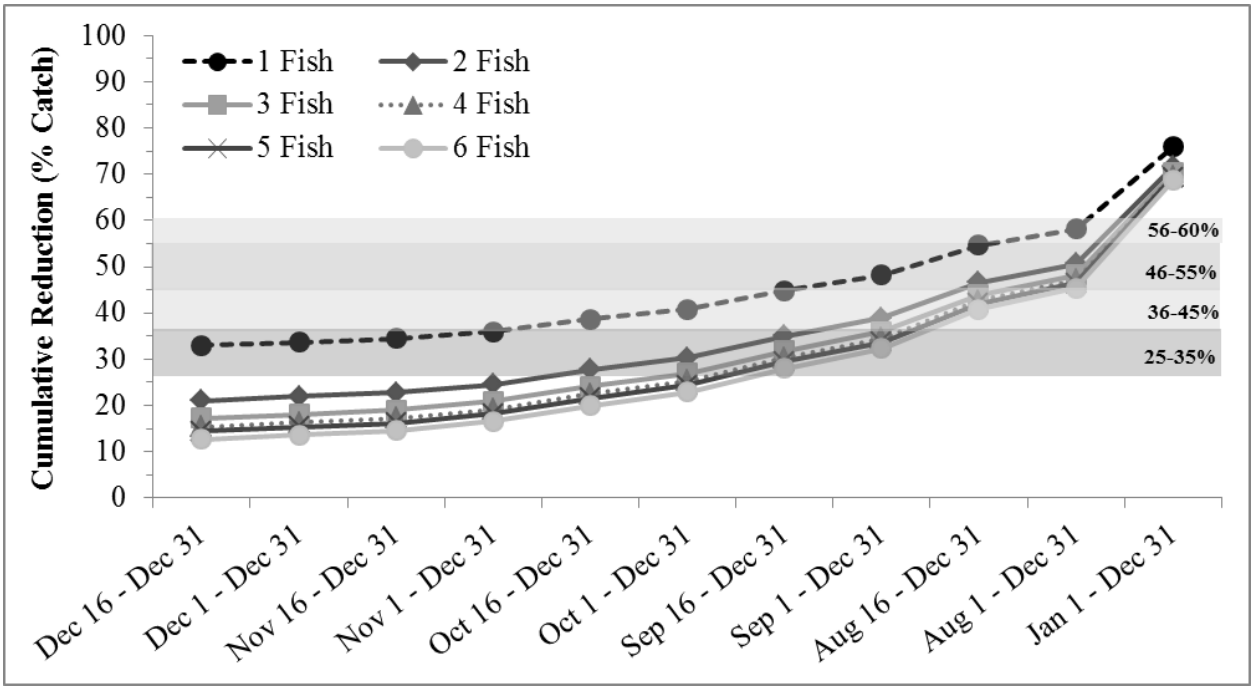

Figure 14. Catch reductions (percent) from the recreational catch by gear for season closures, recreational bag limit decreases and a 16-inch minimum size limit based on 2011-2014 recreational average.

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

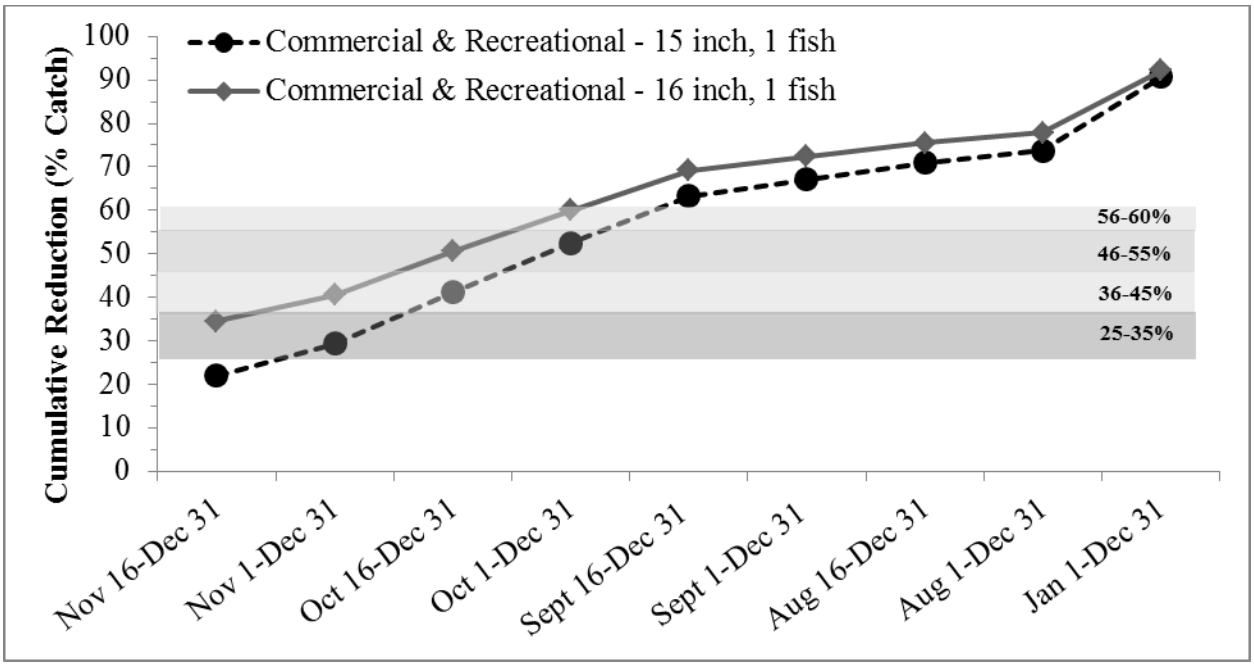

Figure 15. Catch reductions (percent) from the combined fishery catch for season closures, minimum size limit increases and a one-fish recreational bag limit based on 2011-2014 combined fishery average.

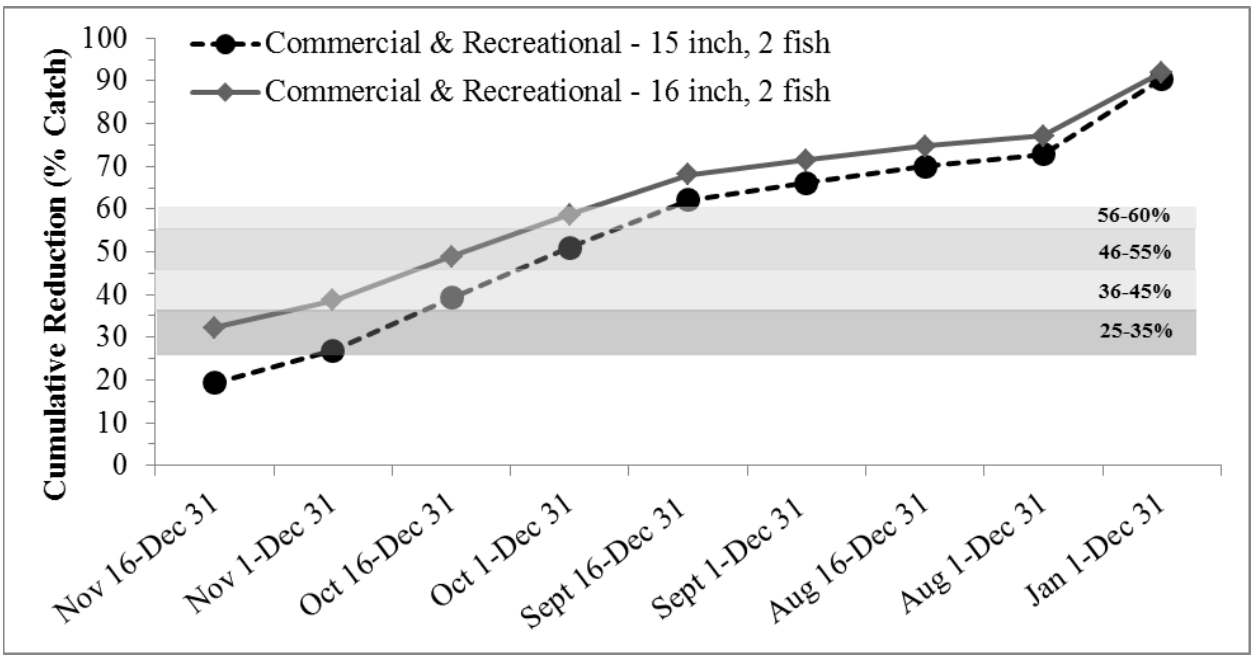

Figure 16. Catch reductions (percent) from the combined fishery catch for season closures, minimum size limit increases and a two-fish recreational bag limit based on 2011-2014 combined fishery average.

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

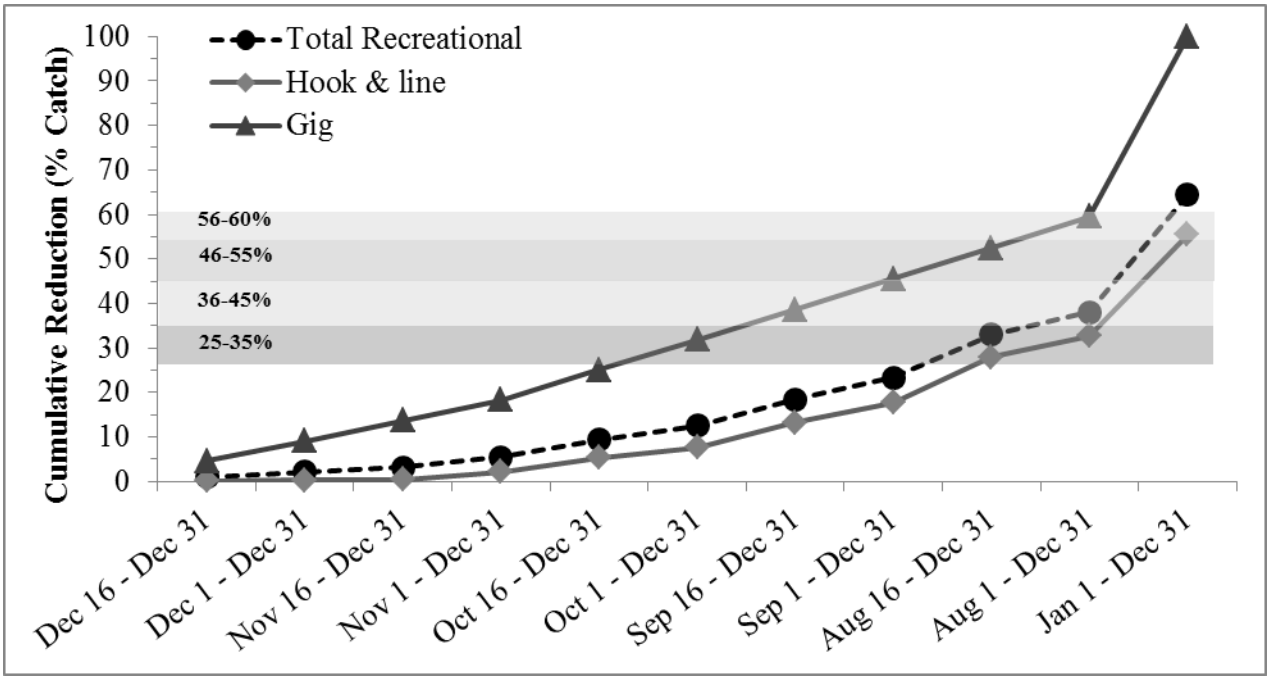

Figure A4.1. Commercial catch reductions (percent) from the catch by gear for season closures based on a 2011-2014 average.

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

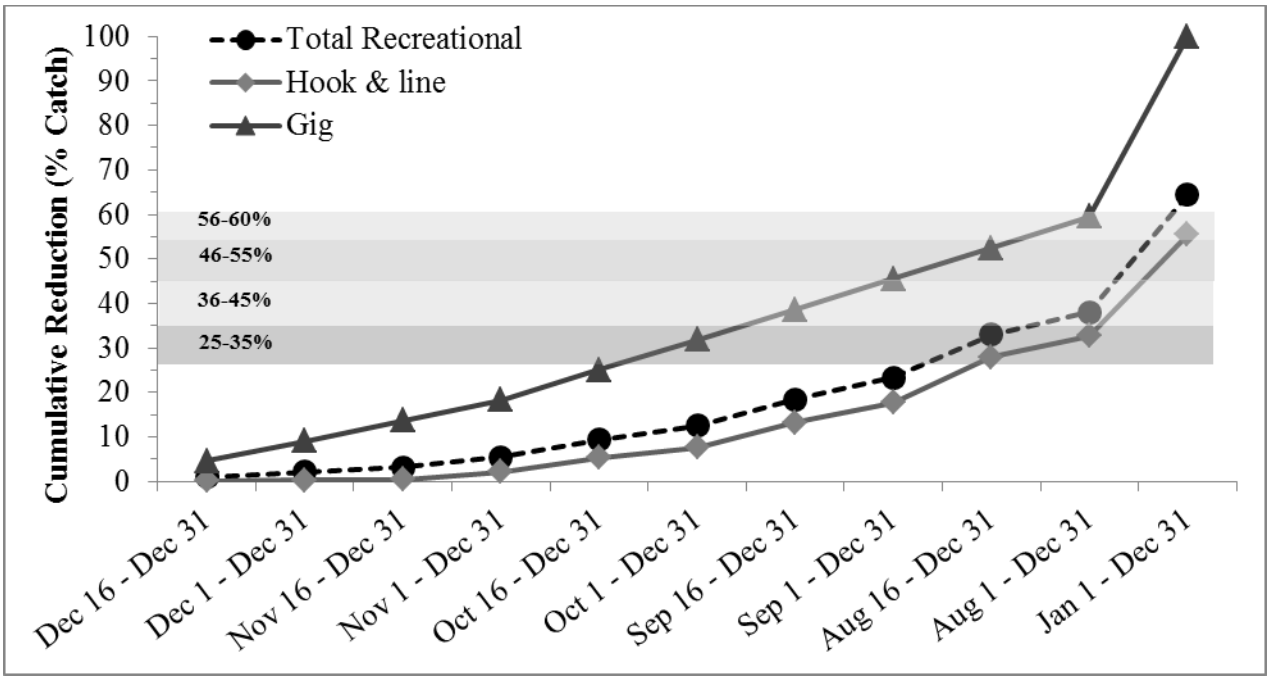

Figure A4.2. Catch reductions (percent) from recreational catch by gear for season closures based on a 2011-2014 average.

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

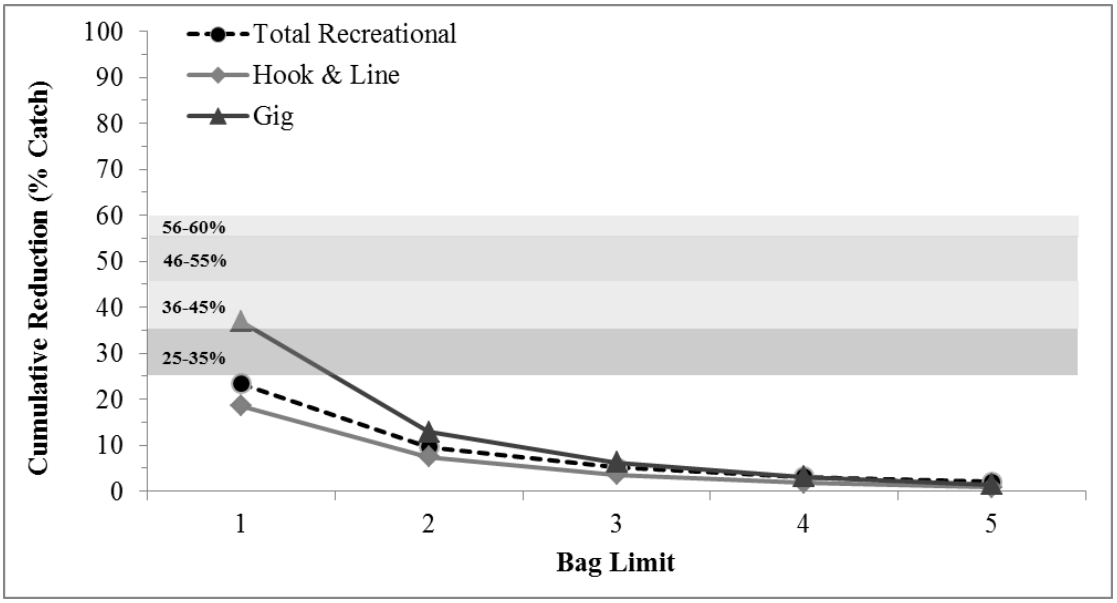

Figure A4.3. Catch reductions (percent) from recreational catch by gear for recreational bag limit decreases based on 2011-2014 average.