DRAFT DOCUMENT
SUBJECT TO CHANGE

North Carolina Southern Flounder (*Paralichthys lethostigma)* Fishery Management Plan Amendment 2

By

North Carolina Division of Marine Fisheries

North Carolina Department of Environmental Quality
Division of Marine Fisheries
3441 Arendell Street
Post Office Box 769
Morehead City, NC 28557
June 2019

Amendment 2 to the N.C. Southern Flounder Fishery Management Plan

Achieving Sustainable Harvest

June 5, 2019

I. ISSUE

The issue is to implement management measures to achieve sustainable harvest in the southern flounder fishery to end overfishing by 2021 and rebuild the spawning stock by 2028.

II. ORIGINATION

North Carolina Division of Marine Fisheries (NCDMF)

The N.C. Fishery Management Plan Review Schedule, as approved by the North Carolina Marine Fisheries Commission (NCMFC) at its August 2018 meeting, shows the review of the Southern Flounder Fishery Management Plan (FMP) is underway. As part of the review, a coast-wide stock assessment determined the stock is overfished and overfishing is occurring (Lee et al. 2018; Flowers et al. 2019). The NCDMF is proceeding with an amendment to the FMP to meet the statutory requirements to specify a time period not to exceed two years from the date of adoption of the amendment to end overfishing and a time period not to exceed 10 years from the date of adoption of the amendment for achieving a sustainable harvest.

III. BACKGROUND

Southern flounder supports one of the largest and most valuable commercial fisheries in North Carolina, accounting for landings of 1.39 million pounds with a dockside value of $5.66 million in 2017. Pound nets, gill nets, and gigs have accounted for 98% of commercial southern flounder landings in North Carolina for the last 10 years (Figure 1). Historically, North Carolina has accounted for approximately 99% of annual U.S. South Atlantic coast commercial southern flounder landings since 1978 (Figure 2). North Carolina's total commercial removals (landings and dead discards; in pounds) are equivalent to approximately 38.3% of the coast-wide removals of southern flounder for the last 10 years (Figure 3). The commercial landings of southern flounder in North Carolina increased steadily in the mid-1970s, peaked in the mid-1990s at more than 4 million pounds, and have since declined to approximately 1.4 million pounds in 2017 (Figure 4). In 2017, dead discards in the North Carolina southern flounder commercial gill net fishery (the only commercial fishery with discard estimates) were the lowest they had been over the time series of the stock assessment (1989-2017), accounting for 0.3% of North Carolina's total commercial removals in 2017. Dead discards in the North Carolina commercial gill net fishery have steadily been declining from a peak in 1994. The total number of individual participants in the commercial southern flounder fishery during 2017 was 1,048 and has been variable the last 10 years ranging from 945 (2016) to 1,299 (2009). Many of the participants often use multiple gears and will fish multiple gears per trip in order to maximize effort. Commercial trips landing southern flounder have declined since 2008 primarily in the gill net and other gear categories. Pound net trips have been variable and gigs have increased (Table 1). Likewise, the number of participants landing southern flounder has declined since 2008, primarily in the gill net and other gear categories. Gig

participants have increased and pound net trips have remained relatively constant since 2008 (Table 1).

Southern flounder, or flounder species in general, are one of the most sought-after recreational species in North Carolina. Historically, North Carolina accounted for approximately 21.1% of the total recreational removals (observed harvest and dead discards; in pounds) in the U.S. South Atlantic (Figure 5); in 2017, North Carolina accounted for 29.6% of the recreational removals coast-wide. For the last 10 years (2008-2017), North Carolina's total recreational removals (in pounds) are equivalent to approximately 19% of the total coast-wide removals (Figure 3). Southern flounder are taken by recreational fishers using hook-and-line, gigs, and through the recreational use of commercial gears such as gill nets. In the North Carolina recreational hook-and-line fishery, flounder species have been the most often reported target species in 20 of the last 37 years (Figure 6; Table 2). Species targeted during recreational angling trips are identified through interviews conducted by Marine Recreational Information Program (MRIP) agents.

The recreational harvest of southern flounder exhibits a distinct seasonality concentrated between May and October, whereas commercial harvest is concentrated between September and November (Figure 7; Figure 8). Since 2011, there has been a decrease in recreational harvest of southern flounder in the recreational hook-and-line fishery due, at least in part, from an increase to a 15-inch minimum size limit (Figure 9). Increases in the minimum size limit over time have also resulted in North Carolina having the largest recreational ratio of released to harvested flounder in the U.S. South Atlantic (Figure 10).

Additional information about stock assessments, fishery habitat and water quality considerations, and user conflicts may be found in Amendment 1 to the FMP, the 2018 FMP Review for Southern Flounder, the Coastal Habitat Protection Plan, and the 2018 updated coast-wide stock assessment for southern flounder (NCDMF 2013, 2018a; NCDEQ 2016; Flowers et al. 2019).

Amendment 1 Management

Southern flounder is currently managed under Amendment 1 and Supplement A to Amendment 1 as modified by the Aug. 17, 2017 settlement agreement of the N.C. Southern Flounder FMP (NCDMF 2013, 2017a; Table 3). Actions to achieve sustainable harvest in Amendment 1 included: 1) accepting certain management measures to reduce protected species interactions as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery and 2) increasing the recreational minimum size limit to 15 inches total length (TL) and decreasing the daily creel limit to six fish. Amendment 1 also set new sustainability benchmarks of 25% Spawning Potential Ratio (SPR; threshold) and 35% SPR (target).

The NCMFC took final action on Supplement A to Amendment 1 at its November 2015 business meeting. The NCMFC adopted a suite of management measures with varied effective dates ranging from Jan. 1 through Oct. 16, 2016. Management actions approved included: 1) increasing the commercial minimum size limit to 15 inches TL; 2) increasing the minimum mesh size for gill nets to six inches stretched mesh (ISM) for the harvest of southern flounder; 3) annually closing the commercial gill net and recreational fisheries on Oct. 15; 4) a 38% harvest reduction in commercial pound net harvest based on 2011–2015 average landings; 5) closing the commercial gig fishery once the commercial pound net fishery closes; and 6) increasing the minimum mesh size of escape panels in flounder pound nets to five and three-quarter inches. On Oct. 10, 2016, a

judge issued a temporary injunction against certain management changes adopted by the NCMFC as part of Supplement A to Amendment 1. The temporary injunction remained in effect until a settlement agreement was reached on Aug. 17, 2017. Per the settlement agreement, only certain provisions of Supplement A remain in place and no new temporary management measures can be implemented until the adoption of the next amendment to the FMP. The management measures that were not implemented under the agreement were the Oct. 15 commercial gill net and recreational closure, the closure of the commercial gig fishery, and the 38% reduction in commercial pound net landings based on 2011–2015 average landings.

The current recreational bag limit of no more than four flounder per person per day is required through the N.C. Fishery Management Plan for Interjurisdictional Fisheries. This was implemented in 2017 to maintain compliance with the Atlantic States Marine Fisheries Commission (ASMFC) Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan Addendum XXVIII.

IV. AMENDMENT 2 GOALS, OBJECTIVES, AND STOCK STATUS

The goal and objectives for the FMP are as stated below.

Goal

Manage the southern flounder fishery to achieve a self-sustaining population that provides sustainable harvest using science-based decision-making processes. The following objectives will be used to achieve this goal.

Objectives

1. Implement management strategies within North Carolina and encourage interjurisdictional management strategies that maintain/restore the southern flounder spawning stock with multiple cohorts and adequate abundance to prevent recruitment overfishing.
2. Restore, enhance, and protect habitat and environmental quality necessary to maintain or increase growth, survival, and reproduction of the southern flounder population.
3. Use biological, environmental, habitat, fishery, social, and economic data needed to effectively monitor and manage the southern flounder fishery and its ecosystem impacts.
4. Promote stewardship of the resource through increased public awareness and interjurisdictional cooperation throughout the species' range regarding the status and management of the southern flounder fishery, including practices that minimize bycatch and discard mortality.

Stock Assessment

The biological unit stock for southern flounder inhabiting U.S. South Atlantic coastal waters includes waters of North Carolina, South Carolina, Georgia, and the east coast of Florida, and is based on multiple tagging studies (Ross et al. 1982; Monaghan 1996; Schwartz 1997; Craig and Rice 2008), genetic studies (Anderson and Karel 2012; Wang et al. 2015), and an otolith morphology study (Midway et al. 2014), all of which provide evidence of a single unit stock occurring from North Carolina through the east coast of Florida. Based on this life history

information, a multi-state cooperative group performed a stock assessment to determine the status of southern flounder in U.S. South Atlantic waters.

To address the coast-wide nature of the southern flounder stock, a comprehensive stock assessment approach, using the Age Structured Assessment Program (ASAP) model, was applied to available data from North Carolina through the east coast of Florida to assess the status of the U.S. South Atlantic southern flounder stock from 1989 through 2017 (Flowers et al. 2019). The assessment is based on a forward-projecting, statistical catch-at-age approach using ASAP3 software (version 3.0.17; NOAA Fisheries Toolbox 2014). The model synthesized information from multiple fishery-independent and fishery-dependent data sources, tracked population dynamics, estimated critical demographic and fishery parameters such as fishing mortality (*F*), and thus, provided a comprehensive assessment of southern flounder status in the U.S. South Atlantic. The model estimated overall declining trends in recruitment and female spawning stock biomass (SSB). Recruitment has decreased throughout the time-series from approximately 13 million recruits in 1989 to approximately 4 million recruits in 2017 (Figure 11). The model also predicted a decline in SSB beginning in 2007, which corresponds with an increase in *F* beginning in 2007 with a time-series high in 2013 (Figure 12; Figure 13).

The model estimated $F_{35\%}$ (fishing mortality target) as 0.35 and $F_{25\%}$ (fishing mortality threshold) as 0.53. Estimated fishing mortality in 2017 was 0.91, which is higher than the *F* threshold of 0.53 and indicates overfishing is occurring (Figure 12). The probability the fishing mortality in 2017 was above the threshold value of 0.53 is 96.4%, whereas there is a 100% chance fishing mortality in 2017 was above the target value of 0.35.

Amendment 2 sustainability benchmarks were calculated using projected SSB values modeled using estimates of fishing mortality associated with a SPR 25% (threshold) and SPR 35% (target) instead of using static estimates of SPR as used in Amendment 1. Static SPR estimates only reflect changes in fishing mortality not SSB. The ASAP model estimated a value of 5,452 metric tons (approximately 12.0 million pounds) for $SSB_{35\%}$ (SSB target) and a value of 3,900 metric tons (approximately 8.6 million pounds) for $SSB_{25\%}$ (SSB threshold). The estimate of SSB in 2017 is 1,031 metric tons (approximately 2.3 million pounds), which is lower than the SSB threshold of 3,900 metric tons and indicates the stock is overfished (Figure 13). The probability that SSB in 2017 was below the threshold and target value (3,900 and 5,452 metric tons, respectively) is 100%.

V. AUTHORITY

North Carolina General Statutes
G.S. 113-134 RULES
G.S. 113-182 REGULATION OF FISHING AND FISHERIES
G.S. 113-182.1 FISHERY MANAGEMENT PLANS
G.S. 143B-289.52 MARINE FISHERIES COMMISSION – POWERS AND DUTIES

North Carolina Marine Fisheries Commission Rules
15A NCAC 03H .0103 PROCLAMATIONS, GENERAL
15A NCAC 03M .0503 FLOUNDER

VI. MANAGEMENT STRATEGIES FOR SUSTAINABLE HARVEST

The management measures implemented from the original FMP (2005), Amendment 1 (2013), and Supplement A to Amendment 1 as modified by the Aug. 17, 2017 settlement agreement (2017) have not resulted in the necessary decrease in fishing mortality and increase in SSB to end the stock's overfishing or overfished status, thus further reductions are necessary (NCDMF 2005, 2013, 2017a). Management measures will be selected and implemented based on the allowable total removals (landings and dead discards) calculated related to the 2017 fishing mortality estimates of the terminal year of the stock assessment through projections.

Projections for Rebuilding and Reductions

North Carolina General Statute 113-182.1 mandates that fishery management plans shall: 1) specify a time period not to exceed two years from the date of adoption of the plan to end overfishing, 2) specify a time period not to exceed 10 years from the date of adoption of the plan for achieving a sustainable harvest, and 3) must also include a standard of at least 50% probability of achieving sustainable harvest for the fishery. Sustainable harvest is defined in North Carolina General Statute 113-129(14a) as "the amount of fish that can be taken from a fishery on a continuing basis without reducing the stock biomass of the fishery or causing the fishery to become overfished."

To meet statutory requirements, calculations were made to determine the reductions in total coast-wide removals (all fishery removals from each of the four states) necessary to end overfishing within two years and recover the stock from an overfished status within the 10-year period. To reach the fishing mortality threshold and end overfishing within two years, a 31% reduction in removals is necessary, while a 51% reduction is necessary to reach the fishing mortality target. However, while both reductions are enough to end overfishing in two years, neither are enough to end the overfished status within the 10-year time period (Figure 14).

An additional series of projections was performed to determine the reductions in total coast-wide removals necessary to end the overfished status by reaching the SSB threshold within 10 years and reaching the SSB target within 10 years. Projections were conducted for years 2018–2050 using the AgePro software version 4.2.2 (Brodziak et al. 1998). Four scenarios were performed that would achieve a sustainable harvest:

1) Determine F needed to end overfished status (i.e., reach the SSB threshold) within 10 years
2) Determine F needed to reach the SSB target within 10 years
3) Determine F needed to reach a value between the SSB threshold and target within 10 years
4) Determine F as a result of a partial moratorium (as requested by the MFC)

Projections assume all four states implement measures for the reductions required to rebuild SSB. In addition, projections detailing changes in SSB assume the shrimp trawl fleet removals will continue in all scenarios. However, the partial moratorium projection also assumes no removals from the commercial or recreational fisheries, whereas less restrictive scenarios account for the specified volume of removals including harvest and dead discards. These projections provide a mathematically optimistic rebuilding schedule for SSB and are unlikely to be fully achieved given

the disparity of regulating commercial and recreational gear removals and without comparable management action from the other southeastern states. For further information on the interjurisdictional nature of this species, please see the Interjurisdictional Management section below.

All projections estimate necessary changes to fishing mortality when compared to the terminal year (2017) fishing mortality identified in the stock assessment. In addition, the projections assumed management would start in 2019 and the 10-year rebuilding deadline would be 2028. The projection scenarios are constrained to the current management regulations, including size limits, creel limits, and gear requirements.

Baseline projections were performed to provide guidance on a scenario where fishing continues with no reductions in removals. Under the assumption that fishing mortality continues at recent levels (F2017=0.91) and the predicted declining trend in recruitment continues, projections indicate SSB will continue to decline (Figure 15). Other projection scenarios were carried out to determine the fishing mortality and the associated reduction in total removals (from 2017 levels and defined for the purpose of this document as the total pounds from observed harvest and dead discards within a fishery) necessary to end the overfished status (i.e., reach the SSB threshold), to reach the SSB target, and to reach a value between the SSB threshold and target within 10 years (by 2028, assuming management measures begin in 2019). The projections indicate a fishing mortality of 0.34 is needed for the SSB to reach the SSB threshold by 2028 and end the overfished status, as is statutorily required (Figure 16). This will require a 52% reduction in total removals coast wide. To reach the SSB target by 2028, fishing mortality would need to be lowered to 0.18 (Figure 17). This will require a 72% reduction in total removals coast wide. To reach a value of SSB between the threshold and the target, fishing mortality would need to be lowered to 0.26 (Figure 18). This will require a 62% reduction in total removals coast wide. All projections are associated with at least a 50% probability of achieving sustainable harvest for the fishery. These three scenarios for rebuilding SSB meet the statutory requirement to end overfishing in two years.

The Southern Flounder Stock Assessment group has developed allowable harvest levels based on coast-wide reductions (North Carolina to the east coast of Florida) necessary for coast-wide stock rebuilding. However, in developing management measures, the NCDMF has applied the reductions only to North Carolina's portion of total removals through the time series of this assessment.

For the purpose of this document total removals are defined as the total pounds of landed southern flounder plus dead discards. Dead discards are comprised of fish that were dead upon retrieval of gear and not harvested and fish that were released alive that experience delayed mortality. The discard mortality rate for recreationally released southern flounder is 9%, and for commercially released flounder from gill nets is 23% (Lee et al. 2018). Management measures specific to shrimp trawl bycatch were not included here because the estimates of discards and reductions needed could not be broken out by state as the calculations are coast-wide. The current level of discards for shrimp trawls was assumed to continue into the future and was maintained as a fleet when estimating necessary reductions. In addition, when the effects of removing shrimp trawl bycatch were analyzed during sensitivity analyses, they did not have an impact on the model results. The discussion below includes specific management measures that are quantifiable and projected to meet the reduction in southern flounder total removals needed to end overfishing within two years

and achieve sustainable harvest within 10 years with at least a 50% probability of success as outlined in North Carolina General Statute 113-182.1. *Status quo*, or maintaining current regulations as are, does not meet the necessary reductions to end overfishing or the overfished status within the required time frame. As a result, *status quo* is not an option in Amendment 2.

Several management tools were explored to achieve North Carolina's contribution to sustainable harvest in the southern flounder fishery. Static quota, dynamic quota, slot limits, changes in size limits, and gear changes related to size limit changes, and species-specific management are not considered feasible options to address sustainable harvest in Amendment 2 due to the accelerated timeline and the immediate need to implement management measures to reduce harvest before the fall 2019 fishing season. The projections assume management would start in 2019 and the 10-year rebuilding period would need to be met by 2028; delayed implementation will further increase the magnitude of necessary reductions. Monitoring of static quotas cannot be implemented in a short time frame as they require the Division to develop permits, evaluate the existing quota monitoring system to determine if southern flounder can be included without major revision, determine if additional staff would be necessary to monitor the quota, develop a means to verify reporting requirements, and identify the level of reporting needed (daily, weekly, monthly). In addition to logistics, the quota itself would need to be finalized, accountability measures for both the commercial and recreational fisheries developed, and the NCDMF would also need to determine what percentage of the landed quota would trigger a closure.

Likewise, changes to size limits require additional analyses and updates to the projections as they are based on 2017 regulations (minimum size limits). Analysis is limited by data currently not available (fecundity estimates) to describe the value of varying sizes of southern flounder and their impact to SSB. Additionally, selectivity estimates need to be identified for various scenarios to determine impacts due to size limit changes including slot limits. If the minimum size limit is decreased, then conservation equivalencies need to be discussed with ASMFC to account for potential impacts to the summer flounder fishery. Static quota and the other options mentioned above will be explored in Amendment 3 to the FMP, which is concurrently being developed with the Southern Flounder FMP Advisory Committee.

The NCDMF recognizes the need for quick implementation of management strategies to reduce total removals stemming from the continued overfished and overfishing status of southern flounder that have remained unchanged since 1989 relative to the 2017 thresholds. Therefore, the NCDMF recommends seasonal closures by sector, with additional management options for the commercial sector to include areas and/or gears, as the best short-term management strategy to initiate reductions to address sustainable harvest in 2019 given the status of the southern flounder stock. Additionally, several non-quantifiable management strategies (i.e., trip limits, gear changes) could be considered in conjunction with seasonal closures to help ensure the required reductions are achieved by mitigating probable effort changes due to shortened seasons. Seasonal closures can be implemented in 2019 to reduce fishing mortality and begin stock rebuilding while other management strategies are further developed and considered as part of Amendment 3 offering a more long-term approach. Implementation of season closures in 2019 with adoption of Amendment 2 starts the time period required by statute to end overfishing and rebuild SSB. Management strategies through Amendment 3 would not restart the time requirements but to further meet the mandates of the statutes.

To account for North Carolina's portion of these reductions in the recreational and commercial fisheries, the percent reduction was applied to the total removals for North Carolina from the terminal year of the assessment, which is 2017 (Figure 19). In 2017, the commercial fishery accounted for 71.8% while the recreational fishery (hook-and-line and gigs) accounted for 28.2% of the total North Carolina removals (Figure 19).

Identify Management Areas for the Commercial Fisheries

Landings data for the southern flounder commercial fishery were reviewed by North Carolina Trip Ticket Program (NCTTP) waterbody locations to determine if natural breaks by area occurred (NCDMF 2017b), thereby allowing the fishery to operate independently within multiple management areas. Areas were investigated by NCTTP waterbody because of the migratory nature of southern flounder; as the fall weather begins to change southern flounder begin to migrate to the south and east then into the ocean. The migration begins in the northern and western sounds and tributaries of the state before it begins in the southern areas. A natural break in effort and landings occurs in several areas across the state; however, three areas appear to provide feasible management area options (Figure 20).

- A "northern" area that includes Albemarle, Currituck, Roanoke, and Croatan sounds and their associated rivers or waters north from a line extending across the 35° 46.3000'N latitude from Oregon Inlet across to mainland Hyde County.
- A "central" area including Pamlico Sound and the Tar-Pamlico, Neuse, Pungo, and Bay rivers and their tributaries north of a line starting at a point on Portsmouth Island 35° 0.0765' N – 76° 7.4123' W running westerly to Cedar Island Ferry following the shoreline to a point at Cedar Island Ferry landing 35° 1.1349' N – 76° 18.7599' W following Highway 12 to the intersection of Highway 70 to the Core Creek bridge.
- A "southern" area comprising all waters from the line described above south to the South Carolina border; including waters of Cape Lookout Bight.

These three management areas capture the seasonality of the commercial southern flounder fishery while providing each area an opportunity for harvest during a portion of the peak migration periods. Because the recreational fishery is not as reliant on the timing of fall migration for successful harvest by region there was no need to select management areas within the recreational fishery.

Identify Seasonal Time Frames

Landings data for the southern flounder commercial and recreational fisheries were evaluated to determine how landings fluctuate during the year. This helped to identify what time periods would allow for the most productive fishery while meeting the necessary reductions in total removals. As of 2019, commercial harvest of southern flounder is allowed from Jan. 1 through Nov. 30, while recreational harvest can occur all year. Commercial landings remain low through the majority of the first half of the year and begin to increase in late summer and peak in October and early November (Figure 8). These times vary by location and gear but typically landings increase in the Albemarle Sound area (northern) in early September, Pamlico Sound (central) in mid- to late September, and Core Sound and south (southern) by October. One exception is in the southern portion of the state where the commercial gig fishery harvests flounder beginning in early summer.

Recreational hook-and-line harvest is low in the early months of the year, begins to increase in May and June, and remains high through the summer before dropping off in October (Figure 7). The recreational gig fishery shows a similar pattern in seasonality with a peak in harvest in the summer.

Reducing discards is extremely important for rebuilding the stock and meeting the necessary reductions in total removals. Therefore, significant periods without commercial gear that interact with flounder in the water and without targeted recreational trips will be necessary in order to reduce discards. Identifying time periods when southern flounder harvest is low, and the harvest of other species will not be significantly impacted confounds identifying potential management options. Due to the large volume of landings that occur in the summer and fall along with the necessary reductions required, any fishing season selected will be very short. After reviewing commercial landings data by day, the fall fishery was identified as the most productive portion of the commercial targeted southern flounder fishery. Varying start dates can be selected but landings data show the earlier the start date the earlier the total allowable removals will be harvested. Also, with the earlier start dates, most of the harvest would come from gigs and gill nets, severely limiting harvest from pound nets. Flounder pound nets have a less protracted season and only operate in the fall. To maximize the commercial harvest period and maintain equitability across gears in the commercial fishery, the southern flounder commercial fishery would need to operate somewhere between the first of September and end of November, but the timing may need to account for variation by area or gear.

MRIP harvest data was analyzed by two-week intervals to identify appropriate recreational southern flounder fishing seasons. The recreational fishery peaks in mid-summer so to maximize opportunity and minimize discards harvest should be allowed to occur within a defined window between May and October. A large portion of the recreational harvest occurs in July, so the length of a season will be significantly reduced if that month is included in any selected season. Delaying harvest until August will maximize season length while still overlapping a portion of the peak harvest period.

Establish Seasonal Closures by Area for the Commercial Fishery

North Carolina commercial harvest accounts for 38.3% of total coast-wide removals (71.8% of total North Carolina removals in 2017) (Figure 3; Figure 19). Dead discards are a minor component of the removals and accounted for 0.2% of North Carolina total commercial removals in 2017. To meet the required reductions in total removals, the NCDMF recommends separating the commercial southern flounder fishery into three management areas as described above and reducing the 2017 removals associated within each area by the necessary reduction. Total removals in pounds are comprised of the landings plus estimates of dead discards from the commercial gill net fishery.

Flounder landings reported through the NCTTP are not broken out by species. To determine the commercial landings of each species, it is assumed that all flounder harvested from internal waters are southern flounder, while all flounder taken from the ocean are summer flounder. The NCDMF determined from dependent sampling efforts of commercial fish houses that southern flounder make up less than 1% of the catch from ocean waters, while summer flounder and Gulf flounder account for approximately 2% or less of the total flounder harvested from internal waters (NCDMF unpublished data).

Once the level of allowable removals by area was calculated, commercial removals that occurred from non-targeted flounder gear such as fyke nets, crab pots, and trawls were compiled. These "other gears" removals comprise approximately 0.6% of the overall total commercial removals. To minimize regulatory burden on the "other gear" fisheries, their removals were set at the 2017 level and subtracted from the allowable harvest. (Table 4) prior to computing the allocation for targeted commercial fisheries of gill net, pound net and gig. Daily harvest values were then summed across various time periods and averaged across a 10-year period to identify dates the fishery could operate and provide the best chance to not exceed the identified level of catch. To maximize opportunity and maintain the fishery during periods when southern flounder are the target species, a start date of Sept. 15 was selected for each area. However, additional options are available (Tables 5, 6, and 7) and will be further considered after review of committees and public comment. To meet the required reductions, it is necessary to remove gears (e.g., anchored large mesh gill nets, flounder pound nets, and large mesh RGCL gill nets) from the water during closed seasons in internal waters where southern flounder discards are likely to occur. Potential exceptions can be allowed for commercial large mesh gill net fisheries that target American and hickory shad and catfish species if these fisheries are only allowed to operate during times of the year and locations where bycatch of southern flounder is unlikely. Any additional discards created during closed periods will negatively impact expected reductions. It is important to note that any selected open season does not take precedent over gill net regulations necessary to maintain compliance through incidental take permits for sea turtles and Atlantic sturgeon, therefore the seasons for gill nets may not be open for the times identified herein if allowable takes for endangered species are reached.

Establish Seasonal Closures by Area for the Commercial Fishery to Reduce F to the Overfishing Threshold

A 31% reduction in total removals is necessary to reduce fishing mortality to the threshold and end overfishing within the required two-year time period. **This does not rebuild the stock to end the overfished status.** The 31% reduction in total removals allows for 965,326 pounds of allowable commercial removals of which 8,416 pounds will be available for non-targeted "other" gears (Table 4). This reduction gives the northern area allowable removals of 224,250 pounds, the central area allowable removals of 480,473 pounds, and the southern area allowable removals of 252,187 pounds (Table 4). With a Sept. 15 start date the northern area will meet their removal level on average by Oct. 26, the central area by Nov. 11, and the southern area by Nov. 25 (Table 5; Figure 21).

Establish Seasonal Closures by Area for the Commercial Fishery to Increase SSB to the Threshold

A 52% reduction in total removals is necessary to allow the SSB to increase to the threshold within the required 10-year time period. The 52% reduction in total removals allows for 671,531 pounds of allowable commercial removals of which 8,416 pounds will be available for non-targeted "other" gears (Table 4). This reduction gives the northern area allowable removals of 155,834 pounds, the central area allowable removals of 332,956 pounds, and the southern area allowable removals of 174,325 pounds (Table 4). With a Sept. 15 start date the northern area will meet their removal level on average by Oct. 17, the central area by Oct. 24, and the southern area by Nov. 15 (Table 5; Figure 21).

Establish Seasonal Closures by Area for the Commercial Fishery to Increase SSB between the Threshold and Target

A reduction of 62% in total removals will end overfishing and achieve sustainable harvest by rebuilding SSB between the threshold and target within the required 10-year time period. The 62% reduction in total removals allows for 531,629 pounds of allowable commercial removals of which 8,416 pounds will be available for non-targeted "other" gears (Table 4). This reduction gives the northern area allowable removals of 123,255 pounds, the central area allowable removals of 262,710 pounds, and the southern area allowable removals of 137,248 pounds (Table 4). With a Sept. 15 start date the northern area will meet their removal level on average by Oct. 13, the central area by Oct. 17, and the southern area by Nov. 2 (Table 5; Figure 21).

Establish Seasonal Closures by Area for the Commercial Fishery to Increase SSB to the Target

A 72% reduction in total removals is necessary to allow the SSB to increase to the target within the required 10-year time period. The 72% reduction in total removals allows for 391,726 pounds of total removals of which 8,416 pounds will be available for non-targeted "other" gears (Table 4). This reduction gives the northern area allowable removals of 90,675 pounds, the central area allowable removals of 192,464 pounds and the southern area allowable removals of 100,171 pounds (Table 4). With a Sept. 15 start date the northern area will meet their removal level on average by Oct. 6, the central area by Oct. 11, and the southern area by Oct. 20 (Table 5; Figure 21).

Establish Seasonal Closure for the Recreational Fishery

North Carolina recreational harvest accounts for 21.1% of the total recreational coast-wide removals (Figure 5). The recreational fishery accounts for 28.2% of the total removals in North Carolina; 26.0% of the total removals were from recreational harvest and 2.2% from recreational dead discards (Figure 19). In 2017, harvest accounted for 92% and dead discards accounted for 8% of the total North Carolina recreational removals. In the last 10 years, the proportion of dead discards in the total removals for the recreational fishery has been of a similar magnitude. North Carolina represents the largest proportion of southern flounder released by recreational anglers in the South Atlantic (Figure 10). Current regulatory measures have resulted in a ratio of nine discarded fish for every one fish harvested by hook-and line in North Carolina in 2017. Dead discards were identified at a rate of 9% of the recreational releases (discard mortality rate). Applying a weight of 0.21 pounds per released fish results in 37,597 pounds of dead discards for 2017. In 2017, the recreational hook-and-line fishery harvested 451,126 pounds of southern flounder. This added to the dead discards (37,597 pounds) results in 488,723 total pounds of southern flounder removed in the recreational hook-and-line fishery. In addition to the recreational hook-and-line fishery, the recreational gig fishery was examined to identify possible seasons to achieve necessary reductions. Gig harvest accounted for 11% of the total recreational harvest in 2017, with dead discards making up 2.6% of the total gig removals. The recreational gig fishery total removals in 2017 was 57,019 pounds. It is necessary to maintain concurrent seasons for the recreational hook-and-line and gig fisheries to keep from undermining the success of achieving necessary reductions.

Once the level of harvest for each reduction value was identified, catch from the MRIP was analyzed by two-week increments (the finest level of detail available) and summed to determine

seasonal dates the fishery could operate while meeting the necessary reduction. When the recreational fishery is closed, recreational harvest of flounder in both internal and ocean waters will be unlawful as all flounder species (southern, summer, Gulf, etc.) are currently managed collectively in North Carolina.

Establish Seasonal Closure for the Recreational Fishery to Reduce F to the Overfishing Threshold

A reduction of 31% in total removals is necessary to reduce fishing mortality to the threshold and end overfishing within the required two-year time period. **This does not rebuild the stock to end the overfished status.** This equates to a total allowable removal of 337,219 pounds from the recreational hook-and-line fishery. Based on available harvest information seasonal dates that most closely meet the necessary reduction were identified as June 1 through Sept. 15 (Table 6).

Applying a 31% reduction leaves 39,343 pounds of allowable removals for the recreational gig fishery. Conducting the same two-week analysis as the hook-and-line fishery identified a 69% reduction in removals if the gig fishery operates during the same season, June 1 through Sept. 15 (Table 7).

Establish Seasonal Closure for the Recreational Fishery to Increase SSB to the Threshold

A reduction of 52% in total removals is necessary to allow the SSB to increase to the threshold within the required 10-year time period. This equates to a total allowable removal of 234,587 pounds from the recreational hook-and-line fishery. Based on available harvest information seasonal dates that most closely meet the necessary reduction were identified as July 16 through Sept. 30 or Aug. 1 through Sept. 30 (Table 6). It should be noted that the July 16 through Sept. 30 season will only result in a 51% reduction for the recreational hook-and-line fishery. This is the closest estimated reduction to the required 52% since MRIP estimates cannot be broken out into less than two-week windows.

Applying a 52% reduction leaves 27,369 pounds of allowable removals for the recreational gig fishery. Conducting the same two-week analysis as the hook-and-line fishery results in a 77% reduction in removals if the gig fishery operates during the July 16 through Sept. 30 season, or an 80% reduction in removals if the gig fishery operates during the Aug. 1 through Sept. 30 season (Table 7).

Establish Seasonal Closure for the Recreational Fishery to Increase SSB between the Threshold and Target

A reduction of 62% in total removals will end overfishing and achieve sustainable harvest by rebuilding SSB between the threshold and target within the required 10-year time period. This equates to a total allowable removal of 185,715 pounds from the recreational hook-and-line fishery. Based on available harvest information seasonal dates that most closely meet the necessary reduction were identified as Aug. 1 through Sept. 30 (Table 6).

Applying a 62% reduction leaves 21,667 pounds of allowable removals for the recreational gig fishery. Conducting the same two-week analysis as the hook-and-line fishery results in an 80% reduction in removals if the gig fishery operates during the Aug. 1 through Sept. 30 season (Table 7).

Establish Seasonal Closure for the Recreational Fishery to Increase SSB to the Target

A 72% reduction in total removals is necessary to allow the SSB to increase to the target within the required 10-year time period. This equates to a total allowable removal of 136,843 pounds for the recreational hook-and-line fishery. Based on available harvest information a single season from Aug. 16 through Sept. 30 was identified that meets the necessary reduction (Table 6).

Applying a 72% reduction leaves 15,965 pounds to be harvested in the recreational gig fishery. Conducting the same two-week analysis as the hook-and-line fishery identified an 84% reduction in removals if the recreational gig fishery operates during the same season, Aug. 16 through Sept. 30 (Table 7).

Establish Seasonal Closure for the Recreational Commercial Gear License (RCGL) Fishery

Recreational use of limited commercial fishing gears is allowed in North Carolina and is subject to the same reductions as the other recreational and commercial fisheries. Calculating reductions for the RCGL fishery is not possible as collection of RCGL harvest data has not occurred since 2008. Multiple management changes have also occurred since 2008, thus reducing the reliability of the data for estimating reductions for Amendment 2. The use of commercial gears for recreational purposes is also only allowed during an open recreational and commercial fishing season that allows the specific gear, and the user is only allowed harvest that does not exceed the recreational limits. Due to these requirements, the only option available for harvest of flounder using a RCGL is during a period of time when the commercial and recreational fisheries are open simultaneously. Based on the above discussion RCGL gear used for harvesting southern flounder could operate between Sept. 15 and Sept. 30.

Establish a Partial Moratorium for the Commercial and Recreational Fisheries

For Amendment 2 a partial moratorium would prohibit the use of commercial and recreational gears to target southern flounder. In addition, it does not allow for any removals including incidental discards through commercial and recreational gears not targeting southern flounder, but it does allow for removals that occur through the shrimp trawl fleet. Implementation of a partial moratorium on the commercial and recreational fisheries meets the statutory requirements to end overfishing within two years and the overfished status within the 10-year time period. A projection that incorporates both commercial and recreational reductions shows the SSB rebuilding to the threshold by 2023, earlier than any other reduction scenario (Figure 22).

Additional Management Strategies

The recommendation of a seasonal approach presents some concern, as seasons do not enforce a maximum removal level on the fishery and only limit the time when targeted harvest can occur. Seasonal closure concerns include the potential to concentrate fishing effort during the open season, potentially altering fishing behaviors from previous years that were used to estimate harvest windows; that is, fishing effort may increase during the open season and lead to higher than predicted removals. To mitigate these concerns the NCDMF is evaluating additional specific quantifiable and non-quantifiable management measures, to augment the seasonal closures, that may serve to improve the overall southern flounder stock by helping to ensure total removals are reduced and southern flounder SSB and recruitment increase. In other words, incorporating management strategies in addition to seasonal closures may be necessary to make a seasonal

closure approach more effective in constraining harvest to the anticipated levels. These additional strategies may not be quantifiable in this amendment but serve the purpose of addressing fishing behavior and changes in effort to minimize the possibility of catching southern flounder in a greater volume than predicted.

These potential additional strategies include items carried over from Amendment 1 and Supplement A as modified by the Aug. 17, 2017 settlement agreement.

Amendment 1 Management Carried Forward in Amendment 2

The following management measures from Amendment 1 and Supplement A to Amendment 1 are incorporated into Amendment 2 upon its adoption.

- From the Southern Flounder FMP Amendment 1:
  - Management measures including limiting the number of fishing days per week and the amount of yardage allowed for large mesh gill nets in various areas of the state;
  - A minimum distance (area dependent) between gill net and pound net sets, per NCMFC Rule 15A NCAC 03J .0103 (d); and
  - A recreational minimum size limit of 15 inches TL.
- From Supplement A to the Southern Flounder FMP Amendment 1, as modified by the Aug. 17, 2017 settlement agreement:
  - A commercial minimum size limit of 15 inches TL;
  - A minimum mesh size of 6.0-ISM to harvest southern flounder from a gill net; and
  - A minimum mesh size of 5.75-ISM for pound net escape panels.

Additionally, the recreational bag limit of no more than four flounder per person per day will be maintained in Amendment 2. This bag limit is required through the N.C. Fishery Management Plan for Interjurisdictional Fisheries to maintain compliance with the ASMFC Summer Flounder, Scup, and Black Sea Bass FMP Addendum XXVIII. It is important to note, the December commercial closure period from Amendment 1 will no longer be in effect, as it will be encompassed by any seasonal closure periods implemented by the adoption of Amendment 2.

In addition to those items described above, the following potential options or strategies may mitigate expansion in effort due to shortened seasons and keep estimates more in line with projections.

Non-Quantifiable Harvest Reductions

There are two categories of management measures: quantifiable and non-quantifiable. "Quantifiable" are those reductions, as discussed in previous sections, that can be measured in terms of the impact they will have on reducing removals of southern flounder. "Non- Quantifiable" measures are those measures that will likely reduce removals, but the magnitude of the impact can only be qualified. This does not mean that non-quantifiable measures are not important to consider in management, they merely are not able to be included in the percent reduction needed to end the overfishing/overfished status as statutorily required. If non-quantifiable measures are implemented, future stock assessments will indirectly reflect their effect on the fishery status along with the impact of the quantifiable measures. These management strategies are intended to help constrain fishing effort in order to ensure required reductions are achieved; these are needed as the

seasons do not cap total removals as a quota would. Various non-quantifiable management options under consideration include:

- trip limits for the commercial gig and pound net fisheries;
- limiting the number of fishing days per week in the large mesh gill net fishery as a means to control effort in the fishery;
- limiting the fishing times in the large mesh gill net fishery as means to control effort in the fishery;
- yardage reductions; and
- prohibiting the use of picks when removing undersized fish from pound nets.

Trip Limits

As of 2019 there are no trips limits in place for the southern flounder commercial fishery. However, as seasons do not create a cap on harvest but only limit harvest to certain time periods, trip limits may enhance the effectiveness of Amendment 2. Trip limits are generally used within the confines of a quota to prevent harvesting the available amount of fish too quickly and to avoid exceeding the quota (overage). In the case of Amendment 2, the proposed seasons are meant to act in a similar capacity as a quota. NCMFC Rule 15A NCAC 03M .0503 allows for the Fisheries Director, by proclamation, to specify the quantity of flounder landed within the flounder fishery. To help ensure the required reductions are achieved, trip limits for pound nets and gigs could be recommended. To calculate the trip limits for the gig and pound net fisheries, average landings for the past 10 years by the areas proposed were reviewed in conjunction with the numbers of trips with landings in increments for each area based on the 10-year average for that fishery.

For the gig fishery, a trip limit in numbers of fish, not pounds, is needed for the restriction to be enforceable. To calculate this, the pounds harvested were converted to numbers of fish based on an average of 2.56 pounds per gigged fish as determined from commercial fish house sampling. Proposed trip limits for the commercial gig and pound net fishery have not be determined at this time, but information is available to identify the volume of trips that remove southern flounder based on various intervals (Table 8; Table 9).

With Amendment 2, trip limits for gill nets to minimize the impacts of additional discards to the total removals in 2019 are not recommended. Trips limits on gill net fisheries create additional discards, as captured fish in excess of a specified trip limit would not be retained but released with an estimated mortality of 23%. There are concerns with trip limits for the pound net fishery, particularly if set too low. Since southern flounder can be held in pound nets, it is possible for fishermen to hold southern flounder until they can be landed. Multiple people can harvest from a single operation in order to land the fish available. If the pound net trip limit is set too low, safety becomes a consideration as well and fisherman may be forced to fish their sets in unfavorable weather conditions; currently, sets are fished on good weather days, not every day.

Fishing Times

Pursuant to NCMFC Rule 15A NCAC 03J .0103 the Fisheries Director may, by proclamation, specify the means and methods for setting gill nets. Per proclamation it is unlawful to use gill nets with a stretched mesh length of 4.0 inches through 6.5 inches for daytime sets in Management Units B, D2, and E; only single overnight soaks are permitted where nets may be set no sooner

than one hour before sunset and must be retrieved no later than one hour after sunrise the next morning. In Management Units D2 and E, overnight sets are allowed five out of seven days; in Management Unit B four out of seven days. Proclamation limits Management Unit A, sub unit A1 to single overnight soaks four out of seven days. The remainder of Management Unit A, which includes Albemarle Sound and its tributaries, as well as the Neuse and Tar/Pamlico rivers are currently exempt from prohibitions on the setting of gill nets and are required to actively fish net sets at least once during a 24-hour period no later than 12 noon each day. One recommendation to help ensure required reductions are achieved could be for gill nets set in the Albemarle Sound and its tributaries as well as the Neuse and Tar/Pamlico rivers to also be reduced to single overnight soaks where nets may be set no sooner than one hour before sunset and must be retrieved no later than one hour after sunrise the next morning. The number of allowable fishing days in these areas, unless otherwise stated in proclamation, could be reduced to setting Sunday night through Thursday night (five out of seven days). Changes to fishing times would bring consistency between soak times across areas of the state and limit potential discards.

Gear Changes

Gill Nets

Pursuant to NCMFC Rule 15A NCAC 03J .0103 the Fisheries Director may, by proclamation, specify the net number and length for setting gill nets. Per proclamation it is unlawful to use large mesh gill nets more than 2,000 yards in length in Management Units A, B and C, and more than 1,000 yards in length in Management Units D1, D2 and E. Table 10 provides the average yards of large mesh gill nets fished by Management Unit for 2016-2017. These values were calculated from observer trips and responses from fishermen during fish house sampling. One recommendation to help ensure required reductions are achieved could be to further reduce the maximum yardage allowed, which could prevent fishermen from increasing the total length of large mesh gill nets set to offset the proposed shortened seasons.

Pound Nets

The use of puncturing devices (including fish picks, gaffs, gigs, and spears) could be prohibited when removing undersized flounder from a pound net. This would minimize additional discards to the total removals.

Socioeconomic Impacts to the Southern Flounder Commercial and Recreational Fisheries

North Carolina General Statute 113-182.1(b)(1) stipulates fishery management plans will include information about the social and economic impact of the fishery to the state. Despite the negative connotation of the term "impact", it includes benefits of the fishery as well as costs. The socio-economic information presented is about the current fishery and is not intended to be used to predict potential impacts from management changes. However, this and other information pertaining to fishery management plans is included to help inform decision-makers regarding the long-term viability of the state's commercially and recreationally significant species or fisheries.

IMPLAN economic impact modeling software is used to generate an input-output model of economic impacts associated with recreational southern flounder fishing (IMPLAN Group, LLC. 2013. IMPLAN System, Version 3.1.1001.2. Huntersville, NC. www.implan.com.) Input-output modelling and analysis provide a means to examine inter-industry relationships within an economy

and relationships between businesses and final consumers. IMPLAN is a regional input-output modeling system consisting of regional data bases and trade flow data. IMPLAN is used by several state agencies, universities and federal agencies, including the U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA) Fisheries, the U.S. Army Corps of Engineers, the National Park Service, and the Bureau of Land Management. Expenditure estimates are input into the appropriate industry sector and the model generates estimates for three types of impacts: employment, income, and output. Output is the gross sales impact from businesses within the economic region affected by an activity. Labor income impacts include personal income (wages and salaries) and proprietors generated as a result of the economic activity in a target area. Employment impacts are the estimated jobs generated from said economic activity.

Quantifying the potential economic impacts to the commercial and recreational fisheries has several uncertainties discussed below, and the commercial and recreational impact estimates cannot be directly compared due to how they are calculated. For a detailed explanation of the methodology used to estimate the economic impacts please refer to the NCDMF's License and Statistics Section Annual Report (NCDMF 2018b). Each model is estimated using the best available data to capture economic activity in each sector. However, the data and the activity being captured in each sector are not the same. The commercial fishing sector is a predefined industry in IMPLAN that can be custom tailored based on NCTTP data. It is a straightforward impact assessment because it is a single industry demand change based on the ex-vessel value of landings. IMPLAN's multipliers and inter-industry transactional data are well defined for this industry. The recreational sector does not have a defined single industry within IMPLAN. Recreational angling economic activity is measured through expenditures in a variety of industries. Angler trip expenditures (fuel, bait, ice, food, lodging, etc.) occur across a variety of industries. The recreational impact model in its nature is of larger magnitude than the commercial aspect because it is describing spending changes in a greater variety of industries. Commercial fishing is driven by inter-industry (indirect) transactions, where recreational fishing is driven by induced household spending. Typically induced impact magnitudes are higher by nature especially in rural areas because of the natural way industries are located. Household demand for lower order goods can be met with relative ease in rural areas but inputs are typically imported.

Commercial Impacts

The economic impact estimates presented represent those of commercial southern flounder harvesters, dealers, and processors and are calculated via the NCDMF commercial fishing economic impact model. The model now includes contributions from wholesalers, distributors, and retailers as sourced from NOAA's most recent Fisheries Economics of the U.S. These estimates are a product of IMPLAN economic impact modeling software customized with data from the NCTTP used as the primary inputs. Output is the gross sales impact from businesses within the economic region affected by an activity. Labor income impacts include personal income (wages and salaries) and proprietors generated because of the economic activity in a target area. Employment impacts are the estimated jobs generated from said economic activity (Table 11).

Due to the reductions in landings that are required, the commercial fishery will likely see a reduction in ex-vessel value of the fishery. Decreased supply of the commercial fishery will likely cause an acute jump in the average ex-vessel price per pound. Past landings and value have fluctuated widely. Ex-vessel prices fluctuate frequently and are often influenced by other substitute

fisheries such as the summer flounder fishery. Southern flounder have exhibited a relatively flexible price elasticity of supply; meaning that a change in the price results in a bigger proportional change in supply. The management options presented here do not propose to explicitly remove participants in the fishery moving forward, although the potential for decreased profitability from reduced landings may cause some to exit the fishery.

Recreational Impacts

The economic impact estimates presented for southern flounder recreational fishing represent the economic activity generated from trip expenditures. These estimates are a product of annual trip estimations originating from the NOAA Fisheries MRIP effort data by area and by mode (i.e., shore, for-hire, private/rental vessel, and man-made), and trip expenditure estimates from the NCDMF economics program biennial socioeconomic survey of Coastal Recreational Fishing License holders (Dumas et al. 2009; Crosson 2010; Hadley 2012; Stemle and Condon 2018). Estimates for trips by charter fishing also include average charter fees and tips paid per trip, and pier trips include average pier admission costs.

Table 12 shows the economic impacts associated with recreational southern flounder fishing in North Carolina from 2009-2017. Over the past 10 years recreational trips targeting flounder have been declining slightly, approximately 3% on average every year. In turn, recreational trip expenditures and overall economic impacts have been declining slightly as well. The top industries impacted by recreational southern flounder fishing in terms of output sales and employment are retail gasoline stores, retail sporting goods stores, retail food and beverage stores, real estate, and wholesale trade businesses. It should be noted that not included in these estimates, but often presented in NCDMF overall recreational impacts models, are the durable good impacts from economic activity associated with the consumption of durable goods (e.g., rods and reels, other fishing related equipment, boats, vehicles, and second homes). Durable goods represent goods that have multi-year life spans and are not immediately consumable. Most equipment related to fishing is considered durable goods. However, the durable good expense of anglers for a given species cannot be estimated. Durable goods expenses and impacts are estimated on an annual basis and serve to supplement angler expenditures outside of trip-based estimates.

The value of the economic impacts from the recreational fishery stem from directed southern flounder trips as well as trips that caught or harvested southern flounder. Trips that caught southern flounder that were not targeted trips are likely to remain at the same level, as flounder will still be available to catch and release during these trips. However, it is expected the total directed trips will likely be reduced if a season is implemented. This will reduce the overall expenditures anglers make annually pursuing southern flounder fishing, and in turn will reduce the economic impacts generated from those expenditures. It is difficult to determine the magnitude of potential losses to angler trips and the associated economic impacts. The NCDMF currently lacks data used in choice experiment methodologies which would enable modelling of predictive behavior of anglers in response to stated management actions. Anglers may choose to target another fishery more than not to fish all together. However, if management actions are successful, the stock would be rebuilt for long-term sustainable use. While there are acute economic costs for the proposed management actions for southern flounder, action is needed to rebuild and improve the fishery to ensure the long-term viability of the stock. Short-term economic costs are expected to be mitigated by the long-term sustainability of the fishery yielding positive economic returns into the fishery overall.

Interjurisdictional Management

While Amendment 2 will not impact other states' removals, it is important to describe the complexity of southern flounder management with regards to the continued cooperation among the state agencies involved with the stock assessment and the willingness of all states to enact management measures to rebuild the stock within their respective jurisdictional boundaries. There is currently no formal agreement in place requiring cooperation among the participating agencies on this particular stock and as a result, each South Atlantic state manages southern flounder in their own waters. Most other coast-wide stocks are managed by a larger governing body, such as the ASMFC or the South Atlantic Fishery Management Council, where states have common vested interests. The identified reductions to North Carolina's southern flounder total removals alone are likely not enough to rebuild the coast-wide stock without cooperation from the other states. In addition, future updates of this coast-wide stock assessment to monitor trends post-management changes hinge on cooperation among these partners. Discussions have taken place to continue cooperation and the NCDMF is spearheading efforts to further build collaborative relationships with these partners to ensure management of the stock provides for the best chance of recovery and sustainability. At an April 1, 2019 meeting with division directors and other representatives from all four states, the directors agreed to create a working group to continue informal collaboration to work towards coast-wide reductions within the constraints of each individual state management system.

An additional component to this complex jurisdictional situation is how requirements from the ASMFC Summer Flounder, Scup, and Black Sea Bass FMP will harmonize with certain southern flounder management strategies because of the overlap in management of the flounder species. It is possible that with certain management strategies (i.e., size limit changes), North Carolina may have to apply for conservation equivalency measures for summer flounder in order to not be found out of compliance with current interstate regulations.

Current Regulations by State

North Carolina

North Carolina's commercial flounder fishery is subject to a 15-inch TL minimum size limit in internal waters and a 14-inch TL minimum size limit in ocean waters. There is a statewide closure in internal waters from Dec. 1 through Dec. 30. All flounder pound nets are required to use escapement panels of at least 5.75-ISM. In internal waters, the use of gill nets with a stretch mesh length less than 6.0 inches is prohibited for harvesting flounder. In all estuarine areas (except Pamlico, Pungo, Bay, and Neuse rivers and the Albemarle Sound Management Area), use of large mesh gill nets is limited to four nights per week and 2,000 yards, except south of Shackleford Banks and south of the Highway 58 Bridge to the South Carolina border; this gear is allowed five nights per week with a maximum of 1,000 yards. All other areas are limited to 2,000 yards of large mesh gill net. Additionally, the gill net fishery is subject to closures and other gear restrictions by Management Unit based on interactions with sea turtles and Atlantic sturgeon, which are managed through incidental take permits issued by NOAA Fisheries under the Endangered Species Act. In crab trawls, a minimum tailbag mesh size of 4-ISM is required in western Pamlico Sound to minimize bycatch of undersized southern flounder.

Current regulations for the recreational flounder fishery include a 15-inch TL minimum size limit in internal and ocean waters, a four-fish per person per day daily creel limit, and no closed season.

South Carolina

Regulations for the South Carolina flounder fishery in 2017 (*Paralichthys* spp.) include a 15-inch TL minimum size limit and a 10 flounder per person per day bag limit, not to exceed 20 flounder per boat per day. Bag limit and minimum size limits are applicable to both hook-and-line and gig fisheries in the state. It is unlawful to gig flounder in salt water during daylight hours (excluding spearfishing). Commercial gill netting for flounder is only permitted in the Little River Inlet, a small estuary in the north of the state (no more than one hundred yards in length with a mesh size no smaller than 3.0-ISM and up to 5.5-ISM; must be attended within 500 feet).

Georgia

Current regulations for the commercial and recreational flounder fishery in Georgia include a 12-inch TL minimum size limit and a 15-fish daily bag limit. Gill nets are prohibited except for landing shad.

Florida

Current regulations for the commercial and recreational flounder fishery in Florida include a 12-inch TL minimum size limit, daily recreational bag limit of 10 fish, and harvest is limited to the use of hook-and-line, cast net, beach seine, and gigs.

Historical regulation histories for each state can be found in Lee et al. 2018.

VII. PROPOSED MANAGEMENT OPTIONS

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

The following positive and negative impacts apply to all options; specific impacts are listed with each option.

+ May increase abundance of mature females to help rebuild SSB
+ Necessary reductions come from both commercial and recreational southern flounder fisheries
+ No rule changes required
– Decreased harvest may result in economic loss to the fishery

<u>Commercial Fishery</u>

A. *Establish Seasonal Closures by Area for the Commercial Fishery to Reduce F to the Overfishing Threshold (31% reduction)*
   + Projected to meet the reduction needed for the commercial fishery to end overfishing, per statutory requirements
   + Season allows for equitability among gears
   – Possible increase in effort due to shortened season creating a “derby fishery”

– Will not meet the reduction in the commercial fishery needed to achieve a level of SSB for sustainable harvest within the 10-year time period, failing to meet statutory requirements

B. *Establish Seasonal Closures by Area for the Commercial Fishery to Reduce F and Allow the SSB to Rebuild to the Threshold (52% reduction)*
   + Projected to meet the reduction needed for the commercial fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the commercial fishery needed to achieve a level of SSB equal to or greater than the threshold, per statutory requirements
   + Season allows for equitability among gears
   – Possible increase in effort due to shortened season creating a "derby fishery"

C. *Establish Seasonal Closures by Area for the Commercial Fishery to Increase SSB between the Threshold and Target (62% reduction)*
   + Projected to meet the reduction needed for the commercial fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the commercial fishery needed to achieve a level of SSB between the threshold and target, per statutory requirements
   + Projections show rebuilding occurring more quickly than the minimum reduction and this increases the probability of reaching the threshold
   + Season allows for equitability among gears
   – Possible increase in effort due to shortened season creating a "derby fishery"

D. *Establish Seasonal Closures by Area for the Commercial Fishery to Reduce F and Allow the SSB to Rebuild to the Target (72% reduction)*
   + Projected to meet the reduction needed for the commercial fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the commercial fishery needed to achieve a level of SSB equal to the target, per statutory requirements
   + Projections show rebuilding occurring more quickly than the minimum reduction and this increases the probability of reaching the threshold
   + Season allows for equitability among gears
   – Possible increase in effort due to shortened season creating a "derby fishery"

E. *Establish a Partial Moratorium for the Commercial and Recreational Fisheries*
   + Projected to meet the reduction needed for the commercial fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the commercial fishery needed to achieve a level of SSB equal to the target, per statutory requirements
   + Projections show rebuilding occurring more quickly than the minimum reduction and this increases the probability of reaching the threshold
   + Prioritizes stock rebuilding
   - Discards due to incidental catch when targeting other species

Recreational Fishery

A. *Establish a Seasonal Closure for the Recreational Fishery to reduce F to the Overfishing Threshold (31% reduction)*
   + Projected to meet the reduction needed for the recreational fishery to end overfishing, per statutory requirements
   – Will not meet the reduction in the recreational fishery needed to achieve a level of SSB for sustainable harvest within the 10-year time period, failing to meet statutory requirements
   – Discards due to incidental catch when targeting other species

B. *Establish a Seasonal Closure for the Recreational Fishery to Reduce F and Allow the SSB to Rebuild to the Threshold (52% reduction)*
   + Projected to meet the reduction needed for the recreational fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the recreational fishery needed to achieve a level of SSB equal to or greater than the threshold, per statutory requirements
   – Discards due to incidental catch when targeting other species

C. *Establish a Seasonal Closure for the Recreational Fishery to Increase SSB between the Threshold and Target (62% reduction)*
   + Projected to meet the reduction needed for the recreational fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the recreational fishery needed to achieve a level of SSB between the threshold and target, per statutory requirements
   + Projections show rebuilding occurring more quickly than the minimum reduction and this increases the probability of reaching the threshold
   – Discards due to incidental catch when targeting other species

D. *Establish a Seasonal closure for the Recreational Fishery to Reduce F and Allow the SSB to Rebuild to the Target (72% reduction)*
   + Projected to meet the reduction needed for the recreational fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the recreational fishery needed to achieve a level of SSB equal to the target, per statutory requirements
   + Projections show rebuilding occurring more quickly than the minimum reduction and this increases the probability of reaching the threshold
   – Discards due to incidental catch when targeting other species

E. *Establish a Partial Moratorium for the Commercial and Recreational Fisheries*
   + Projected to meet the reduction needed for the recreational fishery to end overfishing, per statutory requirements
   + Projected to meet the reduction for the recreational fishery needed to achieve a level of SSB equal to the target, per statutory requirements
   + Projections show rebuilding occurring more quickly than the minimum reduction and this increases the probability of reaching the threshold

+ Prioritizes stock rebuilding
– Discards due to incidental catch when targeting other species

Additional Management Options: Non-Quantifiable Harvest Restrictions

A. *Trip Limits*
   i. Limiting numbers per trip for the commercial gig fishery
   ii. Limiting pounds per trip for the commercial pound net fishery
      + May ensure required reductions are achieved and alleviate concerns of a "derby fishery"
      – Some fisheries impacted more than others
      – Potential issue with enforceability for large volume pound net fishery

B. *Limiting Days per Week Allowed in the Neuse, Tar/Pamlico Rivers and the Albemarle Sound Areas that have Previously been Exempt*
      + May ensure required reductions are achieved
      + Reduce gear in the water
      + Consistency between harvest days across areas of the state
      + Limit the amount of potential discards
      – Some regions impacted more than others

C. *Limiting Fishing Times Allowed in the Neuse, Tar/Pamlico Rivers and the Albemarle Sound Areas that have Previously been Exempt*
      + May ensure required reductions are achieved
      + Reduce gear in the water
      + Consistency between soak times across areas of the state
      + Limit the amount of potential discards
      – Some regions impacted more than others

D. *Gear Modifications*
   i. Prohibiting the use of picks, gaffs, gigs, and spears when removing flounder from pound nets
   ii. Reducing the maximum yardage allowed in the large mesh gill net fishery
      + May ensure required reductions are achieved
      + Reduce gear in the water
      + Prevent expansion of gear
      + Limit the amount of potential discards
      – Some regions impacted more than others

VIII. RECOMMENDATION

NCDMF Recommendation

Management Carried Forward

Under the NCDMF recommendation, the following management measures from Amendment 1 and Supplement A to Amendment 1 will be incorporated into Amendment 2 management upon its adoption.

- From the Southern Flounder FMP Amendment 1:
  - Management measures limiting the number of fishing days per week and the amount of yardage allowed for large mesh gill nets in various areas of the state;
  - A minimum distance (area dependent) between gill net and pound net sets, per NCMFC Rule 15A NCAC 03J .0103 (d); and
  - A recreational minimum size limit of 15 inches TL.
- From Supplement A to the Southern Flounder FMP Amendment 1, as modified by the Aug. 17, 2017 settlement agreement:
  - A commercial minimum size limit of 15 inches TL;
  - A minimum mesh size of 6.0-ISM to harvest southern flounder from a gill net; and
  - A minimum mesh size of 5.75-ISM stretched mesh for pound net escape panels.

Additionally, the recreational bag limit of no more than four flounder per person per day will be maintained in Amendment 2. This bag limit is required through the N.C. FMP for Interjurisdictional Fisheries to maintain compliance with the ASMFC Summer Flounder, Scup, and Black Sea Bass FMP Addendum XXVIII. It is important to note that the December commercial closure period from Amendment 1 will no longer in effect, as it will be encompassed by the seasonal closure periods implemented by the adoption of Amendment 2.

Amendment 2 Management Strategy

In concurrence with the incorporated actions from Amendment 1 and Supplement A to Amendment 1 as modified by the Aug. 17, 2017 settlement agreement, the N.C. Department of Environmental Quality and the NCDMF recommend a management strategy be implemented in Amendment 2 to reduce fishing mortality in the commercial and recreational fisheries to a level that ends overfishing within two years and allows the SSB to increase between the threshold and the target within 10 years via a 62% reduction (F=0.26) in total removals in 2019 and beginning in 2020, via a 72% reduction (F=0.18) in total removals (Figure 23).

Adoption of Amendment 2 Includes Continued Development of Amendment 3

Implementation of the management strategy recommended in Amendment 2 is deemed critical to successful rebuilding of the southern flounder stock, so management actions can be implemented during the 2019 calendar year and reducing harvest is not delayed while more comprehensive strategies are developed for Amendment 3. The N.C. Department of Environmental Quality and the NCDMF recommendation includes that the adoption of Amendment 2 authorizes concurrent development of Amendment 3 and more robust management strategies. Amendment 3 will be completed as quickly as possible with the ongoing contributions of the existing FMP committee appointees. This will best serve to assist the NCDMF in development of Amendment 3, by building on the knowledge, expertise, and cooperation already underway and continue the work uninterrupted from meetings that began in January 2018.

Amendment 2 Management Recommendations

Management measures to implement the strategy from Amendment 2 include:

- The commercial harvest season will close by proclamation immediately following the August 2019 MFC meeting, the division will establish three commercial

southern flounder management areas with open flounder harvest seasons during 2019 as follows:

Northern – Sept. 15 through Oct. 13;
Central – Sept. 15 through Oct. 17; and
Southern – Sept. 15 through Nov. 2.

  - Note: Monitoring, reporting, and closure requirements identified through the NCDMF's sea turtle and Atlantic sturgeon incidental take permits will remain in effect and may impact dates identified.

- The recreational hook-and-line and gig flounder harvest season will close by proclamation immediately following the August 2019 MFC meeting and will not re-open until the identified season in 2020.
- Upon the closure of the recreational hook-and-line flounder harvest season, the RCGL large mesh gill net flounder harvest season will also close as the recreational and commercial seasons must both be open to allow this gear.

- Beginning in 2020, continue use of the three commercial southern flounder management areas with open flounder harvest seasons as follows:

Northern – Sept. 15 through Oct. 6;
Central – Sept 15 through Oct. 11; and
Southern – Sept 15 through Oct. 20.

  - Note: Monitoring, reporting, and closure requirements identified through the NCDMF's sea turtle and Atlantic sturgeon incidental take permits will remain in effect and may impact dates identified.

- Allow an Aug. 16 through Sept. 30 recreational hook-and-line and gig fishery;
- Allow RCGL large mesh gill nets to operate from Sept. 15 through Sept. 30.

Additionally, it is necessary to remove all commercial gears targeting southern flounder from the water (e.g., commercial and RCGL anchored large mesh gill nets and gigs) or make them inoperable (flounder pound nets) in areas and during times outside of the seasons implemented. This is important, as any additional dead discards will negatively impact expected reductions in discards during periods not open for southern flounder harvest and further delay rebuilding of the stock.

Exceptions will be allowed for commercial large mesh gill net fisheries that target American and hickory shad and catfish species if these fisheries are only allowed to operate during times of the year and locations where bycatch of southern flounder is unlikely.

The NCDMF recommendation also addresses possession of southern flounder during closed seasons. During the recommended closed recreational season, it will be unlawful to possess flounder in internal and ocean waters.

During the recommended closed commercial season, it will be unlawful to possess flounder harvested from the internal waters of the state. With adoption of Amendment 2, it will also be unlawful to use any method of retrieving live flounder from pound nets that cause injury to released fish (no picks, gigs, spears, etc.).

Additionally, to minimize the likelihood of creating derby fisheries and to make a seasonal closure more effective in constraining harvest to the anticipated levels, the NCDMF also recommends the following:

- reduce commercial anchored large-mesh gill net soak times to single overnight soaks where nets may be set no sooner than one hour before sunset and must be retrieved no later than one hour after sunrise the next morning in the Neuse, Tar/Pamlico rivers and the Albemarle Sound areas that have previously been exempt; and
- reduce the maximum yardage allowed in the commercial anchored large-mesh gill net fishery by 25% for each Management Unit; allowing a maximum of 1,500-yards in Management Units A, B, and C, and a maximum of 750-yards in Management Units D and E unless more restrictive yardage is specified through adaptive management through the sea turtle or sturgeon Incidental Take Permits (ITP).

The N.C. Department of Environmental Quality and the NCDMF recognize that these reductions are significant but necessary to increase the probability of successfully rebuilding this important recreational and commercial resource. The department and the NCDMF recommend a 62% reduction in 2019 and a 72% reduction beginning in 2020 for the following reasons:

- The projections were made with the assumptions that each state that participated in the coast-wide stock assessment would implement measures for the necessary reductions required to rebuild SSB. There are uncertainties surrounding the other states with implementing cooperative management and the timing of regulations if implemented.
- With the ability to be implemented in 2019, seasonal closures by area provide the best short-term management tool available. It is important to act quickly for the immediate benefit of the stock but not to such a degree that fisheries are eliminated.
- It is best for the resource in the short-term by significantly decreasing fishing pressure and allowing a greater abundance of spawning stock to emigrate to the ocean to spawn, which will ultimately enhance the likelihood of stock rebuilding. The proposed seasonal closures are based on past removals and behavior and assume effort will be consistent with what has been observed in the past. Compared to quotas, seasonal closures do not place a maximum removal level on the fishery, but simply limit the time when targeted harvest can occur. Seasonal closures do present some concerns such as the potential to concentrate fishing effort during the open season, potentially altering fishing behaviors from previous years that were used to estimate harvest windows; that is, fishing effort may increase during the open season and lead to higher than predicted removals.
- The lack of rebuilding success related to management implemented from the original FMP (2005), Amendment 1 (2013), and Supplement A to Amendment 1 as modified by the Aug. 17, 2017 settlement agreement (2017) has not resulted in the necessary increase in SSB to end the stock's overfished status, thus further reductions are necessary.

Harvest of southern flounder has already been occurring during 2019 and the seasonal closures cannot be implemented until the adoption of Amendment 2. Upon adoption of Amendment 2 the director will issue a proclamation immediately closing southern flounder harvest. The director will then issue a proclamation to open the harvest season for southern flounder consistent with the MFC selected management strategy. The NCDMF will review advisory committee and public comment prior to selecting seasons to be recommended. Seasons will still allow for some reductions and increased escapement in 2019. In 2020, reductions will more likely be realized in full, as management measures will already be in place at the start of the calendar year.

Advisory Committee Recommendations (Refer to Table 13 for a comparison of recommendations)

Southern Flounder FMP Advisory Committee

The Southern Flounder FMP Advisory Committee recommends that starting Jan. 1, 2019 a 52% reduction (F=0.34) be adopted with the following changes for the commercial fishery, calculated for the Northern, Central, and Southern areas:

- 40% reduction for the pound net fishery, with a start date of Sept. 15:
  Northern – Sept. 15 through Oct. 28;
  Central – Sept. 15 through Nov. 2; and
  Southern – Sept. 15 through Nov. 3.
- 40% reduction for the gig fishery, with a start date of April 1:
  Northern – April 1 through Oct. 24;
  Central – April 1 through Nov. 11; and
  Southern – April 1 through Aug. 25.
- For the large mesh gill net fishery, a reduction to make up the difference to yield a 52% reduction for the commercial fishery overall, with a start date of Sept. 15, recognizing that the NCDMF proposal for the RCGL large mesh gill net season of Sept. 15-Sept. 30 may be changed by this final percent reduction.

The percent reduction for the large mesh gill net fishery, based on the Southern Flounder FMP Advisory Committee recommendation, would be approximately 71% compared to the 2017 removals. This reduction to the large mesh gill net fishery is equal to 162,770 pounds in total removals. A start date of Sept. 15 results in the following seasons:

- Northern – Sept. 15 through Oct. 12;
- Central – Sept. 15 through Oct. 5; and
- Southern – Sept. 15 through Oct. 21.

The committee recommendation also includes that management measures from Amendment 1 and Supplement A to Amendment 1, as stated above in the NCDMF recommendation, be carried forward. The recommendation also maintains regulations from the ASMFC Summer Flounder, Black Sea Bass, and Scup Addendum XXVIII for recreational size and bag limit for flounder and approves the continued development of Amendment 3.

In addition, the committee recommends prohibiting the use picks, gaffs, gigs, and spears when removing flounder from pound nets. As of Jan. 1, 2020, the committee also recommends

implementing a 1,500-yard limit for large mesh gill nets in Management Unit A, a 1,000-yard limit for large mesh gill nets in Management Units B and C, and a 750-yard limit for large mesh gill nets in Management Units D and E.

Finally, the committee recommends a 52% reduction be applied to the recreational fisheries. The season for the recreational hook-and-line and gig fisheries will be July 16 through Sept. 30.

After analysis of the Southern Flounder FMP Advisory Committee recommendation, the NCDMF determined the recommendation meets the statutory requirement of ending overfishing within two years. The recommendation also meets the statutory requirement of ending the overfished status within the required 10-year time period.

Southern Advisory Committee

The Southern Advisory Committee met on June 3, 2019 and failed to reach consensus on a recommendation for draft Amendment 2.

Northern Advisory Committee

The Northern Advisory Committee met on June 3, 2019 and passed a motion supporting the NCDMF recommendation of the 62% reduction in 2019 and 72% percent reduction from 2020 forward to include management carried forward from Amendment 1 and Supplement A to Amendment 1, maintaining the size and bag limits established by the ASMFC Summer Flounder, Black Sea Bass, and Scup Addendum XXVII, and the continued development of Amendment 3. In addition, the Northern AC passed a motion asking the MFC to consider dividing the allowable days for gill netting amongst allowable fishing months for a given area due to the Sea Turtle ITP.

Finfish Advisory Committee

The Finfish Advisory Committee met on June 3, 2019 and recommended a reduced harvest of 52%, not to exceed 52%, until Amendment 3 is completed. This recommendation includes management carried forward from Amendment 1 and Supplement A to Amendment 1, maintaining the size and bag limits established by the ASMFC Summer Flounder, Black Sea Bass, and Scup Addendum XXVII, and the continued development of Amendment 3. The committee also recommended that the MFC ask the Secretary of DEQ to allow the Director of DMF to go out of compliance with ASMFC Summer Flounder Plan and adopt a 12-inch size limit and a 4-fish bag limit for southern flounder in North Carolina waters. The committee also requested the Southern Flounder AC look at a moratorium on all southern flounder harvest from Nov. 1, 2019 to Sept 1, 2022.

MFC Selected Management Strategy

IX. LITERATURE CITED

Anderson, J.D., and W.J. Karel. 2012. Population genetics of southern flounder with implications for management. North American Journal of Fisheries Management 32(4):656–662.

Brodziak, J., P. Rago, and R. Conser. 1998. A general approach for making short-term stochastic projections from an age-structured fisheries assessment model. In: F. Funk, T. Quinn II, J. Heifetz, J. Ianelli, J. Powers, J. Schweigert, P. Sullivan, and C.-I. Zhang (editors), Proceedings of the International Symposium on Fishery Stock Assessment Models for the 21st Century. Alaska Sea Grant College Program, Univ. of Alaska, Fairbanks.

Craig, J.K., and J.A. Rice. 2008. Estuarine residency, movements, and exploitation of southern flounder (*Paralichthys lethostigma*) in North Carolina. North Carolina State University, North Carolina Sea Grant, Final Report Grant 05-FEG-15, Raleigh.

Crosson, S. 2010. A Social and Economic Survey of Recreational Saltwater Anglers in North Carolina. Department of Environment and Natural Resources, Division of Marine Fisheries.

Dumas, C., J. Whitehead, C. Landry, and J. Herstine. 2009. Economic Impacts and Recreational Value of the North Carolina For-Hire Fishing Fleet. North Carolina Sea Grant Fishery Resource Grant Report 07-FEG-05.

Flowers, A.M., S.D. Allen, A.L. Markwith, and L.M. Lee (editors). 2019. Stock assessment of southern flounder (*Paralichthys lethostigma*) in the South Atlantic, 1989–2017. Joint report of the North Carolina Division of Marine Fisheries, South Carolina Department of Natural Resources, Georgia Coastal Resources Division, Florida Fish and Wildlife Research Institute, University of North Carolina at Wilmington, and Louisiana State University. NCDMF SAP-SAR-2019-01. 213 p.

Fournier, D.A., H.J. Skaug, J. Ancheta, J. Ianelli, A. Magnusson, M. Maunder, A. Nielsen, and J. Sibert. 2012. AD Model Builder: using automatic differentiation for statistical inference of highly parameterised complex non-linear models. Optimisation Methods & Software 27:233–249.

Hadley, J. 2012. A Social and Economic Profile of Ocean Fishing Piers in North Carolina. Department of Environment and Natural Resources, Division of Marine Fisheries.

IMPLAN Group, LLC. 2013. IMPLAN System, Version 3.1.1001.2. Huntersville, NC. www.implan.com

Lee, L.M., S.D. Allen, A.M. Flowers, and Y. Li (editors). 2018. Stock assessment of southern flounder (*Paralichthys lethostigma*) in the South Atlantic, 1989–2015. Joint report of the North Carolina Division of Marine Fisheries, South Carolina Department of Natural Resources, Georgia Coastal Resources Division, Florida Fish and Wildlife Research Institute, University of North Carolina at Wilmington, and Louisiana State University. NCDMF SAP-SAR-2018-01. 425 p.

Midway, S.R., S.X. Cadrin, and F.S. Scharf. 2014. Southern flounder (*Paralichthys lethostigma*) stock structure inferred from otolith shape analysis. Fisheries Bulletin 112(4):326–338.

Monaghan, J.P. 1996. Life history aspects of selected marine recreational fishes in North Carolina: Study 2 migration of Paralichthid flounders tagged in North Carolina, Completion Report, Grant F-43, North Carolina Division of Marine Fisheries, Morehead City, North Carolina. 44 p.

NCDEQ (North Carolina Department of Environmental Quality). 2016. North Carolina Coastal Habitat Protection Plan Source Document. Morehead City, NC. Division of Marine Fisheries. 475 p.

NCDMF (North Carolina Division of Marine Fisheries). 2005. North Carolina fishery management plan southern flounder (*Paralichthys lethostigma*). North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, North Carolina. 359 p.

NCDMF (North Carolina Division of Marine Fisheries). 2013. North Carolina southern flounder (*Paralichthys lethostigma*) fishery management plan: Amendment 1. North Carolina Division of Marine Fisheries, Morehead City, North Carolina. 380 p.

NCDMF 2017a. North Carolina southern flounder (*Paralichthys lethostigma*) fishery management plan: Supplement A to Amendment 1. North Carolina Division of Marine Fisheries, Morehead City, North Carolina. 83 p

NCDMF 2017b. North Carolina Division of Marine Fisheries Trip Ticket User Manual. Version 9. North Carolina Department of Environmental Quality, Division of Marine Fisheries, Morehead City, North Carolina. 43 p.

NCDMF 2018a. Southern Flounder *in* 2017 Fishery Management Plan Review. North Carolina Division of Marine Fisheries, Morehead City, North Carolina. 590 p.

NCDMF 2018b. North Carolina Division of Marine Fisheries License and Statistics Section Annual Report. North Carolina Department of Environmental Quality, Division of Marine Fisheries, Morehead City, North Carolina.

NOAA Fisheries Toolbox. 2014. Age Structured Assessment Program, version 3.0.17. [Available at http://www.nefsc.noaa.gov/nft, accessed October 2018]

Ross, S.W., J.H. Hawkins, D.A. DeVries, C.H. Harvell, R.C. Harriss Jr. 1982. North Carolina Estuarine Finfish Management Program, Completion Report for Project 2-372-R. North Carolina Department of Natural Resources and Community Development, Division of Marine Fisheries, Morehead City, N. C. 175 p.

Schwartz, F.J. 1997. Distance movements of fishes, white shrimp, and blue crabs tagged in or near the estuarine Cape Fear River and adjacent Atlantic Ocean, North Carolina, 1973 through 1978. The Journal of Elisha Mitchell Scientific Society 113:123–132.

Stemle, A., and M. Condon. 2018. Socioeconomic Survey of Recreational Saltwater Anglers in North Carolina 2016. Division of Marine Fisheries, Morehead City, N.C.

Wang, V.H., M.A. McCartney, and F.S. Scharf. 2015. Population genetic structure of southern flounder inferred from multilocus DNA profiles. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 7(1):220–232.

DRAFT DOCUMENT
SUBJECT TO CHANGE

Prepared by	Michael S. Loeffler	Anne L. Markwith
	Michael.loeffler@ncdenr.gov	Anne.Markwith@ncdenr.gov
	252-264-3911	910-796-7292

X. TABLES

Table 1. Number of Commercial Trips and Participants that landed southern flounder by gear, 2008-2017.

	Trips				Participants			
	Gear				Gear			
Year	Gigs	Gill Net	Other	Pound Net	Gigs	Gill Net	Other	Pound Net
2008	1,459	23,493	2,510	1,508	140	924	413	83
2009	1,450	23,691	2,510	1,746	143	992	426	85
2010	2,283	15,134	1,384	1,610	226	837	329	84
2011	2,076	11,403	963	1,370	212	759	250	63
2012	3,001	14,713	1,462	1,754	288	855	291	84
2013	2,408	16,968	2,094	2,111	270	933	343	82
2014	2,655	11,778	1,887	1,806	316	799	373	88
2015	2,616	8,465	1,002	1,803	307	674	249	81
2016	2,657	8,422	838	1,423	323	591	227	77
2017	2,752	12,363	943	1,908	310	713	237	88
Average	2,336	14,643	1,559	1,704	254	808	314	82

Note: Participants often participate using multiple gears and fish multiple gears per trip, individuals and trips may be duplicated across gears.

Table 2. Top five ranked species that are reported targeted in the North Carolina **recreational hook-and-line fishery**, 1981-2017. Top rank for each year is in **bold**. (Source: Marine Recreational Information Program).

	Trip Year																		
Species	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Flounder	3	**1**	2	2	2	2	3	4	4	2	2	2	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Bluefish	**1**	2	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	2	2	4	2	2	2	5
Red Drum	4	4	3	4	4	5	4	3	3	4	4	4	3	3	3	5	5	3	2
Spanish Mackerel	5	5	5	5	5	4	5	5	5	5	5	5	4	5	5	4	3	4	3
Spotted Seatrout	2	3	4	3	3	3	2	2	2	3	3	3	5	4	2	3	4	5	4

	Trip Year																	
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Flounder	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	2	3	3	3	3	3
Bluefish	4	2	4	4	3	2	4	4	4	5	5	3	4	4	5	4	4	4
Red Drum	2	3	3	3	4	5	3	2	2	3	2	4	3	**1**	**1**	**1**	**1**	**1**
Spanish Mackerel	3	4	2	2	2	4	5	5	5	4	4	5	5	5	4	5	5	5
Spotted Seatrout	5	5	5	5	5	3	2	3	3	2	3	2	**1**	2	2	2	2	2

Table 3. Management action taken as a result of Amendment 1 and Supplement A to the Southern Flounder Fishery Management Plan.

MANAGEMENT STRATEGY	OUTCOME	Source Document
Commercial: Accept management measures to reduce protected species interactions as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery. Recreational: Increase the minimum size limit to 15 inches and decrease the creel limit to six fish-20.2% harvest reduction	Commercial: No Action Required; Specific minimum measures for the flounder gill net fishery are provided in Issue Paper 10.1.1 (Amendment 1, page 129). Recreational: Proclamation FF-29-2011 (refer to Supplement A to the 2005 FMP)	Amendment 1
Status quo and address research recommendations	No Action Required	Amendment 1
Status quo (implement mediation and proclamation authority to address user conflicts with large mesh gill nets)	No Action Required	Amendment 1
Status quo (minimum distance (area dependent) between pound nets and gill nets; per rule 15A NCAC 03J .0103 (d))	No Action Required	Amendment 1
Status quo and address research recommendations	No Action Required	Amendment 1
Status quo and expand research on flatfish escape devices and degradable panels under commercial conditions to other parts of the state	No Action Required	Amendment 1
Status quo and expand research on factors impacting the release mortality of southern flounder and on deep hooking events of different hook types and sizes	No Action Required	Amendment 1
• Request funding for state observer program • Apply for Incidental Take Permit for large mesh gill net fishery • Continue gear development research to minimize protected species interactions	No Action Required	Amendment 1
Status quo minimum mesh size for escape panels (5.5-inch stretched mesh) and recommend further research on 5.75-inch stretched mesh escape panels	No Action Required	Amendment 1
Status quo minimum mesh size (5.5-inch stretched mesh)	No Action Required	Amendment 1
Increase minimum mesh size to harvest southern flounder to 6.0- inch stretched mesh Increase minimum size limit for commercial fisheries to 15 inches	Proclamation FF-3-2016 (refer to Supplement A to Amendment 1 of the 2005 FMP)	Supplement A to Amendment 1
Increase minimum mesh size for escape panels to 5.75-inch stretched mesh	Proclamation M-34-2015 (refer to Supplement A to Amendment 1 of the 2005 FMP)	Supplement A to Amendment 1
Reduce daily bag limit for recreational harvest of southern flounder from 6 fish to 4 fish	Proclamation FF-4-2017 (refer to Addendum XXVIII to ASMFC Summer Flounder, Scup, Black seabass FMP)	Addendum XXVIII to the Summer Flounder, Scup, Black seabass FMP

Table 4. Southern Flounder Amendment 2 total allowable removals (observed harvest and dead discards) in pounds by management area to meet the necessary reductions for the overfishing threshold and SSB threshold and target **of the commercial fishery** in 2019 compared to the 2017 harvest and dead discards.

Reduction	Management Area	2017 Landings Value	Dead Discards	2017 Total Catch	After Reduction	"Other" Gear Allocation	Gill Net, Pound Net, Gig Allocation
Overfishing Threshold 31%	Northern	324,779	1,014	325,793	224,797	547	224,250
	Central	700,258	2,203	702,461	484,698	3,644	480,473
	Southern	369,580	1,190	370,770	255,831	4,225	252,187
	Total	1,394,617	4,407	1,399,024	965,326	8,416	956,910
SSB Threshold 52%	Northern	324,779	1,014	325,793	156,381	547	155,834
	Central	700,258	2,203	702,461	337,181	3,644	332,956
	Southern	369,580	1,190	370,770	177,969	4,225	174,325
	Total	1,394,617	4,407	1,399,024	671,531	8,416	663,115
62%	Northern	324,779	1,014	325,793	123,802	547	123,255
	Central	700,258	2,203	702,461	266,935	3,644	262,710
	Southern	369,580	1,190	370,770	140,892	4,225	137,248
	Total	1,394,617	4,407	1,399,024	531,629	8,416	523,213
SSB Target 72%	Northern	324,779	1,014	325,793	91,222	547	90,675
	Central	700,258	2,203	702,461	196,689	3,644	192,464
	Southern	369,580	1,190	370,770	103,815	4,225	100,171
	Total	1,394,617	4,407	1,399,024	391,726	8,416	383,310

*Other gear included gear that catch southern flounder incidentally. These gears include, but aren't limited to, crab post, trawls, peeler post, fyke nets, channel nets, and seines.

Table 5. Southern Flounder Amendment 2 dates of fishery opening (formatted in **bold** font) and associated closure dates by management area necessary to meet the reductions in total removals (observed harvest and dead discards) to the overfishing threshold and SSB threshold and target **for the commercial fishery** in 2019.

		Season Start Date						
		1-Jan	**1-Feb**	**1-Mar**	**1-Apr**	**1-May**	**1-Jun**	**1-Jul**
Reduction	Management Area	Season End Date						
Overfishing Threshold	Northern	30-Sep	30-Sep	30-Sep	1-Oct	4-Oct	7-Oct	11-Oct
	Central	23-Oct	23-Oct	24-Oct	24-Oct	25-Oct	26-Oct	28-Oct
31%	Southern	5-Oct	6-Oct	6-Oct	7-Oct	11-Oct	23-Oct	5-Nov
	Statewide	14-Oct	14-Oct	14-Oct	15-Oct	17-Oct	19-Oct	23-Oct
SSB Threshold	Northern	10-Sep	10-Sep	11-Sep	12-Sep	16-Sep	22-Sep	1-Oct
	Central	7-Oct	7-Oct	8-Oct	8-Oct	9-Oct	11-Oct	14-Oct
52%	Southern	3-Sep	4-Sep	4-Sep	6-Sep	11-Sep	27-Sep	9-Oct
	Statewide	22-Sep	22-Sep	22-Sep	23-Sep	26-Sep	1-Oct	7-Oct
62%	Northern	29-Aug	30-Aug	30-Aug	31-Aug	5-Sep	12-Sep	20-Sep
	Central	29-Sep	29-Sep	29-Sep	1-Oct	2-Oct	3-Oct	6-Oct
	Southern	7-Aug	8-Aug	9-Aug	11-Aug	17-Aug	10-Sep	30-Sep
	Statewide	9-Sep	9-Sep	10-Sep	11-Sep	14-Sep	21-Sep	28-Sep
SSB Target	Northern	16-Aug	17-Aug	17-Aug	18-Aug	24-Aug	1-Sep	12-Sep
	Central	17-Sep	17-Sep	17-Sep	19-Sep	21-Sep	23-Sep	28-Sep
72%	Southern	15-Jul	16-Jul	16-Jul	18-Jul	24-Jul	17-Aug	17-Sep
	Statewide	22-Aug	23-Aug	23-Aug	25-Aug	31-Aug	7-Sep	18-Sep

Note: Monitoring, reporting, and closure requirements identified through the NCDMF's sea turtle and Atlantic sturgeon Incidental Take Permits will remain in effect and may impact dates identified in this table.

Table 5. Continued

		Season Start Date					
		1-Aug	**1-Sep**	**15-Sep**	**1-Oct**	**Jan. 1, mid-year closure, re-open Sept. 1**	**Jan. 1, mid-year closure, re-open Sept. 15**
Reduction	Management Area	Season End Date					
Overfishing Threshold 31%	Northern	14-Oct	18-Oct	26-Oct	11-Nov	15-Oct	22-Oct
	Central	2-Nov	7-Nov	11-Nov	21-Nov	4-Nov	7-Nov
	Southern	19-Nov	25-Nov	25-Nov	29-Nov	17-Nov	24-Nov
	Statewide	29-Oct	4-Nov	17-Nov	20-Nov	31-Oct	4-Nov
SSB Threshold 52%	Northern	6-Oct	10-Oct	17-Oct	31-Oct	5-Oct	13-Oct
	Central	18-Oct	21-Oct	24-Oct	5-Nov	19-Oct	21-Oct
	Southern	24-Oct	7-Nov	15-Nov	24-Nov	23-Oct	29-Oct
	Statewide	12-Oct	19-Oct	24-Oct	7-Nov	14-Oct	20-Oct
62%	Northern	26-Sep	2-Oct	13-Oct	27-Oct	27-Sep	10-Oct
	Central	10-Oct	14-Oct	17-Oct	26-Oct	11-Oct	14-Oct
	Southern	13-Oct	26-Oct	2-Nov	15-Nov	11-Oct	17-Oct
	Statewide	5-Oct	12-Oct	17-Oct	28-Oct	6-Oct	11-Oct
SSB Target 72%	Northern	20-Sep	27-Sep	6-Oct	22-Oct	12-Sep	21-Sep
	Central	2-Oct	8-Oct	11-Oct	19-Oct	4-Oct	8-Oct
	Southern	1-Oct	14-Oct	20-Oct	2-Nov	29-Sep	7-Oct
	Statewide	26-Sep	3-Oct	9-Oct	21-Oct	27-Sep	3-Oct

Note: Monitoring, reporting, and closure requirements identified through the NCDMF's sea turtle and Atlantic sturgeon Incidental Take Permits will remain in effect and may impact dates identified in this table.

Table 6. Southern Flounder Amendment 2 seasons needed to meet the necessary reduction in total removals (observed harvest and dead discards) for the overfishing threshold and SSB threshold and target of **the NC recreational hook-and-line fishery** in 2019.

	Percent Reduction	Total removals (lbs)
Terminal Year	2017	488,723
Target	72%	136,843
62 percent	62%	185,715
Threshold	52%	234,587
Overfishing	31%	337,219

Season	Percent Reduction	Total removals (lbs)
no closure	0%	488,723
Apr 16 -Jul 31	57%	211,477
Apr 16 -Jul 16	66%	165,474
Apr 16 -Jun 30	76%	118,254
May 1 -Jul 31	58%	204,398
May 1 -Jul 16	68%	158,394
May 1 -Jun 30	77%	111,175
May 16 -Jul 31	61%	192,156
May 16 -Jul 16	70%	146,153
Jun 1 - Aug 16	54%	222,471
Jun 1 - Jul 31	66%	165,932
Jun 1 - Jul 16	75%	119,928
May 1 - Sept 30	18%	399,908
Jun 1 - Sept 30	26%	360,813
Jul 1 - Sept 30	41%	286,724
Jul 16 - Sept 30	51%	240,876
Aug 1 - Sept 30	60%	195,868
Aug 16 - Sept 30	72%	138,362
Jul 1 - Oct 15	35%	318,760
Jun 1 - Sept 15	33%	325,691
Jul 1 - Sept 15	48%	253,123
Jun 16 - Sept 15	40%	294,998
Jul 16 - Oct 15	44%	271,391
Aug 1 - Oct 30	49%	249,887
Jul 16 -Oct 30	40%	294,894

Table 7. Southern Flounder Amendment 2 seasons needed to meet the necessary reduction in total removals (observed harvest and dead discards) for the overfishing threshold and SSB threshold and target of **the NC recreational gig fishery** in 2019.

	% Reduction	Total removals (lbs)
Terminal Year	2017	57,019
Target	72%	15,965
62%	62%	21,667
Threshold	52%	27,369
Overfishing	31%	39,343

Season	% Reduction	Total Removals (lbs)
no closure	0%	57,019
Mar 1 - Oct 15	15%	48,707
Mar 16 - Oct 31	16%	47,734
Mar 1 - Sept 30	21%	45,207
Apr 1 - Oct 31	24%	43,260
Mar 16 - Sept 30	29%	40,732
Apr 1 - Oct 15	30%	39,759
Apr 1 - Sept 30	36%	36,258
May 1 - Oct 31	40%	34,311
Apr 16 - Sept 30	44%	31,784
May 1 - Oct 15	46%	30,811
May 1 - Sept 30	52%	27,310
Jun 1 - Sept 30	63%	21,374
Jul 16 -Oct 31	64%	20,330
Jul 1 - Oct 15	67%	18,938
Aug 1 - Oct 31	68%	18,221
Jun 1 - Sept 15	69%	17,873
Jul 16 - Oct 15	70%	16,829
Jul 1 - Sept 30	73%	15,438
Jun 16 - Sept 15	74%	14,905
Jul 16 - Sept 30	77%	13,329
Jul 1 - Sept 15	79%	11,937
Aug 1 - Sept 30	80%	11,219
Aug 16 - Sept 30	84%	9,110

Table 8. Southern Flounder Amendment 2 trip limit options (in pounds) **for the commercial pound net fishery**, including the number, % of trips, and % of harvest within each trip limit option for each management area, September through November 2008-2017.

	Management Area					
	Northern			Central		
Pounds Per Trip	Number of Trips	% of Trips	% of Harvest	Number of Trips	% of Trips	% of Harvest
<251	1,633	65.2%	8.5%	4,173	51.3%	10.5%
251-500	291	11.6%	7.8%	1,533	18.8%	13.5%
501-750	159	6.3%	7.3%	794	9.8%	11.9%
751-1,000	86	3.4%	5.7%	518	6.4%	11.0%
1,001-1,250	63	2.5%	5.2%	315	3.9%	8.7%
1,251-1,500	43	1.7%	4.5%	212	2.6%	7.2%
1,501-2,000	66	2.6%	8.3%	252	3.1%	10.7%
2,001-3,000	63	2.5%	11.4%	209	2.6%	12.4%
3,001-4,000	36	1.4%	9.8%	76	0.9%	6.4%
4,001+	66	2.6%	31.6%	59	0.7%	7.8%
Average Pounds Per Trip	539			503		
	Management Area					
	Southern			Statewide		
Pounds Per Trip	Number of Trips	% of Trips	% of Harvest	Number of Trips	% of Trips	% of Harvest
<251	1,850	65.8%	17.7%	7,656	56.9%	11.2%
251-500	420	14.9%	15.4%	2,244	16.7%	12.6%
501-750	197	7.0%	12.6%	1,150	8.5%	11.0%
751-1,000	123	4.4%	10.9%	727	5.4%	9.9%
1,001-1,250	63	2.2%	7.4%	441	3.3%	7.8%
1,251-1,500	40	1.4%	5.7%	295	2.2%	6.4%
1,501-2,000	48	1.7%	8.8%	366	2.7%	9.9%
2,001-3,000	40	1.4%	10.4%	312	2.3%	11.8%
3,001-4,000	20	0.7%	6.8%	132	1.0%	7.2%
4,001+	9	0.3%	4.4%	134	1.0%	12.3%
Average Pounds Per Trip	344			475		

Table 9. Southern Flounder Amendment 2 trip limit options (in number of fish) **for the commercial gig fishery**, including the number, % of trips, and % of harvest within each trip limit option for each management area, 2008-2017.

		Management Area					
		Northern			Central		
Number of Fish	Equivalent pounds	Number of Trips	% of Trips	% of Harvest	Number of Trips	% of Trips	% of Harvest
25	64	77	81.9%	54.1%	859	69.4%	35.5%
50	128	14	14.9%	33.3%	268	21.6%	33.6%
75	192	2	2.1%	7.1%	75	6.1%	16.2%
100	256	1	1.1%	5.5%	24	1.9%	7.8%
125	320		0.0%	0.0%	5	0.4%	2.1%
150	384		0.0%	0.0%	1	0.1%	0.5%
175	448		0.0%	0.0%	3	0.2%	1.7%
200	512		0.0%	0.0%	3	0.2%	2.7%
Average Pounds Per Trip		41.2			57.2		

		Management Area					
		Southern			Statewide		
Number of Fish	Equivalent pounds	Number of Trips	% of Trips	% of Harvest	Number of Trips	% of Trips	% of Harvest
25	64	16,352	74.7%	44.8%	17288	74.4%	44.3%
50	128	4,222	19.3%	32.9%	4504	19.4%	33.0%
75	192	864	3.9%	11.8%	941	4.1%	12.0%
100	256	299	1.4%	5.8%	324	1.4%	5.9%
125	320	87	0.4%	2.2%	92	0.4%	2.2%
150	384	31	0.1%	1.0%	32	0.1%	0.9%
175	448	16	0.1%	0.6%	19	0.1%	0.7%
200	512	20	0.1%	1.0%	23	0.1%	1.1%
Average Pounds Per Trip		51.6			51.9		

*used an average of 2.56 pounds per fish (2008-2017 average)

Table 10. Average yards of large mesh gill net fished per trip by ITP Management Unit and season during 2016 and 2017.

Management Unit	Season	Average Yards
A	December-February	N/A
	March-May	1,464
	June-August	1,424
	September-November	1,590
B	December-February	N/A
	March-May	1,000
	June-August	921
	September-November	1,007
C	December-February	425
	March-May	951
	June-August	1,042
	September-November	964
D	December-February	600
	March-May	936
	June-August	971
	September-November	951
E	December-February	525
	March-May	586
	June-August	638
	September-November	669

Table 11. Economic impacts associated with **commercial southern flounder fishing** in North Carolina, 2009-2017.

				Economic Impacts		
Year	Participants[1]	Pounds[1]	Ex-Vessel Value[1]	Jobs[2,3]	Income Impacts (thousands of dollars)[3]	Output Impacts (thousands of dollars)[3,4]
2009	1,299	2,396,240	$4,609,932	419	$9,908	$17,769
2010	1,182	1,689,557	$3,695,889	328	$7,963	$14,222
2011	1,039	1,247,450	$2,753,128	246	$5,977	$10,669
2012	1,202	1,646,137	$4,451,482	393	$9,633	$17,259
2013	1,286	2,186,391	$5,673,190	487	$12,347	$21,801
2014	1,222	1,673,511	$4,839,672	396	$10,753	$18,933
2015	1,029	1,202,930	$3,823,707	300	$8,397	$14,722
2016	945	897,765	$3,610,533	286	$7,167	$14,925
2017	1,048	1,394,552	$5,655,489	453	$14,660	$21,442

1 As reported by the North Carolina Trip Ticket Program

2 Represents both full-time and part-time jobs

3 Economic impacts calculated using the NCDMF commercial fishing economic impact model and IMPLAN economic impact modeling software. Economic impact estimates are for the state economy of North Carolina.

4 Represents sales impacts

Table 12. Economic impacts associated with **recreational southern flounder fishing** in North Carolina from 2009-2017.

			Economic Impacts		
Year	Trips[1]	Estimated Expenditures (thousands of dollars)[2]	Jobs[3,4]	Income Impacts (thousands of dollars)[4]	Output Impacts (thousands of dollars)[4]
2009	2,577,363	$442,934	3,572	$108,658	$273,219
2010	2,900,583	$497,196	4,052	$124,734	$310,591
2011	2,519,959	$436,762	3,736	$118,739	$293,707
2012	2,552,146	$444,117	3,686	$119,177	$294,023
2013	2,623,195	$452,931	3,542	$115,739	$286,489
2014	2,685,072	$460,707	3,486	$115,658	$286,196
2015	2,536,854	$434,272	3,286	$110,637	$274,761
2016	2,420,326	$415,870	3,041	$103,370	$254,916
2017	2,107,301	$362,466	2,574	$87,722	$216,218

1 Trip estimates from MRIP include trips in which any Flounder was targeted, harvested, or discarded

2 Estimated expenditures include only trip expenditures.

3 Includes full time and part time jobs

4 Economic impacts calculated using the NCDMF coastal recreational fishing economic impact model and IMPLAN economic impact modeling software. Economic impact estimates are for the state economy of North Carolina.

Table 13. Draft NCDMF and Advisory Committee recommendations for public comment in draft Amendment 2 of the Southern Flounder FMP. Recommendations will be provided by the MFC Regional and Standing Committees and public from June 2019.

Issue	NCDMF	Southern Flounder Advisory Committee	MFC Committees	Public Comment
Sustainable harvest in the commercial fishery	Establish seasonal closures by area for the commercial fishery to reduce F and increase SSB to rebuild between the threshold and the target in 2019 (Option C, 62% reduction) and establish seasonal closures by area for the commercial fishery to reduce F and allow the SSB to rebuild to the target beginning in 2020 (Option D, 72% reduction).	The Southern Flounder Advisory Committee recommends that starting Jan. 1, 2019 a 52% reduction be adopted (Option B) and implemented through seasonal closures by area and major gear type with the following changes for the commercial fishery, calculated for the Northern, Central, and Southern areas: -40% reduction to the pound net fishery -40% reduction to the gig fishery 71% reduction to the gill net fishery (to make the total reduction to the commercial fishery equal 52%)	**Southern** – No recommendation **Northern** – Supports NCDMF recommendation (Option C in 2019, Option D beginning in 2020), in addition ask the MFC to consider dividing up the allowable fishing days for gill netting amongst allowable fishing months for a given area due to Sea Turtle ITP. **Finfish** – A reduced harvest of 52%, not to exceed 52% until Amendment 3 is completed (Option B). The committee also requested the Southern Flounder AC look at a moratorium on all southern flounder harvest from Nov. 1, 2019 to Sept 1, 2022.	**Mail** – 5 letters received all oppose draft Amendment 2. **Online** – 91 of 241 respondents supported draft Amendment 2. Of those that indicated support of draft Amendment 2 Option C (62% reduction) was the most selected option for 2019 and option D (72% reduction) was the most selected option for 2020. **Public Comment** – Thirteen total comments, 3 (23%) in favor of and 10 (77%) oppose draft Amendment 2.

Table 13. Continued.

Issue	NCDMF	Southern Flounder Advisory Committee	MFC Committees	Public Comment
Sustainable harvest non-quantifiable harvest restrictions in the commercial fishery	NCDMF recommends expanding the commercial gill net management measures by reducing to single overnight soaks where nets may be set no sooner than one hour before sunset and must be retrieved no later than one hour after sunrise the next morning in the Neuse, Tar/Pamlico rivers and the Albemarle Sound areas that have previously been exempt; Reduce the maximum yardage allowed in the commercial anchored large mesh gill net fishery by 25% for each Management Unit; allowing a maximum of 1,500-yards in Management Units A, B, and C, and 750-yards in Management Units D and E; Prohibit the use of any method of retrieving live flounder from pound nets that cause injury to released fish (no picks, gigs, spears, etc.).	As of Jan. 1, 2020, implement a 1,500-yard limit for large mesh gill nets in Management Unit A, a 1,000-yard limit for large mesh gill nets in Management Units B and C, and 750-yard limit for large mesh gill nets in Management Units D and E. Prohibit the use of any method of retrieving live flounder from pound nets that cause injury to released fish (no picks, gigs, spears, etc.).	**Southern** – No recommendation **Northern** – No recommendation **Finfish** – No recommendation	**Mail** – No respondents commented on this item. **Online –** 183 of 193 responses supported one or more additional non-quantifiable management measures. **Public Comment** – No respondents commented on this item.

Table 13. Continued.

Issue	NCDMF	Southern Flounder Advisory Committee	MFC Committees	Public Comment
Sustainable harvest in the recreational fishery	Establish seasonal closures by area for the recreational fishery to reduce F and increase SSB to rebuild between the threshold and the target in 2019 (Option C, 62% reduction) and establish seasonal closures by area for the recreational fishery to reduce F and allow the SSB to rebuild to the target beginning in 2020 (Option D, 72% reduction). The Recreational Commercial Gear License fishery, for large mesh gill nets, will operate during the dates where the recreational and commercial seasons overlap.	The Southern Flounder Advisory Committee recommends that starting Jan. 1, 2019 a 52% reduction be adopted (Option B) and implemented through seasonal closures for the recreational hook-and-line and gig fisheries. The recreational gig fishery will follow the same season as the hook-and-line season. The Recreational Commercial Gear License large-mesh gill net season the same as NCDMF	**Southern** – No recommendation **Northern** – Supports NCDMF recommendation (Option C in 2019, Option D beginning in 2020). **Finfish** – A reduced harvest of 52%, not to exceed 52% until Amendment 3 is completed (Option B). The committee also recommended that the MFC ask the Secretary of DEQ to allow the Director of DMF to go out of compliance with ASMFC Summer Flounder Plan and adopt a 12-inch size limit and a 4-fish bag limit for southern flounder in North Carolina waters. The committee also requested the Southern Flounder AC look at a moratorium on all southern flounder harvest from Nov. 1, 2019 to Sept 1, 2022	**Mail** – No respondents commented on this item. **Online** – 91 of 241 respondents supported draft Amendment 2. Option C (62% reduction) was the most selected option for 2019 and option D (72% reduction) was the most selected option for 2020. **Public Comment** - No respondents commented on this item.

Table 13. Continued.

Issue	NCDMF	Southern Flounder Advisory Committee	MFC Committees	Public Comment
Sustainable harvest, management carried forward and Amendment 3	Current management measures, including size limits, the recreational bag limit, minimum mesh size for gill nets and the pound net escape panels, the number gill net fishing days and amount of yardage allowed in various areas of the state, and minimum distance requirements between gill net and pound nets, will be carried forward in Amendment 2. Amendment 3 will continue to be developed with more robust management strategies.	Supports NCDMF recommendation that Amendment 3 will continue to be developed with more robust management strategies	**Southern** – No recommendation **Northern** – Supports NCDMF recommendation **Finfish** – Supports NCDMF recommendation	**Mail** – No respondents commented on this item. **Online** – N/A **Public Comment** - No respondents commented on this item.

XI. FIGURES

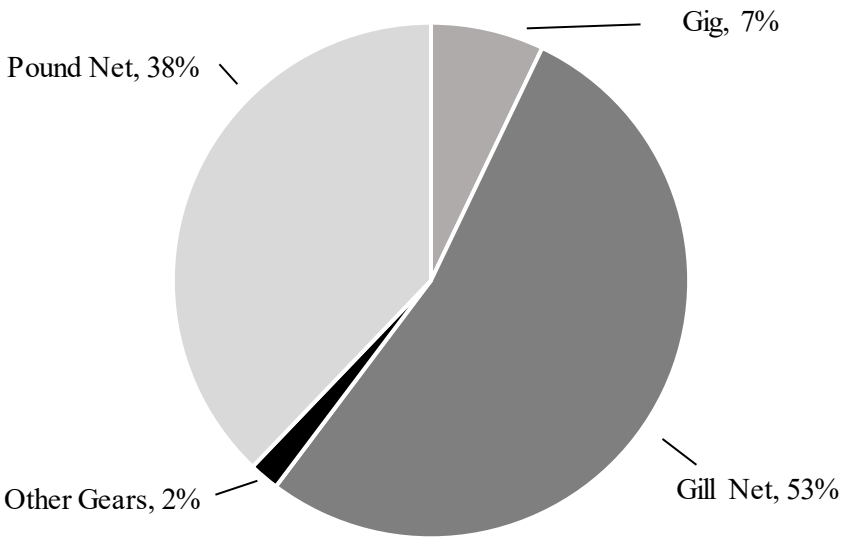

Figure 1. Contribution (pounds) to the North Carolina southern flounder commercial fishery total removals (observed landings and dead discards) by gear, 2008-2017. (Source: North Carolina Trip Ticket Program and North Carolina Estuarine Gill Net Observer Program).

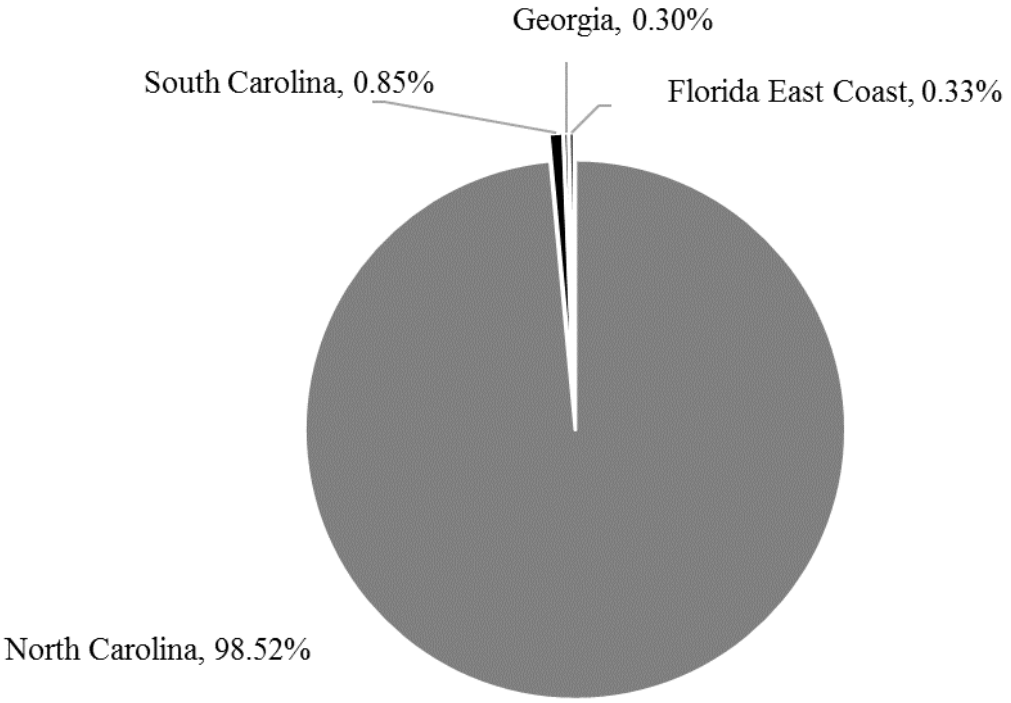

Figure 2. Average contribution to U.S. South Atlantic coast southern flounder commercial landings (pounds) by state, 1978-2017. (Source: NOAA Fisheries Annual Commercial Landing Statistics and North Carolina Trip Ticket Program).

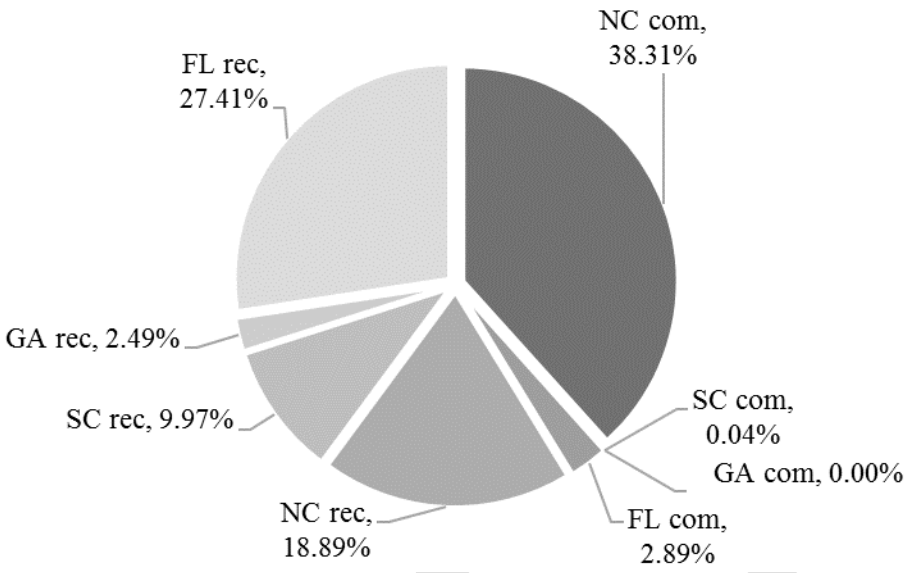

Figure 3. Average contribution to U.S. South Atlantic coast southern flounder commercial and recreational removals (observed harvest and dead discards) in pounds by state, 2008-2017. (Source: NOAA Fisheries Annual Commercial Landing Statistics, North Carolina Trip Ticket Program and the Marine Recreational Information Program).

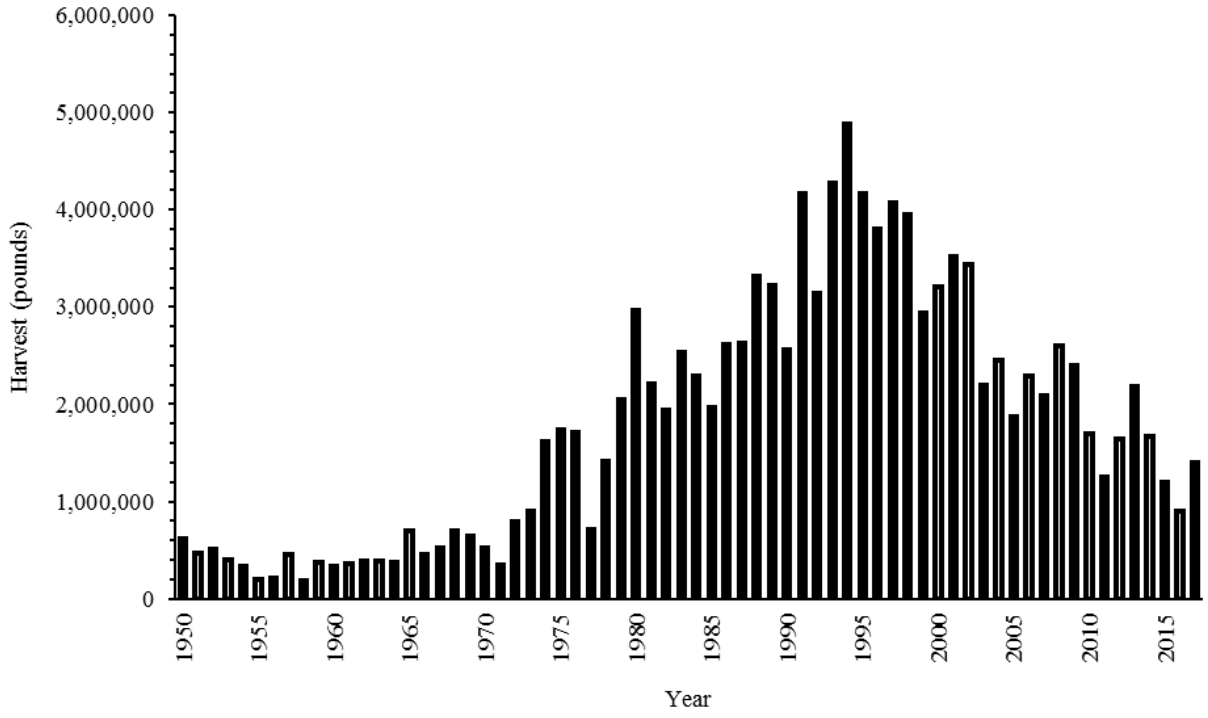

Figure 4. North Carolina annual southern flounder commercial harvest (pounds), 1950-2017. (Source: North Carolina Trip Ticket Program).

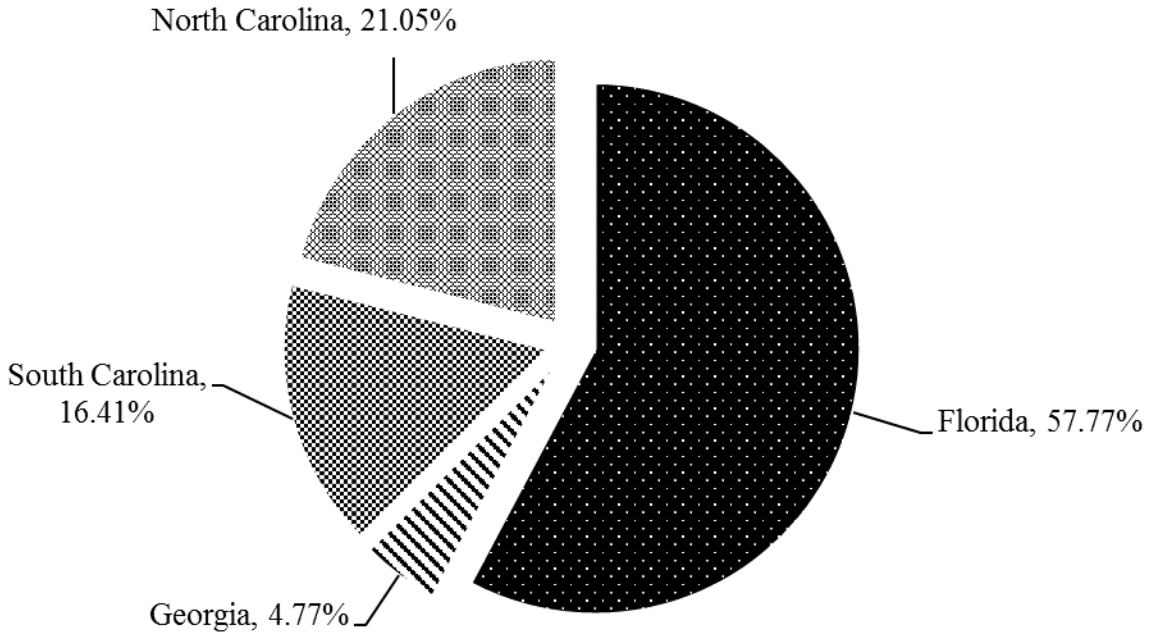

Figure 5. Average contribution to U.S. South Atlantic coast southern flounder recreational removals (observed harvest and dead discards; in pounds) by state, 1981-2017. (Source: Marine Recreational Information Program).

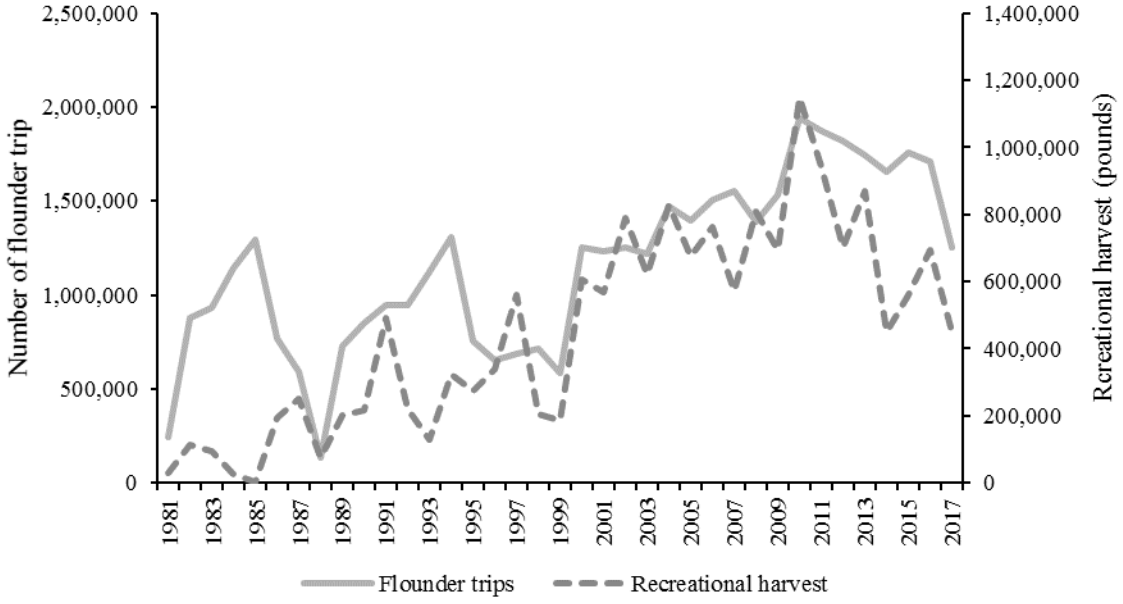

Figure 6. Recreational hook-and-line trips targeting flounder species in North Carolina, 1981-2017. (Source: Marine Recreational Information Program, targeted trips identified by angler interviews)

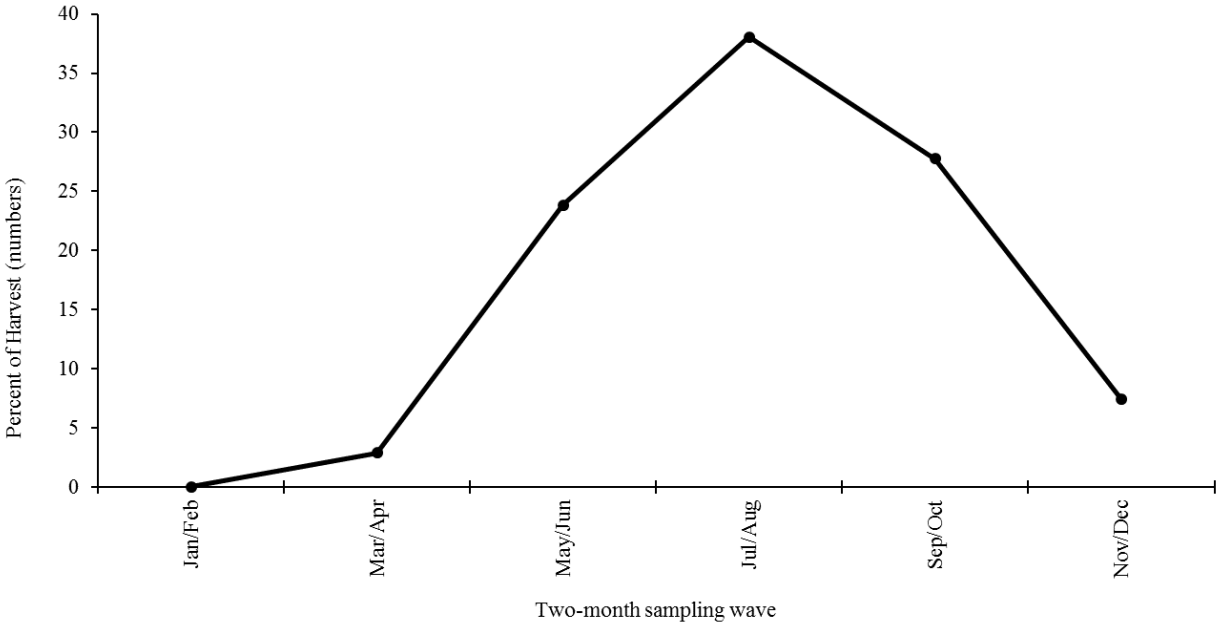

Figure 7. Average percent of recreational harvest (numbers of fish) of hook-and-line caught southern flounder in North Carolina by two-month wave, 1981-2017. (Source: Marine Recreational Information Program).

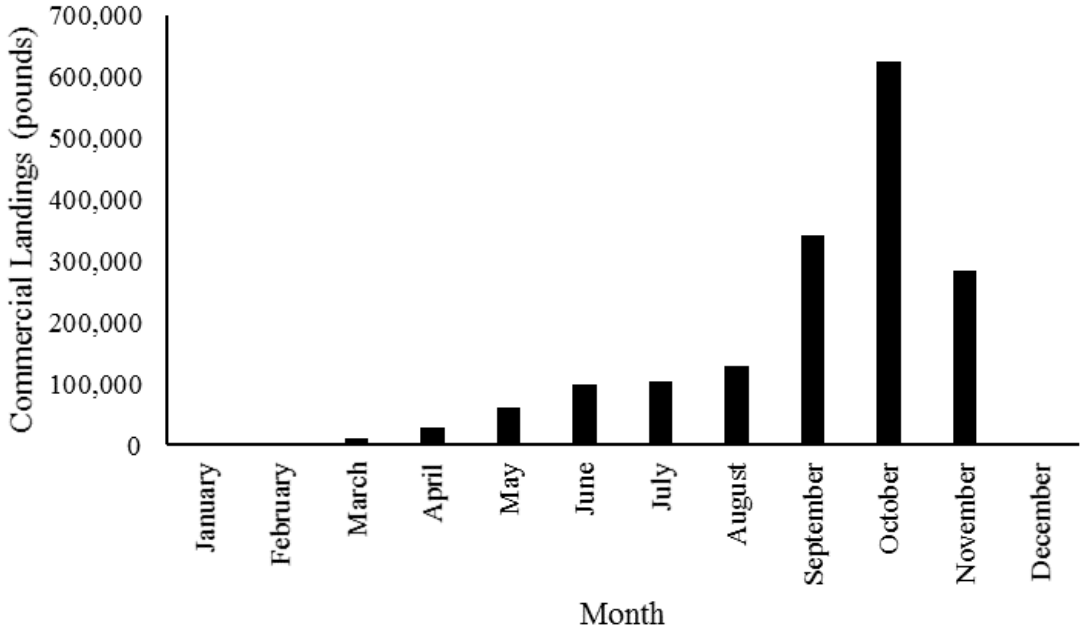

Figure 8. Average commercial southern flounder landings (pounds) by month in North Carolina, 2008-2017. (Source: North Carolina Trip Ticket Program).

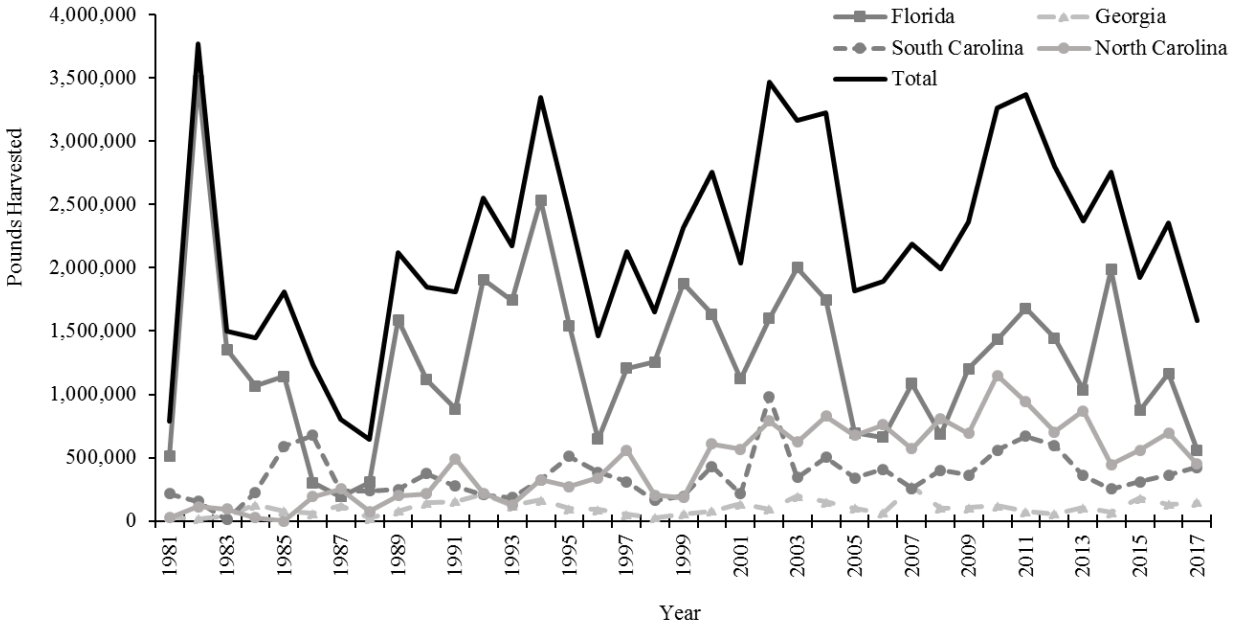

Figure 9. Recreational hook-and-line harvested pounds of southern flounder estimated through MRIP for North Carolina through Florida, 1981-2017. (Source: Marine Recreational Information Program).

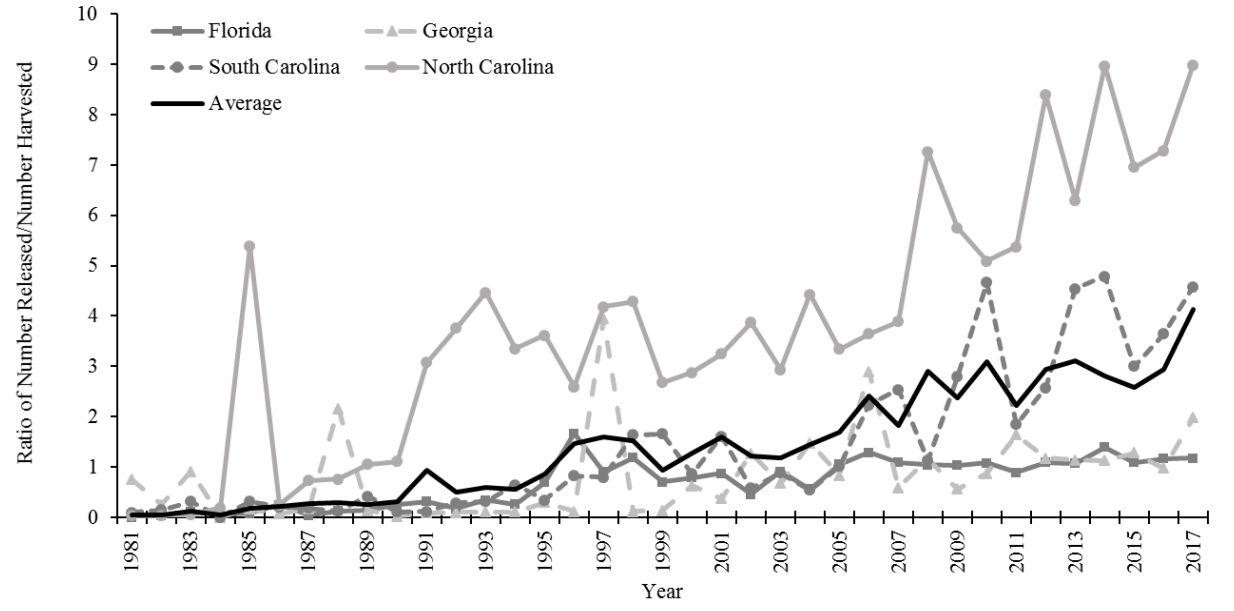

Figure 10. The ratio of released southern flounder compared to harvested southern flounder by number from recreational hook-and-line caught fish for North Carolina through Florida, 1981-2017. (Source: Marine Recreational Information Program).

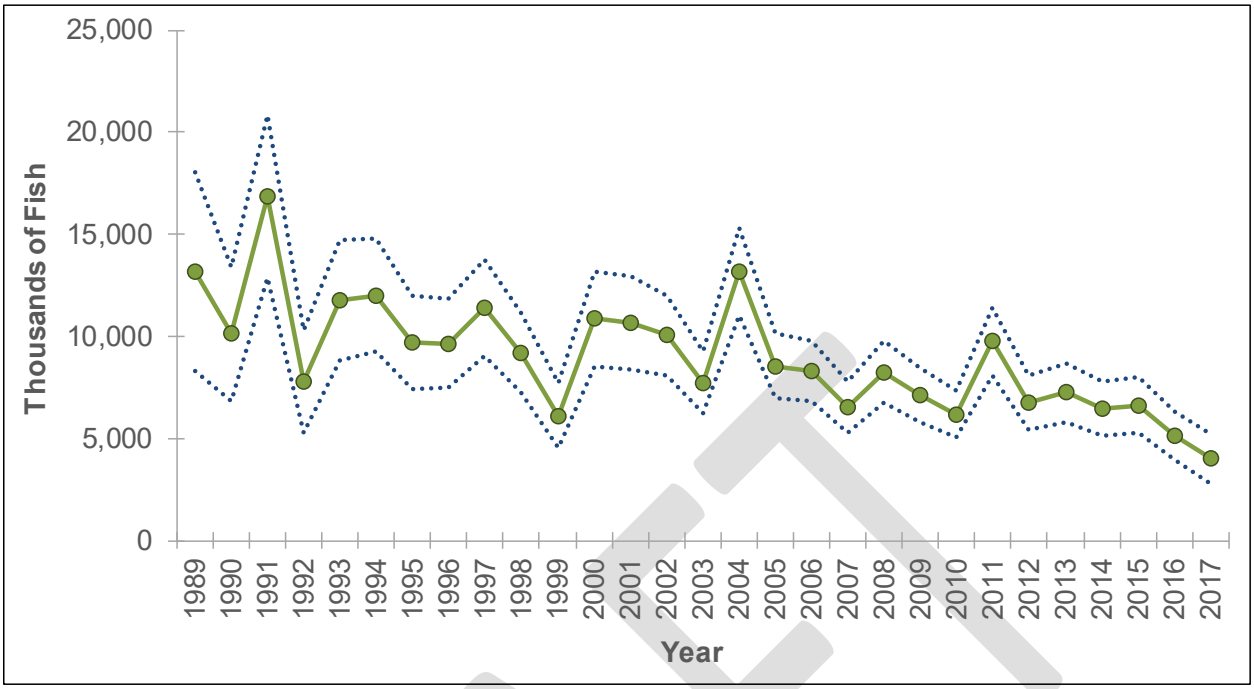

Figure 11. Predicted number of recruits (in thousands of fish) from the base run of the ASAP model, 1989-2017.

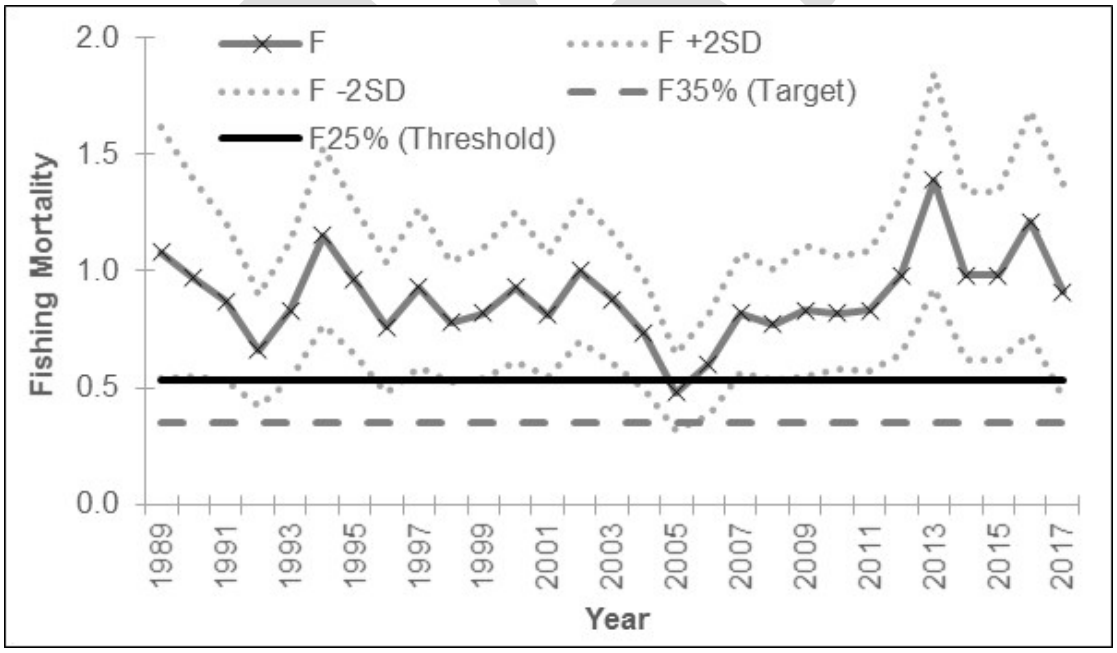

Figure 12. Estimated fishing mortality rates (numbers-weighted, ages 2–4) compared to established reference points, 1989–2017. (Source: Flowers et al. 2019).

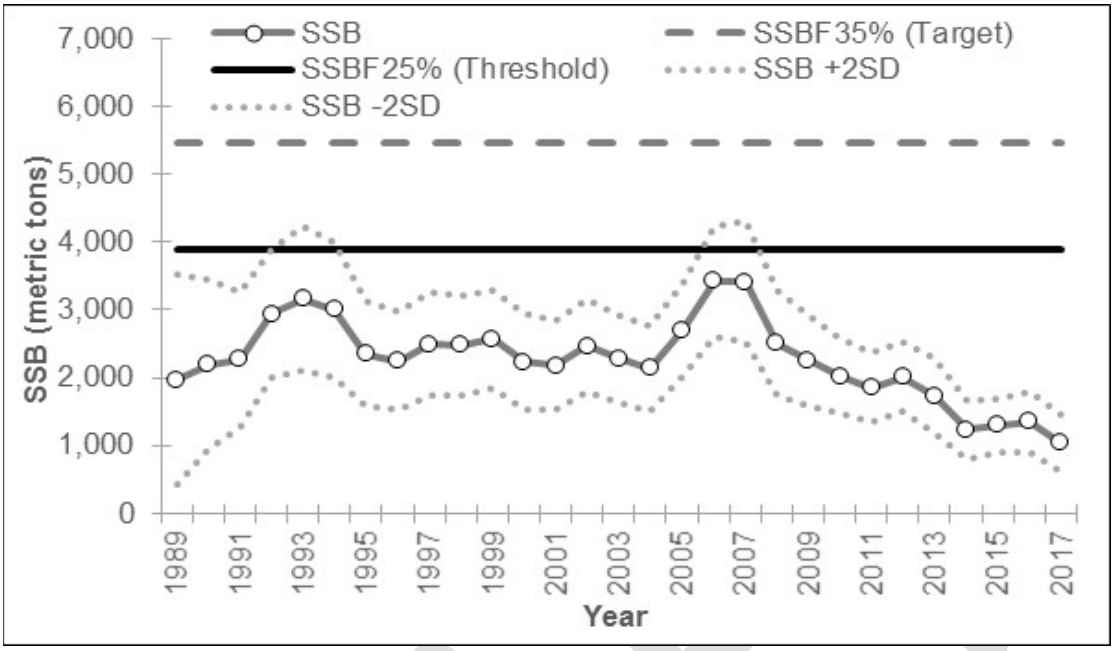

Figure 13. Estimated spawning stock biomass compared to established reference points, 1989–2017. (Source: Flowers et al. 2019).

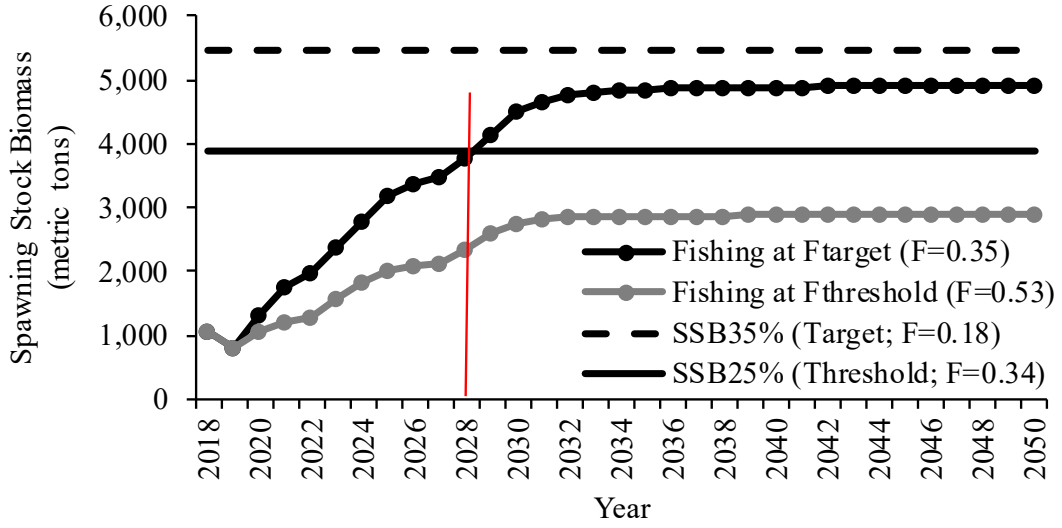

Figure 14. Projections of SSB related to fishing at a level to end overfishing in the required two-year time period. Fishing at $F_{threshold}$ equates to a 31% reduction in total removals, while Fishing at F_{target} equates to a 51% reduction in total removals. (Note: SSB does not rebuild within required 10-year time period; Source: Flowers et al. 2019).

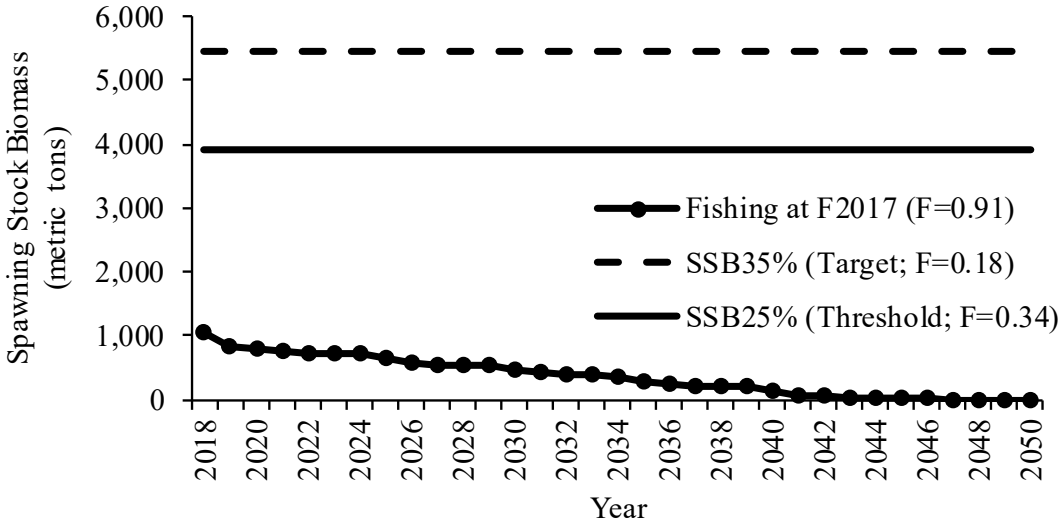

Figure 15. Predicted future spawning stock biomass (metric tons) assuming fishing at recent levels (F_{2017}=0.91) and continuing decline in recruitment. (Source: Flowers et al. 2019).

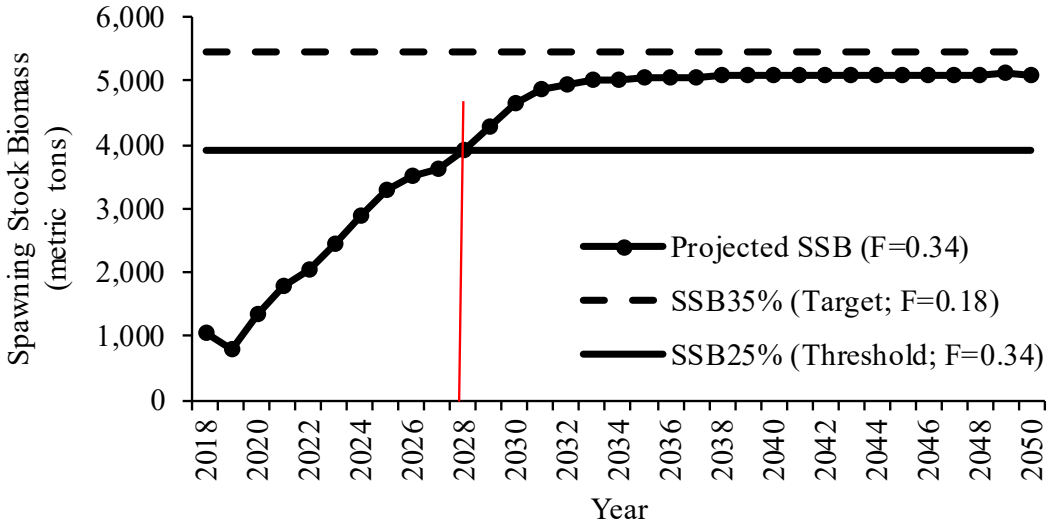

Figure 16. Predicted future spawning stock biomass (metric tons) assuming the fishing mortality value ($F_{25\%}$ = 0.34; 52% reduction in total removals) necessary to end the overfished status ($SSB_{Threshold}$) by 2028. (Source: Flowers et al. 2019)

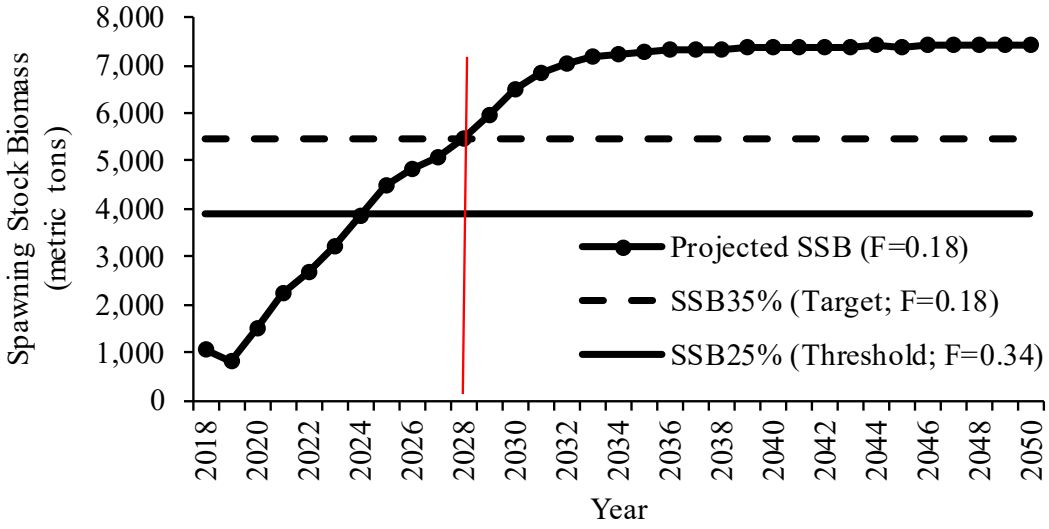

Figure 17. Predicted future spawning stock biomass (metric tons) assuming the fishing mortality value ($F_{35\%}$ = 0.18; 72% reduction in total removals) necessary to reach the SSB_{Target} by 2028. (Source: Flowers et al. 2019).

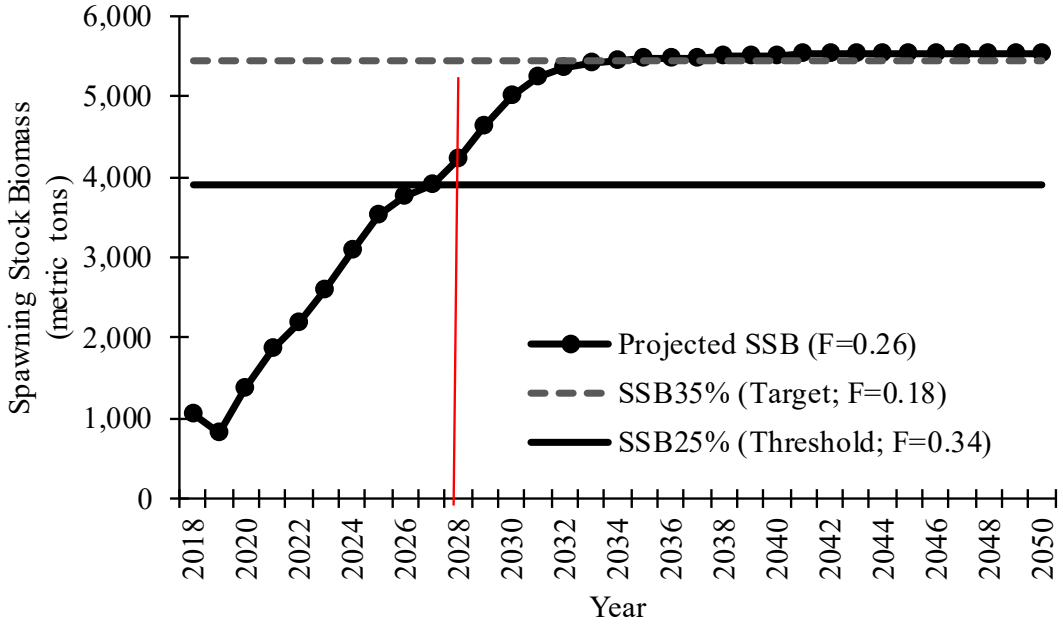

Figure 18. Predicted future spawning stock biomass (metric tons) assuming the fishing mortality value (F= 0.26; 62% reduction in total removals) necessary to reach between the SSB_{Target} and $SSB_{Threshold}$ by 2028.

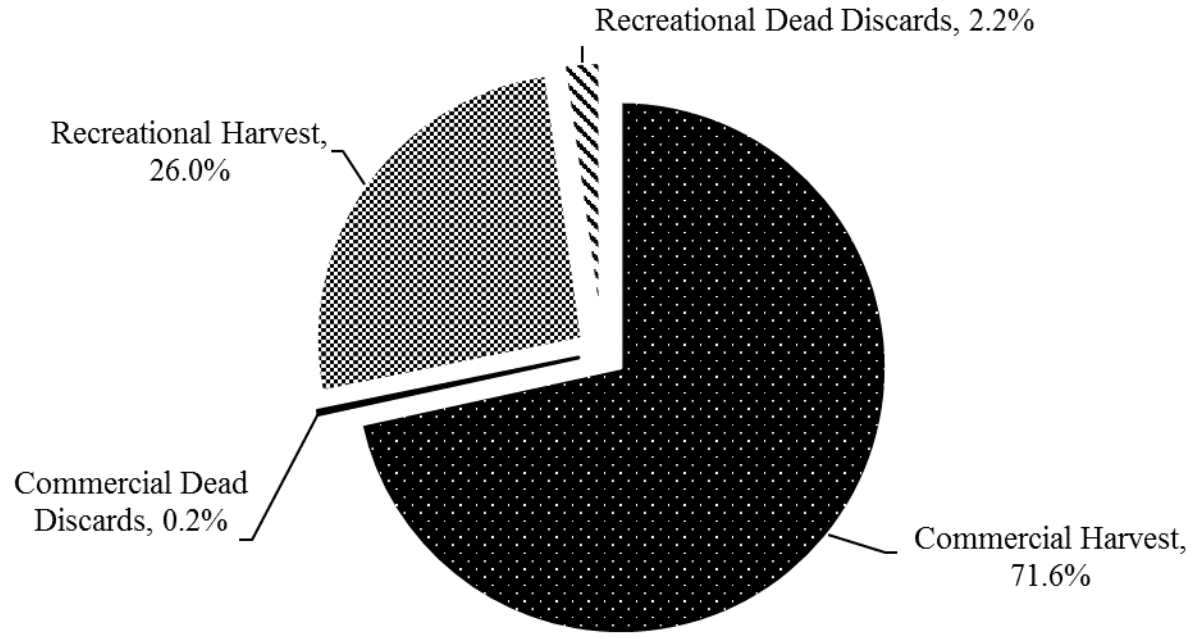

Figure 19. Breakdown of the total removals (observed harvest and dead discards) in % of pounds for the commercial and recreational (hook-and-line and gig) fisheries in North Carolina, 2017. (Source: North Carolina Trip Ticket Program and Marine Recreational Information Program).

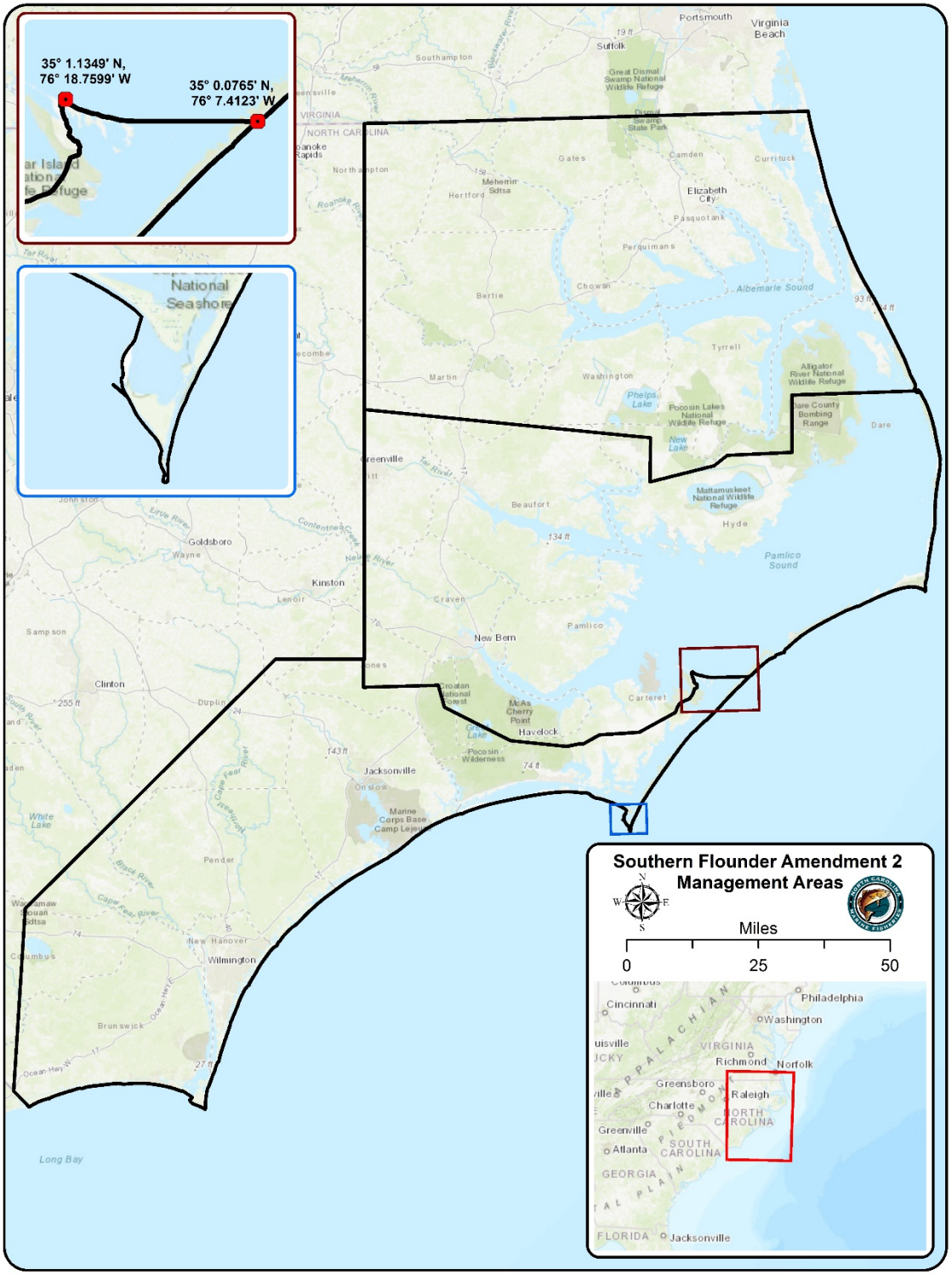

Figure 20. Southern Flounder Amendment 2 management areas for the commercial fishery, 2019.

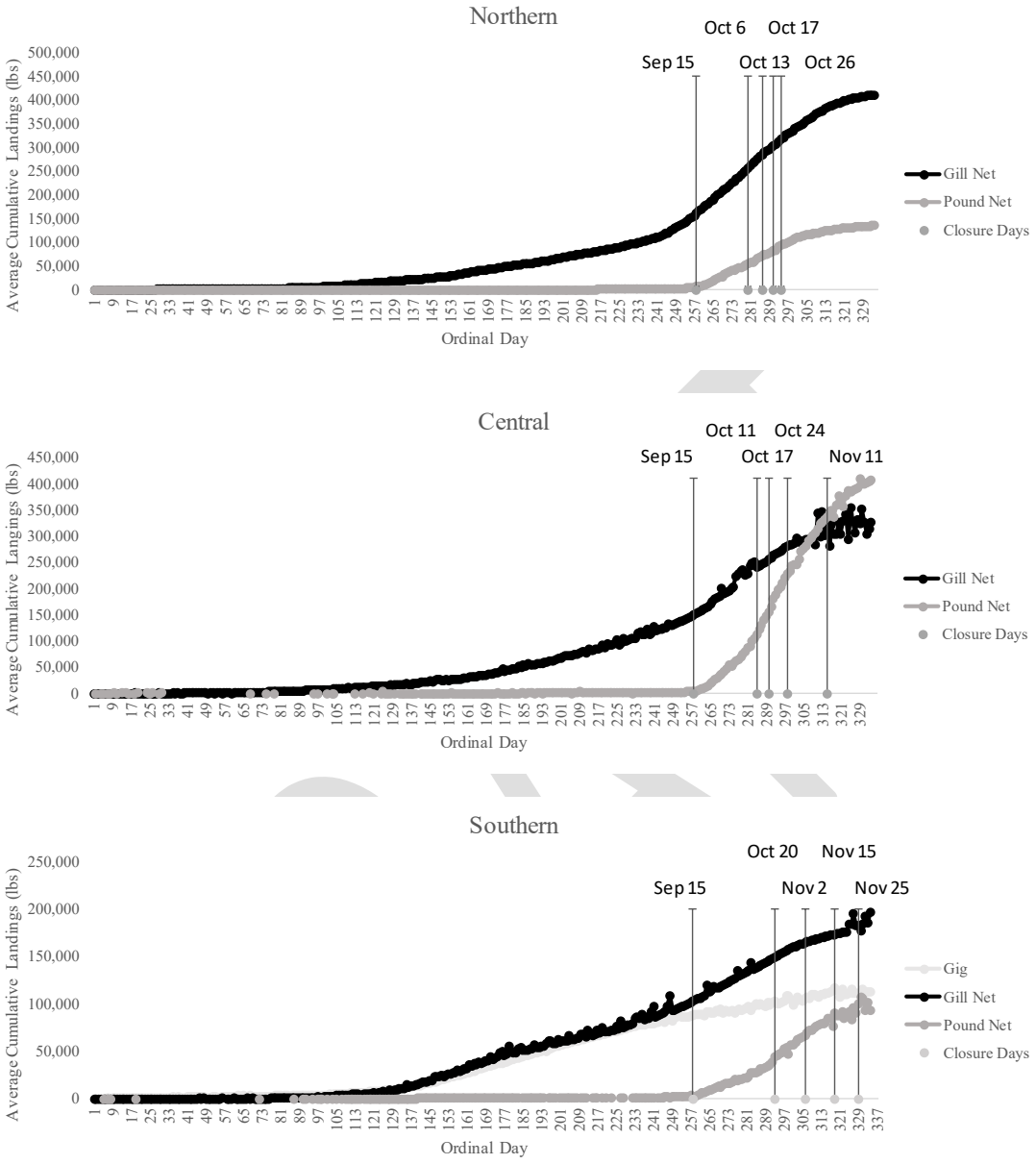

Figure 21. Cumulative commercial landings of the North Carolina southern flounder fishery in three proposed management areas by major gear type and proposed season needed to meet the threshold and target rebuilding reductions. (Source: North Carolina Trip Ticket Program). ***First vertical line indicates the opening date of Sept. 15, the second vertical line indicates the date of closure based on the overfished target (72%), the third vertical line indicates the date of closure based between the threshold and target (62%), the fourth vertical line indicates the date of closure based on the overfished threshold (52%), and the fifth vertical line indicates the date of closure based on the overfishing threshold (31%).** Note: Monitoring, reporting, and closure requirements identified through the NCDMF's sea turtle and Atlantic sturgeon Incidental Take Permits will remain in effect and may impact dates identified in this figure.

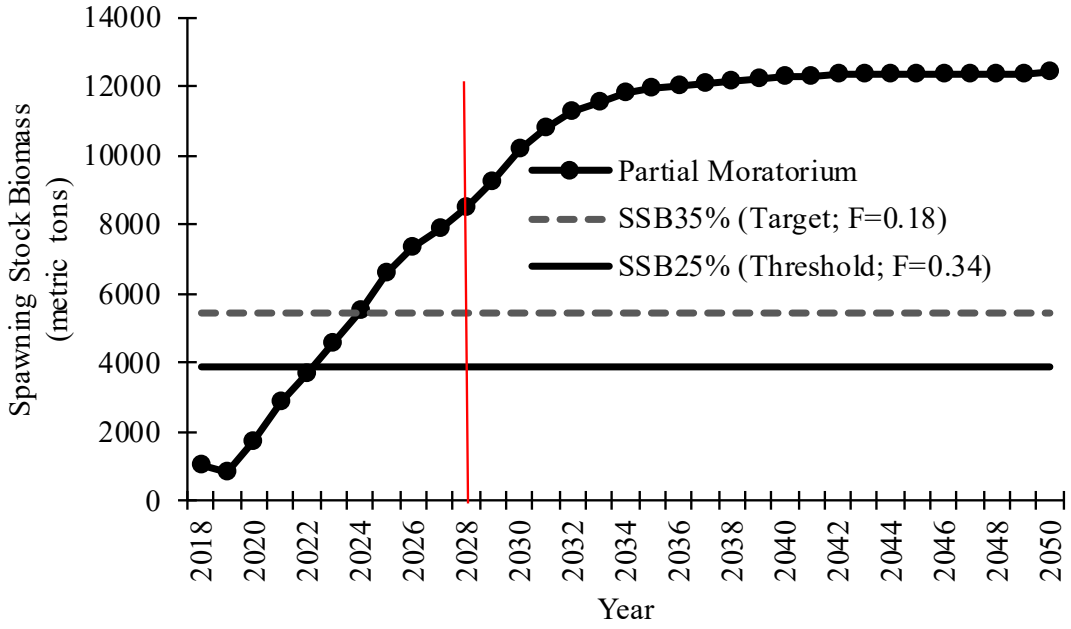

Figure 22. Predicted future spawning stock biomass (metric tons) based on a partial moratorium. This projection is for a coastwide moratorium with the only removals coming from the commercial shrimp trawl fleet.

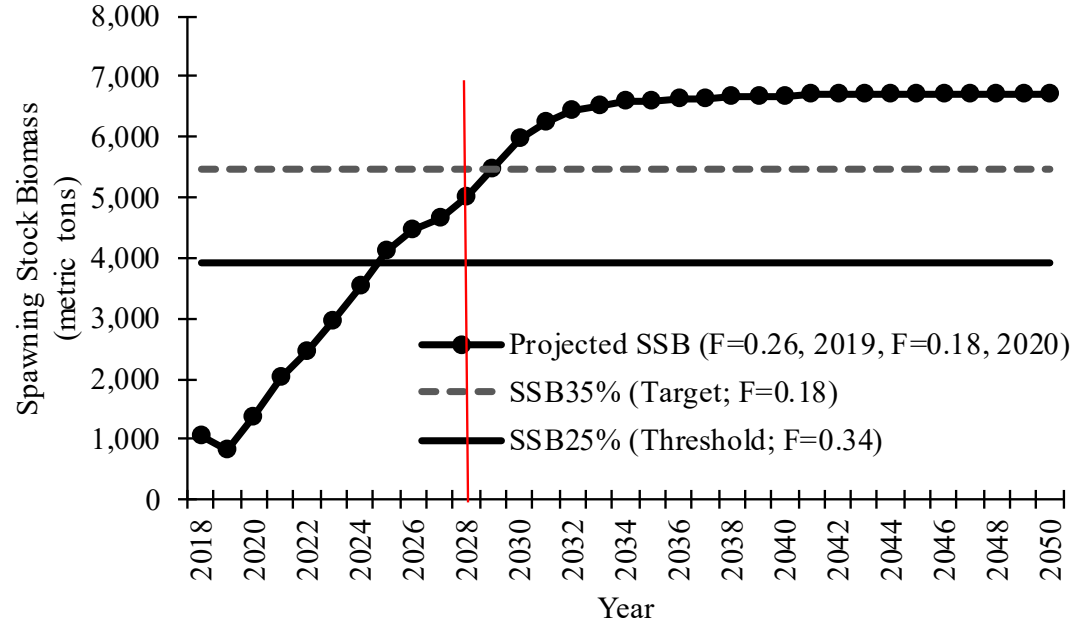

Figure 23. Predicted future spawning stock biomass (metric tons) based on the Department of Environmental Quality/NCDMF recommendation for a 62% reduction in 2019 (F=0.26), and a 72% reduction beginning in 2020 (F=0.18).