APPENDIX 4. ISSUE PAPERS

APPENDIX 4.1. ACHIEVING SUSTAINABLE HARVEST IN THE NORTH CAROLINA SOUTHERN FLOUNDER FISHERY

July 21, 2021

I. ISSUE

Implement long-term management measures to achieve sustainable harvest in the North Carolina southern flounder fishery that end overfishing and rebuild the spawning stock.

II. ORIGINATION

The N.C. Marine Fisheries Commission (NCMFC) adopted Amendment 2 to the Southern Flounder Fishery Management Plan (FMP) in August 2019. Amendment 2 authorized the development of Amendment 3 to begin immediately in order to implement more comprehensive, long-term management measures. State law requires these management measures to achieve sustainable harvest in the southern flounder fishery (Fisheries Reform Act, NCGS § 113-182.1).

III. BACKGROUND

The southern flounder, *Paralichthys lethostigma*, is a demersal species found in the Atlantic Ocean and Gulf of Mexico from northern Mexico to Virginia. 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 (see the *Introduction* and *Description of the Stock* sections for more information on the management authority, distribution, and unit stock definition of southern flounder).

To address the coast-wide nature of the southern flounder stock, a comprehensive stock assessment was completed to determine the status of the stock using data from North Carolina through the east coast of Florida from 1989 through 2017 (Flowers et al. 2019). The assessment model indicated the stock was overfished and overfishing was occurring (Figure 3, Figure 5 *in Description of the Stock* section). Projections were performed to determine the reduction in fishing mortality necessary to end overfishing and to rebuild the spawning stock biomass and end the overfished status.

Fishing mortality (F) was estimated at the target of $F_{35\%}$ as 0.35 and the threshold of $F_{25\%}$ as 0.53. In 2017, fishing mortality was 0.91, which is higher than the F threshold of 0.53 and indicates overfishing is occurring (Figure 5, *in Description of the Stock* section). The probability that fishing mortality in 2017 was above the threshold value of 0.53 is 96%, whereas there is a 100% probability fishing mortality in 2017 was above the target value of 0.35.

The spawning stock biomass target ($SSB_{35\%}$) was estimated to be 5,452 metric tons (approximately 12.0 million pounds) and threshold ($SSB_{25\%}$) to be 3,900 metric tons (approximately 8.6 million pounds). In 2017, the estimated SSB was 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 3 *in Description of the Stock* section). The

probability that SSB in 2017 was below the threshold and target values (3,900 and 5,452 metric tons, respectively) is 100%.

The General Statutes of North Carolina require that an FMP specify a time period not to exceed two years from the date of the adoption to end overfishing (NCGS 113-182.1). The statutes also require that a FMP specify a time period not to exceed 10 years from the date of adoption and at least a 50% probability to achieve a sustainable harvest. In terms of the statutes, a sustainable harvest is attained when the stock is no longer overfished (NCGS 113-129). The statutes allow some exceptions to these stipulations related to biology, environmental conditions, or lack of sufficient data.

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. 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. For more information on projections and the resulting removal reductions refer to Amendment 2 or the 2019 updated stock assessment, which includes assumptions and computational details (Flowers et al. 2019; NCDMF 2019).

The projections are based on the conditions and restrictions such as minimum size limits for both the commercial and recreational fishery, current gear requirements, and selected soak time and daytime restrictions in effect at the time that resulted in the annual total removals. These measures, along with recruitment strength, environmental conditions, and fishing effort, influenced the fishery during the 2017 terminal year of the stock assessment which is the base year for reduction calculations. Any changes in these past conditions will have an undetermined impact on the projections and the rebuilding schedule.

As required by North Carolina law, a fishing mortality of 0.34 is needed to reach the SSB threshold by 2028 and end the overfished status (Figure 7 *in Description of the Stock* section). This will require at a minimum a 52% reduction in total removals coast wide. To increase the probability of success of rebuilding to the higher SSB target by 2028, fishing mortality would need to be lowered to 0.18 (Figure 8 *in Description of the Stock* section). This will require a 72% reduction in total removals coast wide. A fishing mortality that falls between the identified target and threshold values meets the statutory requirements (e.g., 62%; Figure 4.1.1). All projections are associated with at least a 50% probability of achieving sustainable harvest for the fishery.

The management measures implemented in North Carolina from the original Southern Flounder FMP (NCDMF 2005), Amendment 1 (NCDMF 2013), and Supplement A to Amendment 1 (NCDMF 2017a) as modified by the Aug. 17, 2017 settlement agreement have not resulted in the necessary increase in SSB to end the stock's overfished status, thus continued reductions are necessary. In developing management measures for Amendment 2 and Amendment 3, the division applied the reductions only to North Carolina's portion of total removals. To account for North Carolina's portion of these reductions in the recreational and commercial fisheries, the identified reduction was applied to both the dead discards and landings, or total removals, for

each sector (commercial and recreational) of the North Carolina southern flounder fishery from the terminal year of the assessment (2017).

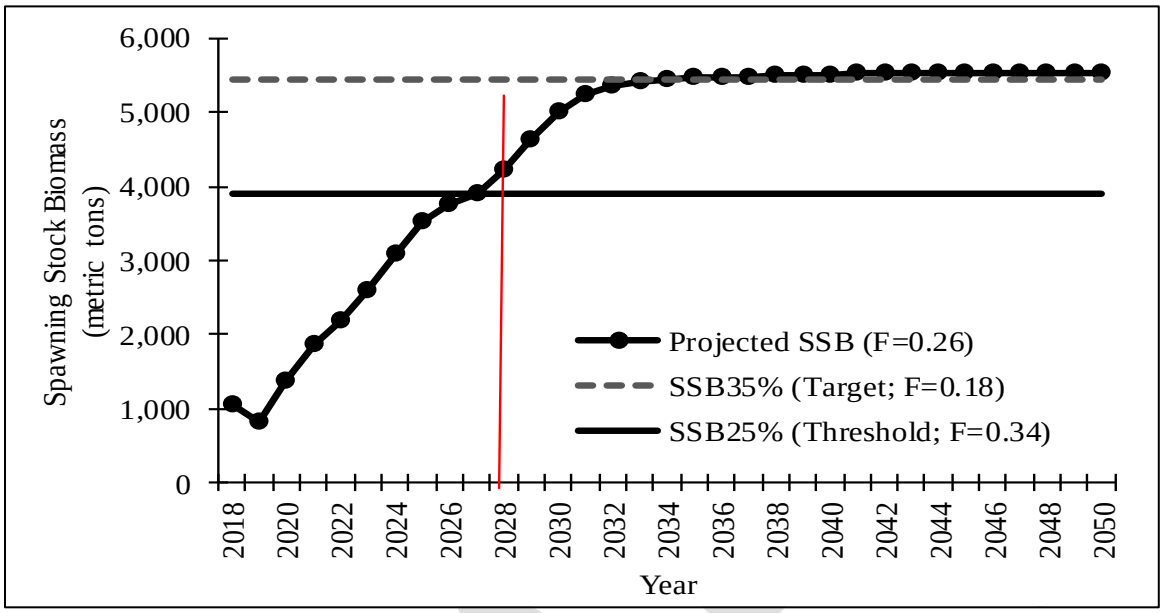


Figure 4.1.1. Predicted future spawning stock biomass (metric tons) assuming the fishing mortality value (F=0.26; 62% reduction in total removals) necessary to reach between the SSB_{Target} and $SSB_{Threshold}$ by 2028 (indicated by vertical red line). (Source: Flowers et al. 2019)

In 2017, total removal for all sectors including dead discards was 1,957,264 pounds; the commercial fishery accounted for 72.2% (including 0.9% dead discards) and the recreational fishery (hook and line and gigs) accounted for 27.9% (including 2.0% dead discards) of the total North Carolina removals (Figure 4.1.2). Additional options for allocations were requested by the NCMFC at its November 2020 business meeting. These options are presented in the *Southern Flounder Allocation* issue paper and their preferred option was used to develop this *Sustainable Harvest* issue paper.

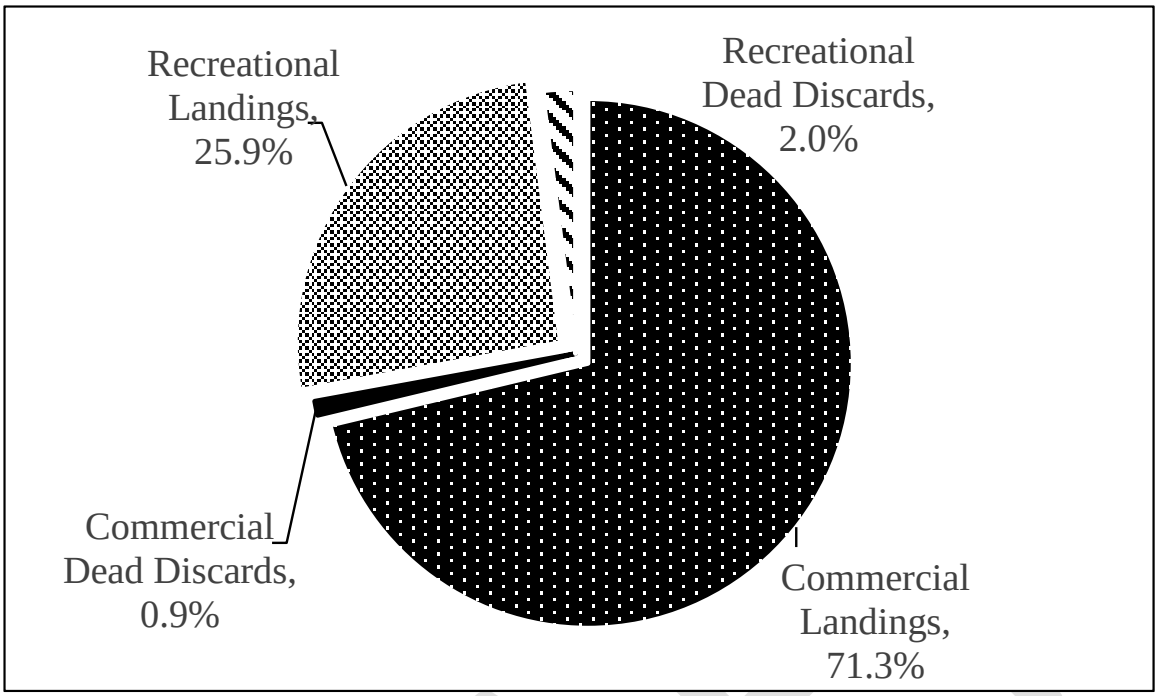


Figure 4.1.2. Contribution of the total removals (observed harvest and dead discards in percent pounds) for the commercial and recreational (hook-and-line and gig) fisheries in North Carolina, 2017. (Source: North Carolina Trip Ticket Program, Marine Recreational Information Program, NCDMF Gig Mail Survey)

In Amendment 3, the management measure proposed to meet sustainable harvest may be changed from a seasonal approach to a quota-based approach. This change does not alter analyses used to calculate reductions but does adjust the terminology used to describe the individual pieces used from Total Allowable Catch (TAC) to Total Allowable Landings (TAL) as landings are the quantifiable mechanism used to manage the quota. Reductions in discards will be accounted for at the end of the fishery as discards are not part of daily quota monitoring and will be added to the annual landings to create total catch to make sure the TAC is not exceeded. This approach differs slightly from Amendment 2. In each amendment, reductions were based on TAC, but as seasons were the selected management measure implemented through Amendment 2, the seasons accounted for estimated reductions in harvest and discards. Based on a fishing mortality that falls between the identified threshold (52% reduction) and target (72% reduction), the range in annual landings of southern flounder that could occur for all sectors is 912,603 pounds to 532,352 pounds, respectively (Table 4.1.1; Figures 4.1.3 and 4.1.4).

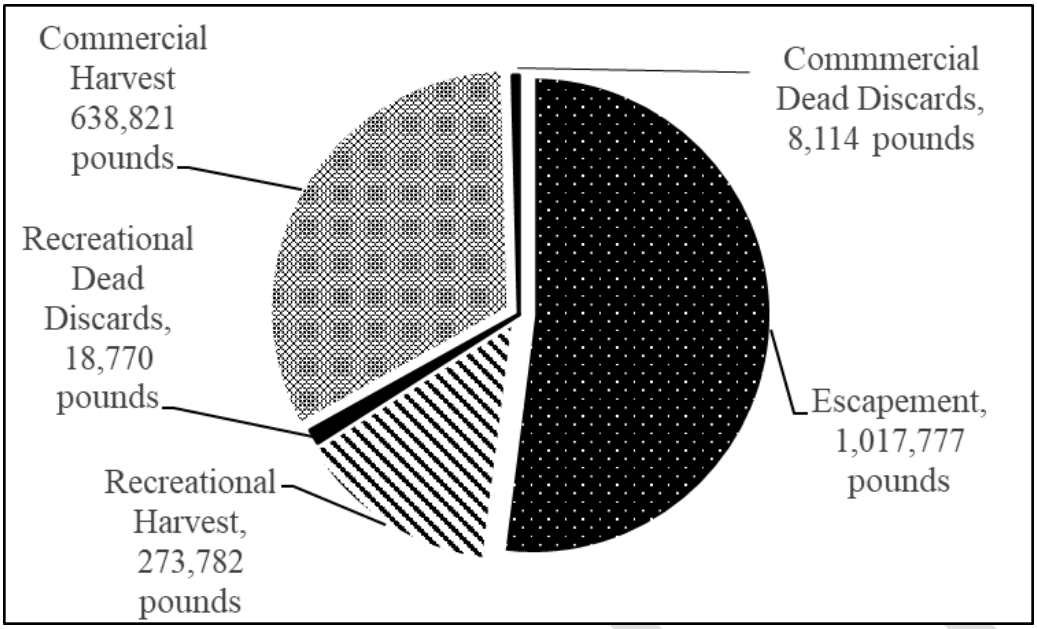


Figure 4.1.3. Estimated escapement of southern flounder (pounds) and contribution of the total removals for the commercial and recreational (hook-and-line and gig) fisheries in North Carolina, 2017, at a 52% reduction and a 70% commercial and 30% recreational allocation. (Source: North Carolina Trip Ticket Program, Marine Recreational Information Program, NCDMF Gig Mail Survey)

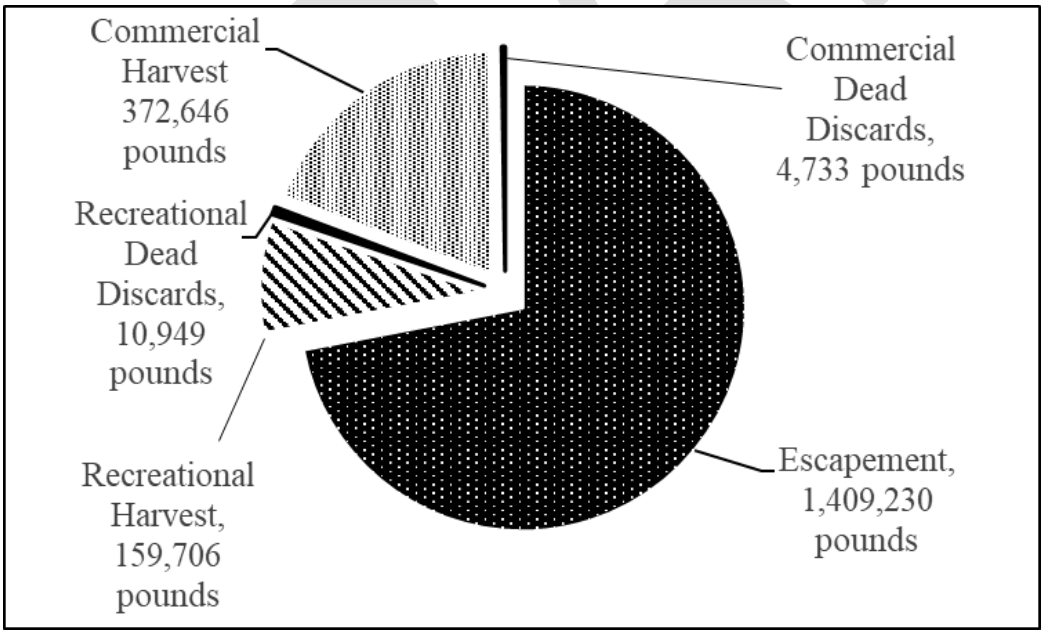


Figure 4.1.4. Estimated escapement of southern flounder (pounds) and contribution of the total removals for the commercial and recreational (hook-and-line and gig) fisheries in North Carolina, 2017, at a 72% reduction and a 70% commercial and 30% recreational allocation. (Source: North Carolina Trip Ticket Program, Marine Recreational Information Program, NCDMF Gig Mail Survey).

Table 4.1.1. Southern flounder total allowable catch (TAC) and total allowable landings (TAL) in pounds to meet the necessary reductions for the overfishing threshold and SSB threshold and target of the commercial and recreational fisheries, following the NCMFC selection of a 70/30 allocation.

				Commercial Fisheries			Recreational Fisheries*		
Percent Reduction from 2017 Terminal Year	Total Allowable Catch	Dead Discards	Total Allowable Landings	Total Allowable Commercial Landings	Mobile Gears	Pound Nets	Total Allowable Recreational Landings	Hook and Line	Gigs
2017	1,957,264	56,008	1,901,256	1,330,879	664,957	665,922	570,377	507,877	62,500
52%	939,487	26,884	912,603	638,821	319,179	319,642	273,782	243,782	30,000
62%	743,760	21,283	722,477	505,734	252,684	253,050	216,743	192,993	23,750
72%	548,034	15,682	532,352	372,646	186,188	186,458	159,706	142,206	17,500

*Recreational commercial gear harvest is unknown since 2008 and could not be quantified in the reductions.

Management measures (seasonal closures) implemented in Amendment 2 met the statutory requirements and were critical for reducing removals and initiating the rebuilding of the southern flounder stock. Seasonal closures do not enforce a maximum removal level on the fishery and only limit the time when targeted harvest can occur. Fishing effort can be more concentrated 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. Though seasonal flexibility is provided to the NCDMF Director by the NCMFC motion approving the adoption of Amendment 2, seasonal closures alone may not result in the needed increase in SSB even if maintained long term (NCDMF 2019). Consequently, the approval of Amendment 2 specified the development of Amendment 3 to begin immediately to implement more comprehensive, long-term management measures to achieve sustainable harvest. Management strategies implemented through Amendment 3 will not restart the time requirements set in Amendment 2 that are necessary to meet the statutory mandates.

Amendment 2 required a 62% reduction in 2019 and a 72% reduction from 2020 onward, both above the minimum 52% reduction that is statutorily required. Preliminary analysis of reductions achieved in 2019 from implementation of Amendment 2 management measures indicate an overall reduction of 35% was achieved or a 43% reduction in total removals for the commercial fishery and a 15% reduction in total removals for the recreational fishery. A level of reduction less than the required 62% was anticipated as the seasons did not begin until Sept. 4, 2019. The fisheries operated three quarters of the calendar year, as compared to estimates that were based on a closure beginning Jan. 1. While Amendment 2 did not meet the 62% reduction in 2019, the 35% reduction achieved was greater than the minimum of 31% to end overfishing. The 2020 landings and preliminary estimates of dead discards indicated a 52% reduction was achieved, exceeding the ending overfishing target and meeting the ending overfished threshold but not meeting the 72% reductions approved under Amendment 2. Harvest exceeded the TAL to meet the 72% for both the commercial and recreational fisheries.

Management measures for Amendment 3 will be selected and implemented from the allowable total removals (landings and dead discards) that are calculated based on the fishing mortality estimates of the terminal year (2017) of the stock assessment (Flowers et al. 2019). Quota-based management accounts for dead discards at the end of each sectors fishing year, therefore quota management is based on total allowable landings. Total allowable catch for the southern flounder fishery was reduced by 72%. Removing dead discards for each corresponding sector results in the estimated total allowable landings that can be removed through the southern flounder fishery. The total allowable landings were allocated 70% commercial and 30% recreational based on the NCMFC decision at the Feb. 2021 business meeting. At a special meeting in March 2021, the NCMFC amended the sector allocations to 70% commercial and 30% recreational in 2021 and 2022, 60% commercial and 40% recreational in 2023, and 50% commercial and 50% recreational in 2024 (see *Recreational and Commercial Sector Allocations in the North Carolina Southern Flounder Fishery* issue paper for further discussion). While the motion included allocating the southern flounder fishery in 2021, allocations will not take effect until the final approval of Amendment 3 (most likely some time in 2022); however, to keep consistent with the NCMFC motion 2021 allocations are presented below. The reductions are only applied to North Carolina's portion of total removals. Calculations to predict future harvest reductions depends on environmental parameters, recruitment, and fishing effort remaining similar to previous years, an assumption of the 2019 updated stock assessment. Any changes to these factors will impact the stock's response and whether the statutory requirement of sustainable harvest is achieved.

Building on the seasonal closures in Amendment 2, additional quantifiable and non-quantifiable management measures in Amendment 3 will serve to improve the overall southern flounder stock to reduce total removals and increase likelihood of improved southern flounder SSB and recruitment, while still providing flexibility for fishermen, when possible, in the timing of the harvest for the sectors. This issue paper required assumptions about the fishery to be made as a quota-based management strategy was developed. Additionally, it evaluates management measures in addition to seasonal closures for a long-term approach in constraining harvest to the anticipated levels in the southern flounder fishery to achieve sustainable harvest in Amendment 3.

IV. AUTHORITY

North Carolina General Statutes
§ 113-134 RULES
§ 113-182 REGULATION OF FISHING AND FISHERIES
§ 113-182.1 FISHERY MANAGEMENT PLANS
§ 113-221.1 PROCLAMATIONS; EMERGENCY REVIEW
§ 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

V. DISCUSSION

The N.C. Department of Environmental Quality and the division recognize the required reductions in the southern flounder fishery are significant but necessary to increase the probability of successfully rebuilding this important recreational and commercial resource. For the discussion of potential management measures in Amendment 3, a 72% reduction is used based on the following:

- Amendment 2 required a 72% reduction from 2020 onward until adoption of Amendment 3.
- Projections for rebuilding are based on a minimum of a 50% probability of success. Adopting a reduction greater than the 52% minimum increases the likelihood of achieving the minimum necessary for rebuilding.
- The projections were made with the assumption 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. The reductions in Amendment 3 are only to North Carolina's portion of total removals through the time series of the assessment.
- The management measures implemented in North Carolina from the original Southern Flounder FMP (NCDMF 2005), Amendment 1 (NCDMF 2013), and Supplement A to Amendment 1 (NCDMF 2017a) as modified by the Aug. 17, 2017 settlement agreement has not resulted in the necessary increase in SSB to end the stock's overfished status, thus further reductions are necessary.

A fishing mortality that falls between the identified threshold (52% reduction; Figure 7 in the *Description of the Stock* section) and target (72% reduction; Figure 8 in the *Description of the Stock* section) meets the statutory requirements (Figure 4.1.1).

There are several assumptions and limitations provided in the background section of this paper that are important to take into consideration as the potential management measures for Amendment 3 are presented. Here is a summary of the key points:

- To account for North Carolina's portion of these reductions in the recreational and commercial fisheries, the identified reduction was applied to both the dead discards and landings, or total removals, for each sector (commercial and recreational) of the North Carolina southern flounder fishery from the terminal year of the assessment (2017; Figure 4.1.2).
- Reductions in dead discards will be accounted for at the end of the fishery as dead discards are not part of daily quota monitoring and will be added to the landings to adjust the value to make sure the TAC is not exceeded. This approach differs slightly from Amendment 2, in each amendment reductions were based on TAC, but as seasons were the selected management measure implemented through Amendment 2, the seasons accounted for estimated reductions in harvest and dead discards.
- The projections for rebuilding necessary to end overfishing and the overfished status included the minimum size limits for both the commercial and recreational fishery, the current gear requirements, and selected soak time and daytime restrictions. These measures influenced the fishery during the terminal year of the stock assessment and any

consideration of changes to those values should be viewed with caution as they will have an undetermined impact on the projections and the rebuilding schedule.

- The approval of Amendment 2 specified the development of Amendment 3 to begin immediately to implement comprehensive, long-term management measures to achieve sustainable harvest. Management measures for Amendment 3 will be selected and implemented from the allowable total removals (landings and dead discards) that are calculated based on the fishing mortality estimates of the terminal year (2017) of the stock assessment.
- Additional quantifiable and non-quantifiable management measures to augment the seasonal closures will serve to improve the overall southern flounder stock to ensure total removals are reduced and southern flounder SSB and recruitment increase, while still providing flexibility for fishermen, when possible, in the timing of the harvest for the sectors. Quantifiable measures are calculable and count towards the requirements to end overfishing and rebuild the stock, while non-quantifiable measures serve as a buffer and help to prevent the expansion of harvest as the stock rebuilds.

MANAGEMENT CARRIED FORWARD

There are several management measures from Amendment 2 to carry forward into Amendment 3 to serve the purpose of addressing fishing behavior and potential changes in effort to minimize the possibility of catching southern flounder in a greater volume than predicted.

Management measures from the Southern Flounder FMP Amendment 2 that will be clarified and carried forward in Amendment 3 are:

- A minimum distance (area dependent) between gill-net and pound net sets, per NCMFC Rule 15A NCAC 03J .0103 (d)
- No greater than a recreational fishery four fish bag limit
- A recreational minimum size limit of 15 inches Total Length (TL)
- A commercial minimum size limit of 15 inches TL
- A minimum mesh size of 6.0-Inch Stretched Mesh (ISM) for anchored large mesh gill nets used in the taking of flounder
- A minimum mesh size of 5.75-ISM for pound net escape panels
- Reduced 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
- For anchored large mesh gill nets with a stretched mesh length of 4.0 inches through 6.5 inches, maintain 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)
- Removal of 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 an open season with exceptions 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
- Unlawful to use any method of retrieving live flounder from pound nets that cause injury to released fish (e.g., picks, gigs, spears, etc.)
- For the commercial fishery during the closed southern flounder season, it is unlawful to possess any species of flounder harvested from the internal waters of the state

QUANTIFIABLE AND NON-QUANTIFIABLE MANAGEMENT MEASURES

Both quantifiable and non-quantifiable management measures are presented to meet the North Carolina harvest reduction for southern flounder based on the terminal year of the stock assessment (2017). Quantifiable management measures include a quota for the commercial fishery, which relies on daily quota monitoring, and a quota implemented by seasons for the recreational fishery, which serves to constrain the recreational fishery within a quota; these measures relate specifically to the stock assessment total removals and are calculable.

Additional types of management measures that are non-quantifiable are likely to be effective in reducing mortality, but the resulting reduction cannot be determined using existing data sources. Examples of non-quantifiable measures explored in this paper include certain management measures carried forward from Amendment 2 as described above including changes to trip limits in the commercial fisheries, changes to bag limits in the recreational fisheries, and a RCGL season. Additionally, a discussion of slot limits as a non-quantifiable management measure can be found in the *Changes to Size Limits through the Implementation of a Slot Limit* issue paper. Such non-quantifiable measures are needed to prevent the expansion of harvest as the stock rebuilds, increasing the likelihood of rebuilding success; however, the magnitude of these management measures, as well as the possible response of the stock, is unknown.

QUANTIFIABLE MANAGEMENT MEASURES: QUOTA

For Amendment 3, a quota will be set so the TAL that establishes maximum fishing limits (in pounds) in a year for all participants does not exceed a pre-determined amount. A quota is a specified numerical harvest objective, the attainment of which causes closure of the fishery of that species (Blackhart 2005). For the North Carolina southern flounder fisheries the quota is measured in pounds of fish. The quota that meets the required reductions and the NCMFC allocation motion is a 548,034 pounds TAC which results in 532,352 pounds of TAL for management. This TAL will be further divided into commercial and recreational allocations based on a motion approved by the NCMFC in March 2021. The allocations will be 70% commercial and 30% recreational in 2021 and 2022, 60% commercial and 40% recreational in 2023, and 50% commercial and 50% recreational beginning in 2024. The TAL for each sector can be found in Table 4.1.2 and additional information on allocations can be found in the *Recreational and Commercial Sector Allocation in the North Carolina Southern Flounder Fishery* issue paper.

Table 4.1.2. Allocations for commercial and recreational fisheries and associated sub-allocations for each sector for the North Carolina Southern Flounder Fishery that maintains overall reductions of 72%.

					Commercial Fisheries	Recreational Fisheries*
Year	Allocation	Total Allowable Catch	Dead Discards	Total Allowable Landings	Total Allowable Commercial Landings	Total Allowable Recreational Landings
2021 -	70/30	548,034	15,682	532,352	372,646	159,706
2022	70/30	548,034	15,682	532,352	372,646	159,706
2023	60/40	548,034	15,682	532,352	319,411	212,941
2024	50/50	548,034	15,682	532,352	266,176	266,176

* RCGL gear removals not included in the Total Allowable Landings

When using a quota to manage a fishery, decisions need to be made on how to split out or allocate the resource within each of the sectors and then also determine whether rollover of unused quota, payback of exceeded quota, or both will occur. Accountability measures implemented provide a means to manage the quota. A conservative approach benefits the resource by protecting any unharvested fish and not exceeding the total allowable catch. This benefits the resource but may have consequences to user groups by shortening seasons or limiting access in some areas during subsequent years. A more liberal approach to accountability measures benefits the user groups by allowing harvest of any remaining allocation during subsequent years and not requiring paybacks for any harvest over an allocation but may have consequences to the resource.

Commercial Fisheries

For all commercial fisheries combined, the total allowable landings are 372,646 pounds of southern flounder for 2021 and 2022, 319,411 pounds in 2023, and 266,176 pounds beginning in 2024 (Table 4.1.2). This is the commercial allocation of the overall quota. To ensure the commercial allocation is not exceeded but provides all sectors continued access to the resource under these restrictions, further refinement maybe necessary to allow an annual harvest, to manage by areas, gears and opening dates and stay within the overall quota. The division analyzed data to determine individual gear allocations for different areas and opening time frames, as well as data that combined some gears into one allocation for a given area. This analysis was undertaken with the understanding that increasing the complexity of management also increases the complexity of monitoring the quota, reducing the ability to effectively meet the targets to achieve sustainable harvest.

Commercial Gear Allocation

Given the large reduction needed to achieve sustainable harvest and the importance of each allocation staying within its allowed landings, it is most practical to separate the gears into two categories: pound nets and mobile gears (including gears that target southern flounder, primarily gigs and gill nets, and "other" gears that do not target southern flounder such as shrimp trawls, crab pots, and fyke nets). Using these two categories of mobile gears and pound nets also provides flexibility by allowing fishermen to use multiple gears in a trip without having to

separate catches unless a pound net is involved. Combining mobile gears into a single category prevents users from switching between the two categories or altering their behavior that may increase harvest. For example, if there is a closure for gill nets due to protected species interactions, the remaining allocation would be available for harvest using non gill-net gears within the mobile gear category. In addition, the NCMFC has requested the division to evaluate phasing out large mesh gill nets in the southern flounder fishery by the terminal year of the current sea turtle ITP, August 2023. If the NCMFC selects this as a management measure it may impact the sub-allocations for each gear category. More information can be found in the *Phasing out Large Mesh Gill Nets in the North Carolina Southern Flounder Fishery* issue paper in Appendix 4.7.

All mobile gears have the capability to be used to harvest southern flounder throughout the year, although there is variability in their use among the individual gears. Combining mobile gears into one allocation makes monitoring the daily harvest more efficient with less risk of exceeding the annual allocation. Looking at the seasonality and movement of southern flounder, commercial gig and "other" gears could have the ability to open in the late spring or early summer to maximize the economic benefit of the market at that time. The gig fishery could open in early summer and any remaining allocation would be available for harvest by gill nets and other gears at a specific opening date later in the fall. Consequences of the southern flounder gill-net fishery operating in the early spring or summer include at-net mortality, discards of non-marketable fish, as well as post-release mortality of undersized flounder.

The commercial southern flounder pound net fishery only has the capability to operate during the fall months, beginning in late August in Albemarle Sound and ending in late November in Core Sound. Allocating harvest to the pound net fishery outside of the fall migration would not be appropriate. Flounder pound nets are stationary gears and are only actively fishing when southern flounder are migrating to the ocean. The pound net gear is most susceptible to changes in average price per pound, as the market typically drops in value in October due to the opening of the summer flounder winter trawl fishery.

Commercial Gear Sub-Allocations

Due to the shift in allocation based on the March 2021 NCMFC motion, it is prudent to evaluate the sub-allocations for the commercial fishery. Presented below are three potential scenarios that account for the NCMFC approved allocation changes as well as changes to the sub-allocations for the commercial fishery sectors. The first scenario is showing the TAL by year for each sector based on historical landings and can be found in Table 4.1.3. A second scenario is to meet the NCMFC approved allocation and adjust the commercial sub-allocations so the pound net fishery maintains their current harvest estimate of 186,458 pounds. This scenario provides a level of harvest that maintains the fishery at a reduced level but accounts for the increased monetary investment of operating and maintaining the pound net gear. Sub-allocations for this scenario can be found in Table 4.1.4. A final scenario considered is to adjust the allocation and phase out large mesh gill nets in the southern flounder fishery at the end of the current ITP in 2023 as proposed by the NCMFC. Under this scenario the sub-allocations remain consistent with the first scenario for 2021 and 2022 but beginning in 2023 half of the gill net landings are transferred to the pound net gear category and the other half remaining with the mobile gear category (Table

4.1.5). This 50/50 transfer of gill net allocation is just one example and can be altered based on NCMFC, Advisory Committee, or public input.

Table 4.1.3. Allocations for the North Carolina Southern Flounder commercial and recreational fisheries and associated sub-allocations for each sector for the North Carolina Southern Flounder Fishery that maintains overall reductions of 72% and historical sub-allocations.

					Commercial Fisheries			Recreational Fisheries*		
Year	Allocation	Total Allowable Catch	Dead Discards	Total Allowable Landings	Total Allowable Commercial Landings	Mobile Gears	Pound Nets	Total Allowable Recreational Landings	Hook and Line	Gigs
2021	70/30	548,034	15,682	532,352	372,646	186,188	186,458	159,706	142,206	17,500
2022	70/30	548,034	15,682	532,352	372,646	186,188	186,458	159,706	142,206	17,500
2023	60/40	548,034	15,682	532,352	319,411	159,590	159,821	212,941	189,608	23,333
2024	50/50	548,034	15,682	532,352	266,176	132,992	133,184	266,176	237,010	29,166

* RCGL gear removals not included in the Total Allowable Landings

Table 4.1.4. Allocations for the North Carolina Southern Flounder commercial and recreational fisheries and associated sub-allocations for each sector that maintains overall reductions of 72% but maintains the current level of sub-allocation for the pound net fishery.

					Commercial Fisheries			Recreational Fisheries*		
Year	Allocation	Total Allowable Catch	Dead Discards	Total Allowable Landings	Total Allowable Commercial Landings	Mobile Gears	Pound Nets	Total Allowable Recreational Landings	Hook and Line	Gigs
2021	70/30	548,034	15,682	532,352	372,646	186,188	186,458	159,706	142,206	17,500
2022	70/30	548,034	15,682	532,352	372,646	186,188	186,458	159,706	142,206	17,500
2023	60/40	548,034	15,682	532,352	319,411	132,953	186,458	212,941	189,608	23,333
2024	50/50	548,034	15,682	532,352	266,176	79,718	186,458	266,176	237,010	29,166

* RCGL gear removals not included in the Total Allowable Landings

Table 4.1.5. Allocations for the North Carolina Southern Flounder commercial and recreational fisheries and associated sub-allocations for each sector that maintains overall reductions of 72% but redistributes the gill net allocation equally between mobile and pound net gears.

					Commercial Fisheries			Recreational Fisheries*		
Year	Allocation	Total Allowable Catch	Dead Discards	Total Allowable Landings	Total Allowable Commercial Landings	Mobile Gears	Pound Nets	Total Allowable Recreational Landings	Hook and Line	Gigs
2021	70/30	548,034	15,682	532,352	372,646	186,188	186,458	159,706	142,206	17,500
2022	70/30	548,034	15,682	532,352	372,646	186,188	186,458	159,706	142,206	17,500
2023	60/40	548,034	15,682	532,352	319,411	99,102	220,309	212,941	189,608	23,333
2024	50/50	548,034	15,682	532,352	266,176	85,803	180,373	266,176	237,010	29,166

* RCGL gear removals not included in the Total Allowable Landings

Commercial Areas and Seasons Allocation

Because of the migratory nature of southern flounder, areas were investigated by the NCTTP waterbody locations to allow more equitable access by fishermen across the state with seasonal opening varying by area. As the weather begins to change during the fall, southern flounder migrate to estuarine waters in the south and east before moving into the ocean (Craig et al. 2015). The migration begins in the northern and western sounds and tributaries before it begins in the southern areas. As previously stated, increasing the complexity of management also increases the complexity of monitoring the quota, reducing the ability to effectively meet the targets; however, the benefit of this type of flexibility is the potential for staggered opening dates that will be determined by the director after consultation with user groups (more information on how the division will determine opening dates is available in the *Adaptive Management* issue paper). Staggering opening dates minimizes the chances of a "derby fishery", which forces all participants to fish at the same time ultimately leading to a flooded market and lower prices. Altering opening dates allows for specific areas and gears to target southern flounder when they are accessible and most valuable to fishermen with the expectation that harvest is tracked daily so the total allowable landings are not exceeded.

Analysis indicates that gear and area combinations with no more than three areas statewide would provide the best chance of success of achieving sustainable harvest through daily quota monitoring. For some gear and area combinations, two areas would allow some flexibility to the sectors and make accountability even more manageable.

Landings data for the southern flounder commercial fishery were reviewed using waterbody locations and gear type identified by the NCTTP to determine if natural breaks by area and gear occurred (NCDMF 2017b). Identification of natural breaks by waterbody and gear determines how finely the areas can be managed within each gear category. A natural break in commercial effort and landings occurs in several areas across the state, but for ease of enforcement and

knowledge of existing areas by fishermen, it is beneficial to use regulatory boundaries already in place.

Dividing mobile gears into two areas using current boundaries would result in a northern area from the North Carolina/Virginia border south to the B-D ITP boundary line in Core Sound (34° 48.2700' N latitude which runs approximately from the Club House on Core Banks westerly to a point on the shore at Davis near Marker "1") and a southern area from the 34° 48.2700' N latitude south to the North Carolina/South Carolina Border (Figure 4.1.5). Splitting mobile gears into three areas may best be approached with a northern area encompassing the Albemarle Sound and its tributaries including the Croatan and Roanoke sounds, a central area encompassing the Pamlico Sound and its tributaries, and a southern area encompassing all waters from Core Sound south (Figure 4.1.5).

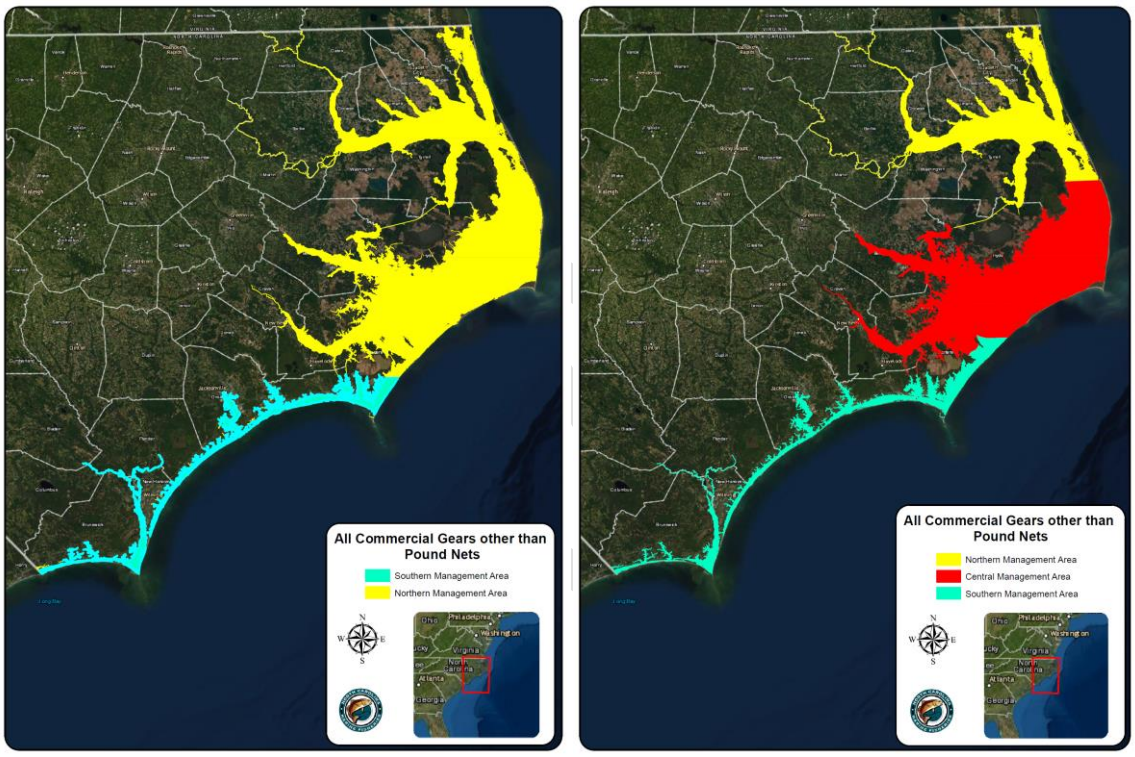


Figure 4.1.5. Boundary descriptions for two and three areas to consider for mobile gears. The three area boundaries are identical as seen for pound nets.

Dividing the state's pound net fishery into two areas may best be approached with a northern area from the North Carolina/Virginia border south to the 35° 46.3000' N latitude which runs approximately from the north end of Pea Island (old Coast Guard station) westerly to a point on the shore at Point Peter Canal and a southern area from 35° 46.3000' N latitude south to the North Carolina/South Carolina border (Figure 4.1.6). Three areas for the pound net fishery would be consistent with areas already in place under Amendment 2 for this fishery and would be the same boundaries described for mobile gears (Figure 4.1.6).

Commercial landings for mobile gears were combined and allocated by waterbody, with the exception of landings from Core Sound. Due to Core Sound being in two management areas,

50% of the landings from Core Sound were counted towards the northern area and 50% were counted towards the southern area (Table 4.1.2; Table 4.1.6-4.1.8). Commercial pound net landings were allocated to each waterbody within the areas.

Based on the determined allocations provided by the NCMFC, the division determined the annual commercial TAL allocation in 2021 and 2022 is 372,646 pounds (Table 4.1.1). This allocation will be reduced in 2023 to 60% (319,411 lb) and again in 2024 to 50% (266,176 lb) to meet the requirements outlined by the NCMFC (Table 4.1.2). Three options presenting associated pounds of available allocation by area and gear can be found in tables 4.1.6, 4.1.7, 4.1.8. These options explore impacts using 2017 catch proportions, keeping the pound net fishery at the current level of harvest, and eliminating gill net harvest and allocating those landings to the mobile and pound net gears evenly. The first option (Table 4.1.6) shows the sub-allocations by each are based on the commercial landings from 2017. The landings indicate almost a 50/50 share of harvest between mobile hears and pound net gears. The second option (Table 4.1.7) is to maintain the pound net fishery allocation at 186,458 pounds or another static value. This option is being considered due to the costs and generational acquisition of the sets and gear. In addition, the pound net operates in a fashion where catches vary significantly as the fish migrate out of the estuary. There needs to be a sufficient volume of allocation to provide managers with the ability to monitor the landings daily while not exceeding the quota. The last option (Table 4.1.8) provides sub-allocations that result from removing gill nets as an allowable fishing gear for southern flounder and distributes the projected harvest across the mobile and pound net gear categories evenly. This option is considered because the NCMFC requested development of Appendix 4.7: Phasing Out Large-Mesh Gill Nets from the North Carolina Southern Flounder Fishery issue paper. The option selected for Appendix 4.7 may influence available options under sustainable harvest sub-allocations.

Sub-allocations are presented to provide additional details of allocation shifts and to solicit ideas from the user groups on how to distribute quota among the commercial gears. Any of the three options can be implemented while maintaining harvest at a level that meets the required 72% reductions moving forward but some combinations of gear/area and sub-allocation do not provide sufficient quota for NCDMF to manage without concern for exceeding the quota.

Table 4.1.6. Allocation for the North Carolina Southern Flounder commercial fishery and associated sub-allocations for each sector that maintains overall reductions of 72% and 2017 sub-allocations.

Commercial Gear	Allocation %	Area/Allocation (lb)			Total Allocation (lb)	Option
Mobile Gears	70	Statewide 186,188			186,188	1.1B
	70	Northern 123,879	Southern 62,309		186,188	1.1A
	70	Northern 47,082	Central 65,355	Southern 73,751	186,188	1.1C
	60	Statewide 159,590			159,590	1.1B
	60	Northern 106,182	Southern 53,408		159,590	1.1A
	60	Northern 40,356	Central 56,018	Southern 63,216	159,590	1.1C
	50	Statewide 132,992			132,992	1.1B
	50	Northern 88,486	Southern 44,506		132,992	1.1A
	50	Northern 33,360	Central 46,682	Southern 52,680	132,992	1.1C
Pound Nets	70	Statewide 186,458			186,458	1.2B
	70	Northern 37,900	Southern 146,758		186,458	1.2C
	70	Northern 39,700	Central 121,756	Southern 25,002	186,458	1.2A
	60	Statewide 159,821			159,821	1.2B
	60	Northern 34,028	Southern 125,793		159,821	1.2C
	60	Northern 34,028	Central 104,363	Southern 21,430	159,821	1.2A
	50	Statewide 133,184			133,184	1.2B
	50	Northern 28,357	Southern 104,827		133,184	1.2C
	50	Northern 28,357	Central 86,969	Southern 17,858	133,184	1.2A

Table 4.1.7. Allocation for the North Carolina Southern Flounder commercial fishery and associated sub-allocations for each sector that maintains overall reductions of 72% but maintains the current level of sub-allocation for the pound net fishery.

Commercial Gear	Allocation %	Area/Allocation (lb)			Total Allocation (lb)	Option
Mobile Gears	70	Statewide 186,188			186,188	1.1B
	70	Northern 123,879	Southern 62,309		186,188	1.1A
	70	Northern 47,082	Central 65,355	Southern 73,751	186,188	1.1C
	60	Statewide 132,593			132,953	1.1B
	60	Northern 88,460	Southern 44,493		132,953	1.1A
	60	Northern 33,621	Central 46,668	Southern 52,664	132,953	1.1C
	50	Statewide 79,718			79,718	1.1B
	50	Northern 53,040	Southern 26,678		79,718	1.1A
	50	Northern 20,159	Central 27,982	Southern 31,577	79,718	1.1C
Pound Nets	70	Statewide 186,458			186,458	1.2B
	70	Northern 37,900	Southern 146,758		186,458	1.2C
	70	Northern 39,700	Central 121,756	Southern 25,002	186,458	1.2A
	60	Statewide 186,458			186,458	1.2B
	60	Northern 37,900	Southern 146,758		186,458	1.2C
	60	Northern 39,700	Central 121,756	Southern 25,002	186,458	1.2A
	50	Statewide 186,458			186,458	1.2B
	50	Northern 37,900	Southern 146,758		186,458	1.2C
	50	Northern 39,700	Central 121,756	Southern 25,002	186,458	1.2A

Table 4.1.8. Allocation for the North Carolina Southern Flounder commercial fishery and associated sub-allocations for each sector that maintains overall reductions of 72% but redistributes the gill net allocation equally between mobile and pound net gears beginning in 2023 (shown in the 60% and 50% allocations).

Commercial Gear	Allocation %	Area/Allocation (lb)			Total Allocation (lb)	Option
Mobile Gears	70	Statewide 186,188			186,188	1.1B
	70	Northern 123,879	Southern 62,309		186,188	1.1A
	70	Northern 47,082	Central 65,355	Southern 73,751	186,188	1.1C
	60	Statewide 99,102			99,102	1.1B
	60	Northern 65,937	Southern 33,165		99,102	1.1A
	60	Northern 25,060	Central 34,786	Southern 39,255	99,102	1.1C
	50	Statewide 85,803			85,803	1.1B
	50	Northern 57,089	Southern 28,714		85,803	1.1A
	50	Northern 21,697	Central 30,118	Southern 33,988	85,803	1.1C
Pound Nets	70	Statewide 186,458			186,458	1.2B
	70	Northern 37,900	Southern 146,758		186,458	1.2C
	70	Northern 39,700	Central 121,756	Southern 25,002	186,458	1.2A
	60	Statewide 220,309			220,309	1.2B
	60	Northern 46,907	Southern 173,402		220,309	1.2C
	60	Northern 46,907	Central 143,861	Southern 29,541	220,309	1.2A
	50	Statewide 180,373			180,373	1.2B
	50	Northern 38,404	Southern 141,969		180,373	1.2C
	50	Northern 38,404	Central 117,783	Southern 24,186	180,373	1.2A

Landings data for the southern flounder commercial fisheries were evaluated to determine how landings and price per pound fluctuated during the year. This helped to identify what time frames would allow for the most productive fishery while minimizing discard mortality and meeting the necessary reductions. 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 4.1.7).

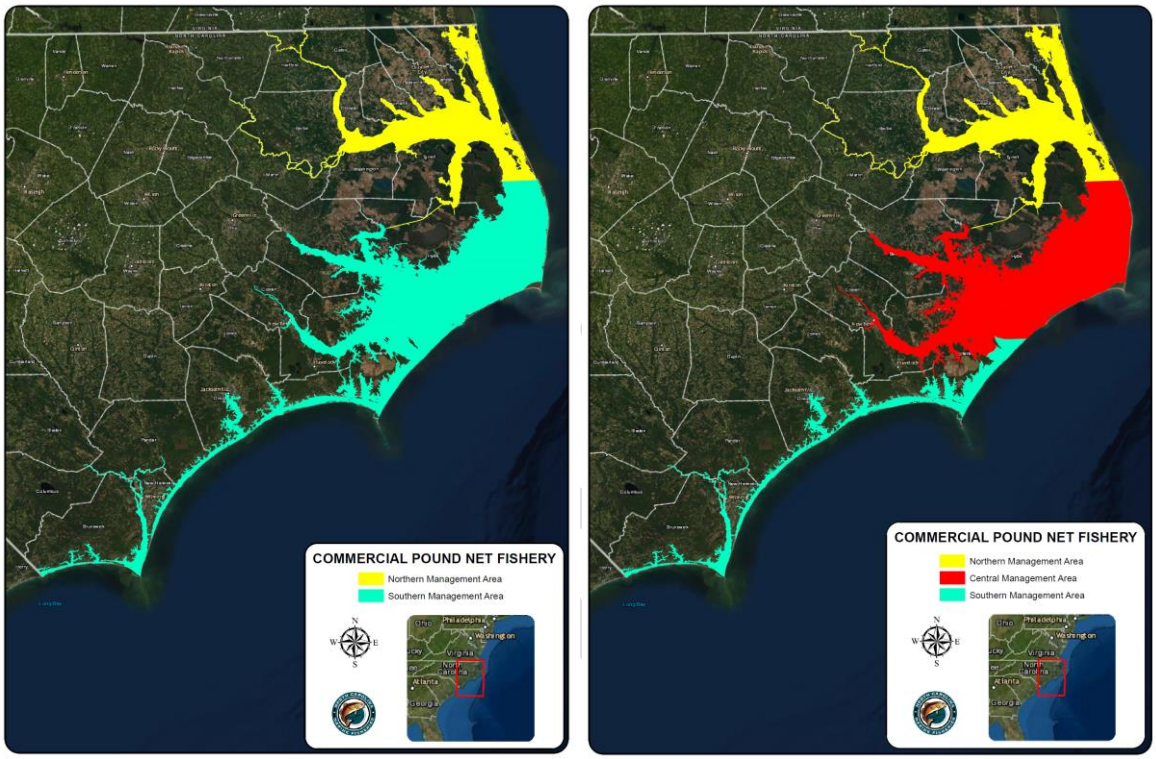


Figure 4.1.6. Boundary descriptions for two and three areas to consider for the pound net fishery. The three area boundaries are the same as mobile gears.

Southern flounder landings vary by location, month, and gear but typically 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. Due to these variations in seasonal landings by gear and area, landings were analyzed to show the weekly rate of harvest as a percent of the total average landings from 2008 to 2017 (Figures 4.1.8 and 4.1.9). This analysis shows harvest rates through the year for each gear category statewide and by area as identified in Figures 4.1.5 and 4.1.6. One exception is in the southern portion of the state where the commercial gig fishery harvests flounder beginning in early summer and drives the harvest in the summer for the southern area (Figure 4.1.8).

Combining all mobile gears into a single group would allow for flexibility in determining opening dates for gears within the larger category, possibly allowing a gig fishery to operate during these summer months when the fish are available. For example, a sub-allocation of 38,614 pounds of the mobile gear allocation can be set aside for gigs and other gears, excluding gill nets, for harvest beginning May 1 and operating until this sub-allocation is harvested. This

sub-allocation is based on the commercial gig fishery portion of the mobile gears category but could change if the NCMFC selects to phase out large mesh gill nets in the southern flounder fishery. Once this sub-allocation is met, the remaining harvest would be available for harvest during the fall fishery where all gears, excluding pound nets, would be able to harvest the remainder of the available allocation for mobile gears. It is important to note that this summer sub-allocation is not independent of the mobile gear allocation. All reporting from dealers during this period will be accounted to the mobile gear allocation. In addition to seasonal information, effort data, environmental changes, ITP constraints, and quota monitoring requirements all provided information for the division to select management areas, opening dates, and gear combinations.

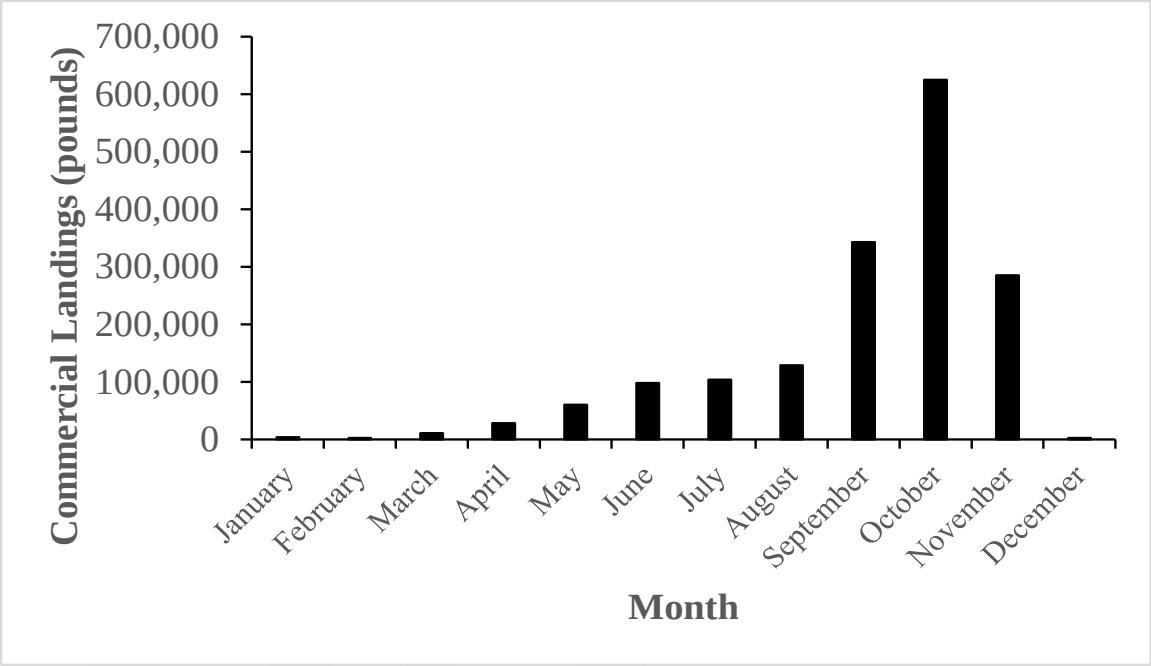


Figure 4.1.7. Average commercial southern flounder landings (pounds) by month in North Carolina, 2008-2017. (Source: North Carolina Trip Ticket Program).

Combining all mobile commercial gears into one category split between two areas of the state, with each area having its own mobile gear allocation, will provide the most flexibility to accommodate opening dates within an area based on southern flounder movements. Dividing the pound net fishery into three areas will allow the timing of the openings to this gear to be more relevant to their geographic locations. Because pound nets are stationary gear, areas to further split the allocation will accommodate some flexibility on opening dates based on southern flounder movements; however, there will be consequences of disproportionate impacts to individual areas and gears that should be noted within these added layers to the quota allocation.

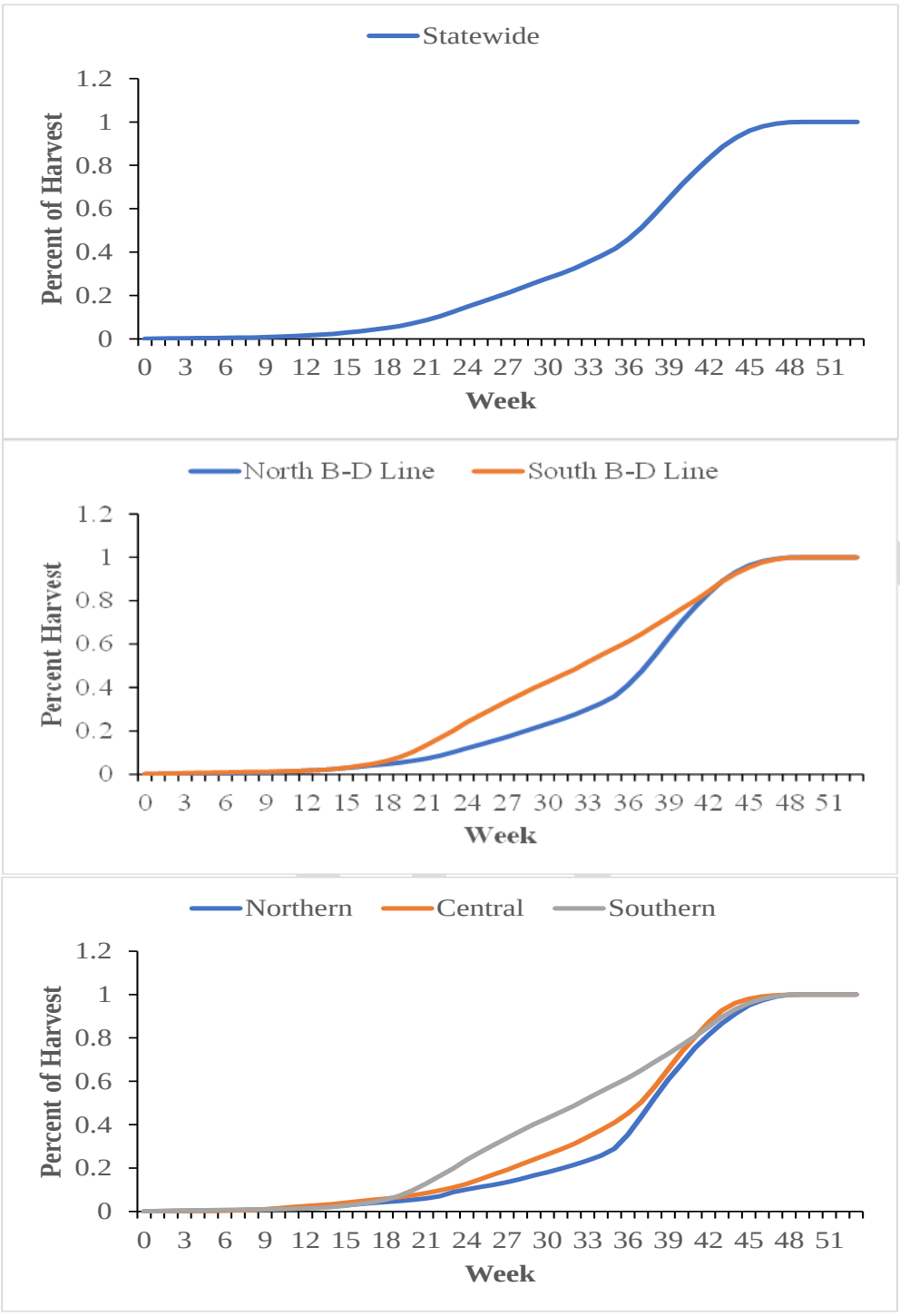
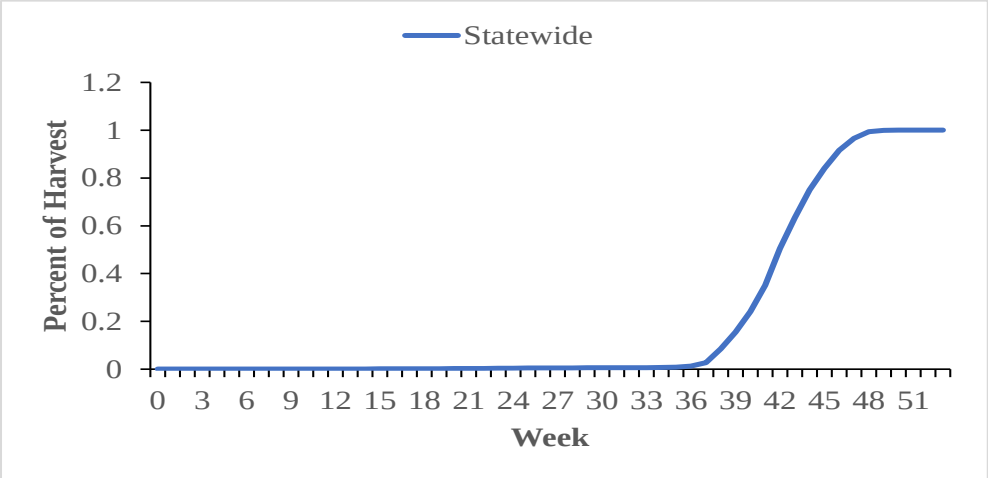
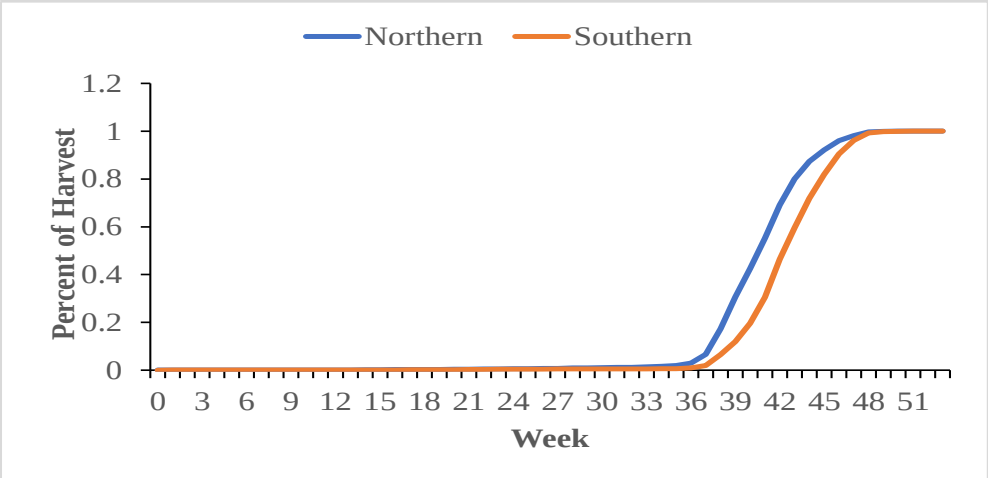


Figure 4.1.8. Average weekly harvest (in percent, 2008–2017) through the year from mobile gears statewide and for two and three areas management scenarios as identified in Figure 4.1.5.





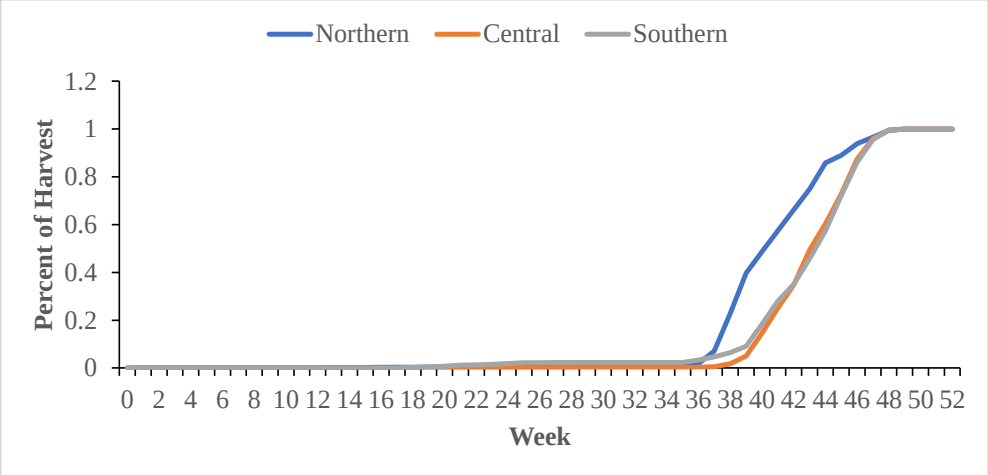


Figure 4.1.9. Average weekly harvest (in percent, 2008–2017) from the commercial pound net fishery statewide and for two and three areas management scenarios as identified in Figure 4.1.6.

Commercial Accountability Measures

For the commercial fishery, if the combined TAL for all gear and area combinations are not exceeded at the end of a fishing year, accountability measures will not be applied. If the combined TAL are exceeded, paybacks due to overages of an allocation for a particular year from landings and dead discards would be applied to the responsible gear and area combination, meaning overages would be subtracted from the following year's allocation for that gear and area combination. These overages will be applied on a pound for pound basis. Any unused allocation or rollover would not be added to the subsequent year's allocation and would serve as a benefit to the resource and potentially decrease the time for rebuilding. The final total of pounds landed (including estimates of dead discards for the gill-net fishery) from a year's harvest will be determined through verification of the quota monitoring forms and NCTTP landings data. It is important to restate that it is not the individual gear and area allocations that are driving management, rather it is the overall quota. The NCDMF will do what is necessary to maintain landings to meet the needs of rebuilding of the stock. Flexibility in managing each gear and area combination is necessary for the overall success of a quota system; see *Adaptive Management* issue paper for further flexibility in developing long-term management measures.

Division staff will monitor the quota on a daily basis in order to prevent landings becoming so large that the quota will be exceeded and the stock will continue to be overfished. When the sum of the daily reporting for an area and gear combination approaches approximately 80% of the allocated landings, the division will issue a proclamation immediately to close the gear and area combination to the harvest of southern flounder. The mechanism for closing the southern flounder commercial fishery is through NCGS 113-221.1 (b) and Rule 15A NCAC 03M .0503 that provide the director proclamation authority to immediately close a fishery that is monitored by a quota. Closure under this rule does not require a 48-hour notice and can be issued effective immediately. This may be necessary to prevent additional overfishing as certain gear-area combinations can harvest a large percentage of the commercial quota if left unchecked.

Daily quota monitoring of the commercial fisheries will be key in achieving a long-term sustainable harvest of the southern flounder stock. A quota in combination with area, season openings, and trip limits for some gears will also provide access to the fish as they migrate through the sounds and into the ocean and maintain some buffer to reduce the potential for overages in the quota.

If remaining allocation is available, the division may reopen the gear and area combination for a short window to provide opportunity to harvest the remaining allocation; however, if the remaining allocation is not practical to manage while ensuring an overage will not occur, the fishery in question will not be reopened. This reopening may include trip limits for gears where this type of management would not increase dead discards as an additional regulation to prevent any overage of the allocation.

For gears where trip limits are not a viable option, like gill nets, the division may open the fishery daily. Daily openings may prove futile in keeping landings within an allocation and may not be a good option to use; the remaining allocation could be made available for other gears

within the mobile gears category in this case; however, if the remaining allocation is not practical to manage while ensuring an overage will not occur, the fishery in question will not be reopened.

Recreational Fisheries

For the recreational fisheries, hook and line and gigs, the TAL will vary with 2021 and 2022 being 159,706 pounds, 2023 being 212,941 pounds and from 2024 onward the TAL will be 266,176 pounds (Table 4.1.9). These are the recreational allocations of the overall quota as determined by the NCMFC. To ensure the recreational allocation is not exceeded but provides both sectors continued access to the resource under these restrictions, the allocation will be further refined to allow an annual harvest of 81% of the recreational TAL for the hook-and-line fishery and 11% of the recreational TAL for the recreational gig fishery. The associated pounds can be found in Table 4.1.9. The ability to monitor a recreational quota in real time is possible with a well-designed creel survey specific to the species and covering the geographic range of harvest and gears. The division relies on the MRIP, in which southern flounder is a species encountered regularly in the hook-and-line recreational fishery. The survey design of MRIP does not allow for results on a daily or weekly basis. Instead, results are available by two-month waves, several months after the data are collected. As a result, historical catch data must be used to predict future catch rates. 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 (Table 4.1.10). Seasons may vary as the TAL increases from 30% in 2021 until 50% parity is reached in 2024. This will be determined through Adaptive Management.

Although the recreational hook-and-line fishery is monitored through the MRIP, this program does not collect necessary information to provide estimates for the recreational gig fishery. As a result, the division conducts an annual mail survey for gig fishery effort and harvest estimates (see the *Description of the Fishery* section for additional details on MRIP and the Recreational Gig survey).

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. RCGL holders primarily use large-mesh gill nets to harvest southern flounder but may occasionally harvest southern flounder from shrimp trawls and crab pots. The collection of RCGL harvest data has not occurred since 2008 and is not reliable for estimating reductions due to multiple management changes since the survey ended. See the section on the *Description of the Fisheries* for trends in the RCGL fishery.

Table 4.1.9. Southern flounder recreational fishery total allowable landings allocations in pounds by gear and total recreational allocation percentage.

	Recreational Gear		
Allocation %	**Hook-and-Line**	**Gig**	**Total**
30	142,206	17,500	159,706
40	189,608	23,333	212,941
50	237,010	29,166	266,176

Table 4.1.10. Seasons identified to reach the TAL (142,206 pounds in 2021 and 2022, 189,608 pounds in 2023, and 237,010 pounds in 2024) of the NC recreational hook-and-line fishery quota in pounds at the current four fish bag limit based on average landings from 2008–2017. Seasons may vary as the TAL increases until 50% parity is reached and will be determined through Adaptive Management.

	Landings (lb)			
Season	**4-Fish Bag Limit**	**3- Fish Bag Limit**	**2- Fish Bag Limit**	**1- Fish Bag Limit**
no closure	451,126	428,594	400,502	332,075
Apr 16–Jun 30	109,157	107,657	105,569	100,911
May 1–Jun 30	102,622	102,622	99,249	94,985
Jun 1–Jul 15	110,702	109,102	106,836	102,184
Aug 1–Sep 30	179,895	175,782	171,480	161,015
Aug 16–Sep 30	127,706	125,359	123,267	118,071
July 16–Sep. 30	222,360	216,583	210,150	194,024
June 16–Sep. 15	272,287	263,508	252,502	226,790
Aug 16-Oct 15	156,040	152,524	149,254	*141,382
Aug-16-Oct 30	177,680	173,505	169,590	159,554

* This season and bag limit does meet the harvest level of TAL but exceeds estimates at the TAC level for the 30% allocation in 2021 and 2022.

The use of RCGL gear is only allowed when both the recreational and commercial fisheries are open for the particular gear, and the user can only harvest recreational limits. Due to these requirements, the only options available to regulate the harvest of flounder using a RCGL is to allow harvest during a period of time when the commercial and recreational fisheries are open simultaneously or prohibit the harvest of flounder using a RCGL.

The limitations in monitoring for the recreational southern flounder fisheries allows for less flexibility in management measures to ensure the recreational allocation is not exceeded. Final estimates of recreational harvest are not available until the season ends, so real time accounting of catch cannot be determined for underage or overage to the sector allocation. To complement a

seasonal approach to the allocations, further non-quantifiable measures such as bag limits and allowable RCGL harvest are considered, as maintaining the four-fish daily bag limit allows for harvest just above the maximum required within the current season. These additional management tools are needed to increase the likelihood of meeting required reductions in the recreational fisheries and are discussed below.

Further discussion on species-specific management measures is considered and presented in the *Increased Recreational Access* issue paper.

Recreational Season Allocation

The recreational hook-and-line fishery is allocated an increasing volume from 142,206 pounds in 2021 up to 237,010 pounds of southern flounder beginning in 2024 (Tables 4.1.1 and 4.1.9). With the current four-fish bag limit, the identified season of Aug. 16 through Sept. 30 meets the reductions when combined with the inability to provide estimates of gig harvest and discards at reduced bag levels and the potential additional harvest from an ocellated flounder season (*See Increased Recreational Access* issue paper). While this seasonal approach does meet the reductions, changes to bag limits are discussed in detail later due the potential for increased angler success. Seasonal allocation results in a quota that is validated using MRIP landings only after the season has closed. In North Carolina, the previous years' MRIP landings are available by mid-April of the following year.

The recreational gig fishery is allocated an increasing volume from 17,500 pounds in 2021 up to 29,166 pounds of southern flounder beginning in 2024 (Table 4.1.9). 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 (Table 4.1.11). Allowing a gig fishery to operate longer than the recreational hook-and-line fishery would allow excess harvest from the gig fishery that would exceed the gig allocation. In addition, if the gig fishery and the hook-and-line fishery operated during independent seasons, anglers could alter their current behavior by participating in each of the seasons, increasing effort and harvest on an already limited allocation.

Table 4.1.11. Seasons identified to reach the initial TAL (17,500 pounds in 2021 and 2022, 23,333 pounds in 2023, and 29,166 pounds in 2024) of the N.C. recreational gig fishery landings (observed harvest) at the current four-fish bag limit based on average landings from 2010 through 2017. Seasons may vary as the TAL increases until 50% parity is reached and will be determined through Adaptive Management.

Season	Landings (lb)
no closure	85,688
Jul 1–Sep 30	33,532
Jul 16–Sep 30	28,060
Jul 1–Sep 15	27,711
Aug 1–Sep 30	22,587
Aug 16–Sep 30	17,115

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) are managed collectively in North Carolina. Other measures may be available to allow for species-specific management (see *Increased Recreational Access* issue paper*).*

Recreational Accountability Measures

Accountability measures will also be necessary for the recreational hook-and-line and gig fisheries. The final recreational total catch will be determined by adding the total landings from the MRIP and gig surveys to the estimates of dead discards. To account for overages from landings and dead discards, the following year's recreational quota and season will be adjusted based on the results of the MRIP and gig mail surveys from the previous year. If the TAL for the recreational sector combined is not exceeded, then accountability measures will not be applied. If the TAL are exceeded, any overages to the TAL will be applied to the subsequent season (which includes both hook and line and gig gears). Using the conservative approach described in the commercial accountability measures, any remaining allocation will not be rolled over to subsequent years. These data are typically available by mid-April for the previous calendar year, can be calculated quickly, and are expected to be finalized prior the usual recreational season, assuming the season does not open prior to June 1. For the recreational fishery, final total of pounds harvested from a year's harvest, discard estimates, and estimates of number of trips will be determined through verification of the final MRIP and gig mail survey.

A set annual quota is also the most appropriate tool for the recreational fisheries to maintain sustainable harvest, but it is more challenging to track every trip because harvest data are only available in two-month intervals with delays in verification. Instead, a season for the recreational fisheries that will maintain the allocation within its bounds may be the most reasonable approach. Due to a high level of discards in the recreational hook and line fishery, there is concern that the volume of discards can have a large direct impact on subsequent seasons if anglers continue to target and release southern flounder during closed seasons. Recreational hook-and-line discards are not monitored through a quota and are not available until after the season is complete. It is important to restate that it is not the individual gear allocations that are driving management, rather it is the overall quota. Additional measures can be implemented in concert to further refine harvest management to limit impacts due to overages while the fishery is recovering. This approach does limit angler access during periods of no harvest, but it does not stop the unintended consequences of large volumes of discards through indirect hooking while targeting other species or intentional catch and release discards. Unintended discards are a major source of removals in the southern flounder recreational fishery (Flowers et al. 2019; NCDMF 2019).

OTHER NON-QUANTIFIABLE MANAGEMENT MEASURES

Non-quantifiable measures are those that are not directly part of the stock assessment model and there is no way to measure the impact on the modeled fishing mortality. This does not mean that these 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 overfishing/overfished status as statutorily required. If non-quantifiable measures are implemented, future stock assessments will

indirectly reflect their effect on the fishery status. The non-quantifiable management measures under consideration to control effort in the fishery include trip limits in the commercial fisheries and bag limits in the recreational fisheries. Because specific impacts on recruitment and overfishing cannot be calculated, relevant empirical data for the various measures are presented herein. Earlier in the discussion section, the management carried forward was described. In addition to those non-quantifiable management measures carried forward, there are other non-quantifiable management measures to consider.

Commercial Fisheries Trip Limits

In the southern flounder commercial fishery, the use of a trip limit may be useful to maintain the quota allocation in the gig and pound net fisheries but is not ideal for the gill-net fishery due to the potential for increased dead discards. Unlike gigs or pound nets where commercial fishermen can selectively harvest flounder or release captured flounder with a high rate of survival, gill nets, although selective for fish size, cannot select for volume of fish entangled. As a result, any fish entangled in a gill net that is over a trip limit would be released with a higher rate of discard mortality, increasing the pounds of removals and impacting the overall quota.

To calculate trip limits for the gig and pound net fisheries, average landings for the past 10 years by proposed areas were reviewed in conjunction with the numbers of trips with landings in varying poundage 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 trip limit 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.

Trip limits for the commercial pound net and gig fisheries cannot be determined at this time because trip limits may change depending on the fishery and how many pounds are available to harvest. The director will determine the trip limit amounts dependent upon how close the fishery is to their allocation and what overall daily harvest amounts have already occurred in the season. Information is available to identify the volume of trips that remove southern flounder based on various intervals to provide some guidance (Tables 4.1.12 and 4.1.13). There are concerns with a trip limit for the pound net fishery, particularly if set too low. Because 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 fishermen may be forced to fish their sets in unfavorable weather conditions; currently, sets are fished on good weather days, not every day. Understanding these shortcomings in the pound net fishery, a trip limit would allow harvest of southern flounder while minimizing dead discards as discards from pounds nets are assumed to have a high survival rate. Allowing the gig fishery additional landings within the allocation using trip limits on the remaining quota will allow harvest and minimize discards as the gig fisherman can stop harvesting fish when the daily limit is reached. A trip limit for the gill-net fishery creates additional discards, as once their trip limit has been reached remaining gear soaking will capture fish in excess of the specified trip limit and be released with an estimated mortality of 23% (Lee et al. 2018). Additional information on trip limits can be found in the *Adaptive Management* issue paper.

Recreational Fisheries Bag Limits

Potential changes to bag limits for all recreational gear were evaluated. Reductions in recreational bag limits may increase the likelihood of meeting required reductions as the stock rebuilds. The daily bag limit for flounder currently is set at four fish; the average angler success rate for a single trip is one harvestable southern flounder (Figures 4.1.10 and 4.1.11). During 2017, recreational anglers released nine southern flounder for every one southern flounder that was harvested (Figure 19 in *Description of the Fishery* section). Angler success rates are tied to stock size (fish availability) and minimum size limits. As stock abundance increases during the rebuilding period, it is likely angler success will increase as well. If angler success improves, any gains achieved through limited open seasons will be lessened, limiting the actual recovery of the species. Harvest should be constrained using multiple measures in the recreational fisheries while rebuilding occurs.

Reducing the southern flounder bag limit would minimize the impacts of increased angler success on the rebuilding stock. Current data show that recreational anglers harvest 93% of the southern flounder total landings during trips where only one fish is harvested in a daily trip, although there is a four-fish daily bag limit in addition to the minimum size limit (Table 4.1.14). A reduction from four fish to three fish or from four fish to two fish daily bag limit does not curtail actual harvest (Table 4.1.14). Dropping the recreational bag limit for southern flounder to zero fish still results in dead discards of over 50,000 pounds for all identified potential season dates by anglers who are not targeting southern flounder and happen to catch and release some (Table 4.1.3). If angler success increases during the rebuilding time period, the volume of removals could increase relative to the original reduction calculations (Figure 4.1.11). If angler success doubles, which would be a two-fish daily harvest limit, paybacks from overharvest have the potential to severely curtail continued recreational angling opportunities as the stock recovers (Figure 4.1.12). For example, angler success increased from 0.9 fish per trip in 2019 to 1.3 fish per trip in 2020. Limiting the potential future harvest during times of increased abundance will allow the stock to rebuild, making further bag limits necessary to constrain recreational harvest to meet the required reductions.

Table 4.1.12. Commercial southern flounder pound net trip limit scenarios (in pounds), including the number and cumulative of % trips, and % harvest within each trip limit bounds, September through November, 2008–2017.

	Management Area									
	Northern					Central				
Pounds Per Trip	**Number of Trips**	**% of Trips**	**Cumulative Trip %**	**% of Harvest**	**Cumulative Harvest %**	**Number of Trips**	**% of Trips**	**Cumulative Trip %**	**% of Harvest**	**Cumulative Harvest %**
<251	1,633	65	65	8	8	4,173	51	51	11	11
251-500	291	12	77	8	16	1,533	19	70	14	24
501-750	159	6	83	7	24	794	10	80	12	36
751-1,000	86	3	87	6	29	518	6	86	11	47
1,001-1,250	63	3	89	5	34	315	4	90	9	56
1,251-1,500	43	2	91	5	39	212	3	93	7	63
1,501-2,000	66	3	93	8	47	252	3	96	11	74
2,001-3,000	63	3	96	11	59	209	3	98	12	86
3,001-4,000	36	1	97	10	68	76	1	99	6	92
4,001+	66	3	100	32	100	59	1	100	8	100
Average Pounds Per Trip	539					503				

	Management Area									
	Southern					Statewide				
Pounds Per Trip	**Number of Trips**	**% of Trips**	**Cumulative Trip %**	**% of Harvest**	**Cumulative Harvest %**	**Number of Trips**	**% of Trips**	**Cumulative Trip %**	**% of Harvest**	**Cumulative Harvest %**
<251	1,850	66	66	18	18	7,656	57	57	11	11
251-500	420	15	81	15	33	2,244	17	74	13	24
501-750	197	7	88	13	46	1,150	9	82	11	35
751-1,000	123	4	92	12	57	727	5	88	10	45
1,001-1,250	63	2	94	7	64	441	3	91	8	52
1,251-1,500	40	1	96	6	70	295	2	93	6	59
1,501-2,000	48	2	98	9	78	366	3	96	10	69
2,001-3,000	40	1	99	10	89	312	2	98	12	81
3,001-4,000	20	1	100	7	96	132	1.0	99	7	88
4,001+	9	0	100	4	100	134	1.0	100	12	100
Average Pounds Per Trip	344					475				

Note: Rounding of values may cause cumulative percentages to differ slightly.

Table 4.1.13. Commercial southern flounder gig fishery trip limit scenarios (in number of fish), including the number and cumulative % of trips, and % of harvest within each trip scenario, 2008–2017.

Number of Fish	Number of Trips	% of Trips	Cumulative Trip %	% of Harvest	Cumulative Harvest %
25	17,288	74	74	44	44
50	4,504	19	94	33	77
75	941	4	98	12	89
100	324	1	99	6	95
125	92	0	100	2	97
150	32	0	100	1	98
175	19	0	100	1	99
200	23	0	100	1	100
Average Pounds Per Trip	52				

Note: Rounding of values may cause cumulative percentages to differ slightly.

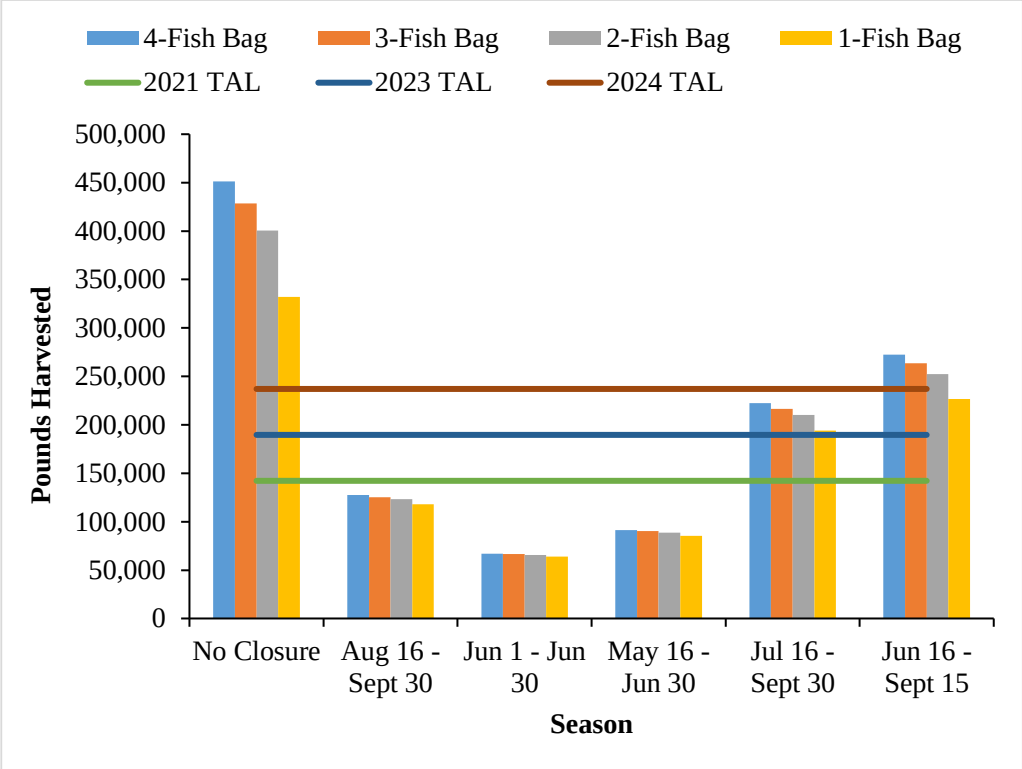


Figure 4.1.10. North Carolina southern flounder recreational fishing season relating to the increasing TAL (142,206 pounds in 2021 and 2022, 189,608 pounds in 2023, and 237,010 in 2024) and changes to the daily bag limit.

Table 4.1.14. Percent contribution of bag limit trips to total harvest of southern flounder for select seasons.

	Percent Contribution of Bag Limit to Total Harvest			
Season	**4-Fish Bag Limit**	**3-Fish Bag Limit**	**2-Fish Bag Limit**	**1-Fish Bag Limit**
No Season	5%	6%	15%	74%
Aug 1 - Sept 30	2%	2%	6%	90%
Aug 16 - Sept 30	2%	2%	4%	93%
Jun 1 - Jun 30	1%	1%	2%	95%
Apr 1 - June 30	1%	2%	4%	92%
Apr 1 - Sep 30	4%	6%	13%	77%
Mar 1 - Apr 15	0%	0%	0%	100%
Sep 1 – Sep 30	1%	1%	2%	96%
Apr 16 - Jun 30	1%	2%	4%	92%
May 1 - Jun 30	1%	2%	4%	93%
May 16 - Jun 30	1%	2%	3%	94%

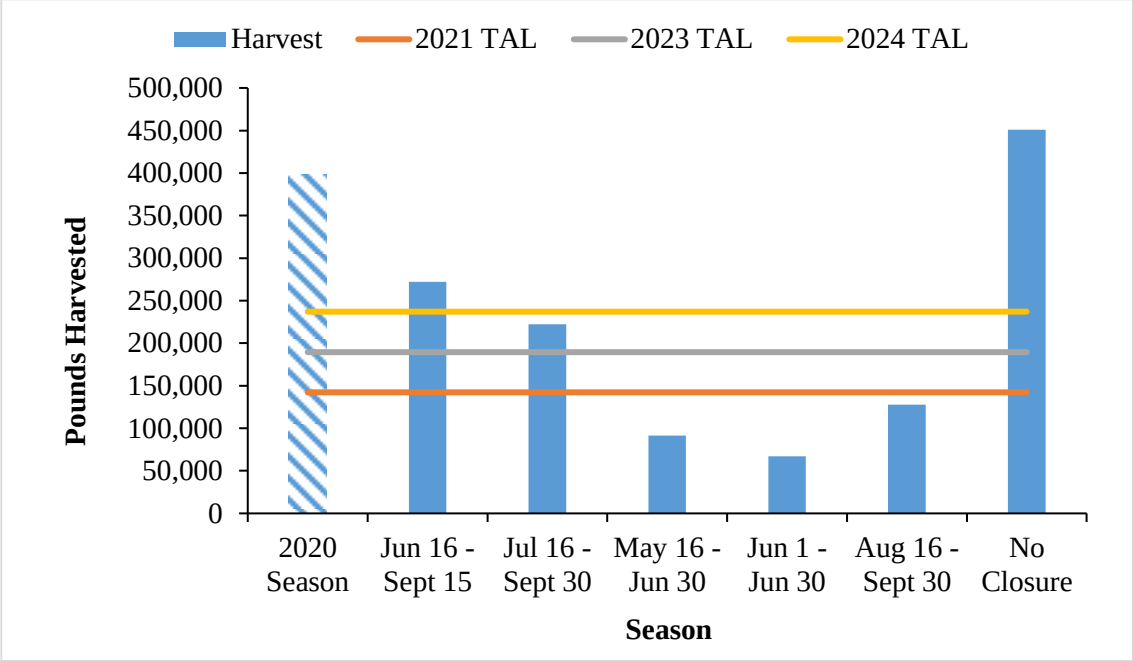


Figure 4.1.11. North Carolina southern flounder recreational fishing season relating to the increasing TAL (142,206 pounds in 2021 and 2022, 189,608 pounds in 2023, and 237,010 in 2024). The 2020 season was Aug. 16 through Sept. 30.

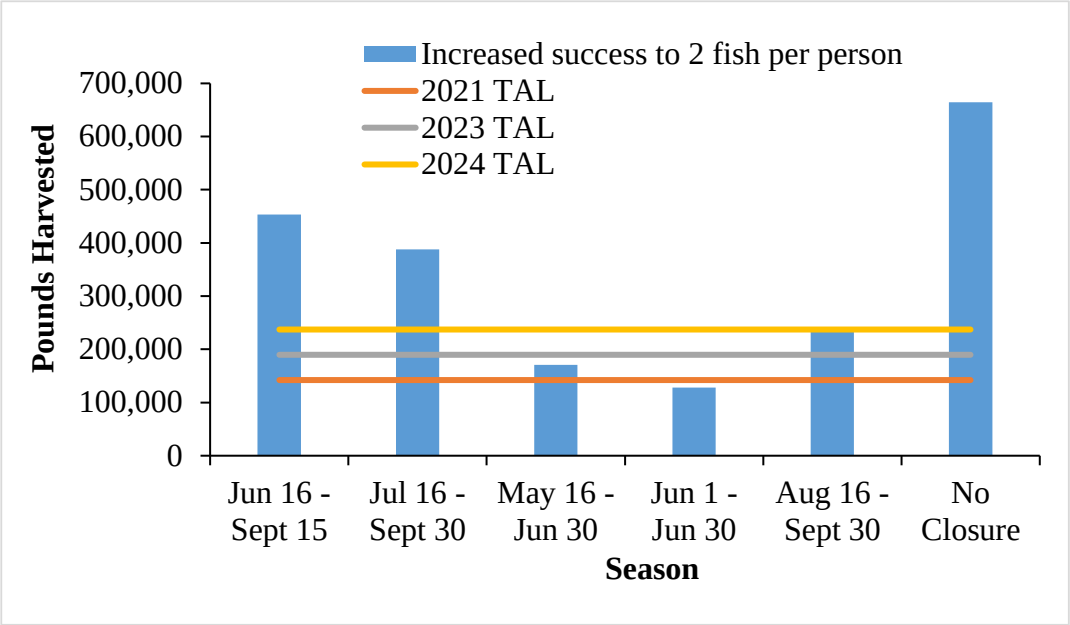


Figure 4.1.12. North Carolina southern flounder recreational fishing season relating to the increasing TAL (142,206 pounds in 2021 and 2022, 189,608 pounds in 2023, and 237,010 in 2024) anticipating angler success increasing to two fish per trip in the future.

Additional discussion of bag limits and the potential for increased angler opportunities through species-specific management of summer, southern, and Gulf flounder can be found in the *Increased Recreational Access* issue paper.

Recreational Commercial Gear

Recreational use of limited commercial fishing gears is allowed by law 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 because collection of RCGL harvest data has not occurred since 2008. Data collected in 2008 and prior may not be reliable for estimating reductions for Amendment 3 due to multiple management changes that have also occurred since the surveys ended. See *Description of the Fishery* section for trends in the RCGL fishery

Recreational gear license holders primarily use large-mesh gill nets to harvest southern flounder but may occasionally harvest southern flounder from shrimp trawls and crab pots. The use of commercial gears for recreational purposes is also only allowed during concurrently open recreational and commercial fishing seasons that allow the specific gear, and the user is only allowed harvest that does not exceed the recreational limits. Due to these requirements, the only measures available for harvest of flounder using a RCGL is during a period of time if and when the commercial and recreational fisheries are open simultaneously or prohibit the use of the RCGL for the harvest of southern flounder.

The volume of removals cannot be estimated for RCGL gears, but the number of license holders has continually declined from 6,055 participants in 2000 to a low of 1,662 participants in 2017 (additional information on RCGL can be found in the *Description of the Fishery* section). Amendment 2 provides minimal opportunity to fish RCGL gears targeting southern flounder when both the recreational and commercial seasons are open. In addition, if the bag limit for recreational harvest is reduced, the resulting change could also further limit the impacts of the RCGL fishery. If harvest of southern flounder is prohibited from RCGL gear, then an increase in discards will occur if these gears continue in targeting other non-flounder species.

CONCLUSION

Certain measures are better to attain the goal to maintain sustainable harvest at the much-reduced harvest levels than others, while other measures provide more flexibility to benefit the sectors both in access to the resource and for higher economic value. Below we expand on the key measures that are the most risk averse in that they have the highest likelihood of succeeding in maintaining sustainable harvest while providing some flexibility in access to the resource for all sectors in the fisheries.

A summary of the key decision choices that are discussed as potential management measures in this paper are found in Tables 4.1.15 and 4.1.16.

Table 4.1.15. Summary of quantifiable management measures for Amendment 3.

Management Option	Management Sub-option	Management Measure	Gear	# Management Areas	Description
1	1.1A	Commercial Quota	All gear other than pound nets	2	Division at the ITP B-D Boundary Line
1	1.1B	Commercial Quota	All gear other than pound nets	1	Statewide
1	1.1C	Commercial Quota	All gear other than pound nets	3	Same areas as Amendment 2
1	1.2A	Commercial Quota	Pound Nets	3	Same areas as Amendment 2
1	1.2B	Commercial Quota	Pound Nets	1	Statewide
1	1.2C	Commercial Quota	Pound Nets	2	Division at approximately Pea Island
2	2.1	Commercial Sub-Allocations	All commercial gears	N/A	2017 landings
2	2.2	Commercial Sub-Allocations	All commercial gears	N/A	Maintain current pound net allocation
2	2.3	Commercial Sub-Allocations	All commercial gears except gill nets	N/A	Allocate gill net harvest to mobile and pound net gears equally (50/50)
3	3	Recreational Quota (through season)	Hook-and- Line, Gigs	1	Statewide

Table 4.1.16. Summary of non-quantifiable management measures for Amendment 3.

Management Option	Management sub-option	Management Measure	Description
4	4A	Commercial Fishery Trip Limits	Implement trip limits for pound nets and gigs only to maximize potential opportunities for reopening a fishery to harvest remaining allocation
4	4B	Commercial Fishery Trip Limits	Implement trip limits for all gears
4	4C	Commercial Fishery Trip Limits	Status quo, do not implement trip limits
5	5A	Recreational Fishery Bag Limits	Reduce recreational bag limit of flounder to one fish per person per day
5	5B	Recreational Fishery Bag Limits	Reduce recreational bag limit of flounder to no more than three fish per person per day
5	5C	Recreational Fishery Bag Limits	Reduce recreational bag limit of flounder to no more than two fish per person per day
5	54D	Recreational Fishery Bag Limits	Status quo, keep the recreational bag limit of flounder at no more than four fish per person per day
6	6A	Recreational Commercial Gear	Allow the RCGL to be used to harvest flounder only during a period of time when the commercial and recreational fisheries are both open
6	6B	Recreational Commercial Gear	Prohibit the use of RCGL to harvest southern flounder

VI. PROPOSED MANAGEMENT OPTIONS

Management Options

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

Below are overarching positive and negative impacts for all options, specific impacts from an option may be found below that option.

+ May increase the abundance of female southern flounder helping to rebuild the spawning stock
+ Will impact both the commercial and recreational fisheries
+ No rule changes required
- Decreased harvest and economic impacts

Option 1. Implement A Quota for Mobile Gears and Pound Nets

The following positive and negative impacts apply to all of option 1; specific impacts are listed under each sub-option.

+ Two gear categories reduces potential for increased error in dealer reporting
+ Allows individuals to fish and report multiple gears under the mobile gear category
+ Meets the requirements for rebuilding
+ If gill-net fishing is closed due to ITP, then allocation would be available to other gears in combined category
+ Would allow fishermen to explore alternate fishing gears to reduce bycatch
+/- Could allow for different opening dates
- Seasonal selections may impact landings from certain gears and locations more than others
- The more gears and areas are divided, the more complex dealer reporting and division monitoring becomes and we will be less likely to meet targets

1.1A. Dividing the states mobile commercial gears into two areas using the ITP boundary line for management units B–D.

+ Meets requirements for reductions
+ Maintains consistency for gill-net ITP boundary lines
+ Allows flexibility in opening dates for each area
+/- May shift fishing effort and alter behavior
- Some regions may be impacted more than others
- Some gears may be impacted more than others
- More areas make monitoring the daily landings more difficult

1.1B. A single statewide mobile commercial gear allocation that includes all coastal estuarine waters.

+ Single allocation area is easiest to monitor

+ Combing mobile gears makes reporting by dealers easier
+ Equal access to commercial fishers
+ Meets requirements for reductions
- Seasonal selection may impede landings in certain locations

1.1C. Dividing the states mobile commercial gears into three areas (northern, central, and southern). The northern area would encompass the Albemarle Sound and its tributaries including the Croatan and Roanoke sounds, the central would encompass the Pamlico Sound and its tributaries, and the southern would encompass all waters from Core Sound south matching the boundaries described for the pound net fishery three-area option 2.2A.

+ Meets requirements for reductions
- Some regions may be impacted more than others
- Some gears may be impacted more than others
- Enforcement issues through increased boundaries not consistent with current ITP lines
- More areas make monitoring the daily landings more difficult
- More areas increase complexity for dealers daily reporting

1.2A. Dividing the state's pound net fishery into three areas maintaining consistency with areas in Amendment 2.

+ Meets requirements for reductions
+ Allows flexibility for different opening dates for each area
+ Maintains consistency with Amendment 2 boundaries
- Some regions may be impacted more than others
- Some fishermen may have pound nets in multiple areas
- More areas make monitoring the daily landings more difficult

1.2B. A single statewide pound net allocation.

+ Meets requirements for reductions
+ Makes monitoring the daily landings easier
- No flexibility in opening dates
- Availability of fish varies across the state; may impact some areas more depending on when fishery is open

1.2C. Dividing the states pound net fishery into two-areas using the 35° 46.3000' N latitude.

+ Meets requirements for reductions
- Some fishermen may have pound nets in multiple areas
- Availability of fish varies across the state; may impact some areas more depending on when fishery is open

Option 2. Commercial Sub-Allocations

Decisions on commercial sub-allocations may be influenced based on the option selected in Appendix 4.7: Phasing out Large-Mesh Gill Nets from the NC Southern Flounder Fishery issue paper.

2.1. Maintain overall reductions of 72% and 2017 sub-allocations (Table 4.1.6)

+ Allows for all commercial gears to harvest southern flounder
+ Meets the requirements for sustainable harvest
- May reduce pound net sub-allocation to a level that is not economically viable
- May reduce pound net sub-allocations to a level where daily quota monitoring may be problematic

2.2. Maintain overall reductions of 72% and the current level of sub-allocation for the pound net fishery (Table 4.1.7).

+ Allows for all commercial gears to harvest southern flounder
+ Meets the requirements for sustainable harvest
- Reduces the available sub-allocation for mobile gears
- Would decrease the economic benefit of the commercial mobile gear fisheries

2.3. Maintain overall reductions of 72% and redistributes the gill net allocation equally between mobile and pound net gears beginning in 2023 (shown in the 60% and 50% allocations) (Table 4.1.8).

+ Meets the requirements for sustainable harvest
+ Increases the sub-allocations for remaining mobile gears and pound nets
+ May increase the economic impact of the remaining gears
- Does not allow for harvest of southern flounder using gill nets
- Would decrease the economic benefit of the commercial gill net fishery

Option 3. Recreational Quota

+ Meets requirements for reductions
+ Consistent with Amendment 2
+ Should limit removals and allow rebuilding of the stock
+ Allows for continued access to stock during rebuilding
- Several month delay to receive final estimates after season ends due to MRIP data availability
- Reduces access to anglers during closed seasons
- Difficult to account for angler behavior changes
- Does not stop indirect discards while targeting other species
- Does not limit future harvest during times of increased abundance from rebuilding

Option 4. Commercial Fisheries Trip Limits

The following positive and negative impacts apply to all of option 4; specific impacts are listed under each sub-option.

+ Allows for maximizing available allocations
+ Meets requirements for reductions
- May create additional discards if the trip limits are set too low
- Pound nets will have fish in pounds that non-permit holders may access

4A. Implement trip limits for pound nets and gigs only to maximize reopening after reaching division closure threshold.

+ Can be effective for gears with limited discard mortality
- Any SCFL or RSCFL holder can fish a permitted pound net with permission; a single net could distribute fish to multiple SCFL/RSCFL holders that normally would not use that gear

4B. Implement trip limits for all commercial gears.

+ May limit harvest from non-targeted gears as the stock recovers
+ May alleviate concerns of a derby fishery
- Not effective for gears where discard mortality is high (gill nets)
- May force fishermen to fish in unfavorable weather

4C. Status quo, do not implement trip limits

+ Any quota not harvested would act as additional savings for the spawning stock biomass
+/- Would not allow fisheries to re-open after closure due to approaching the TAL
- Economic impacts to the commercial sector would be greater if unable to harvest all of the TAL

Option 5. Recreational Fisheries Bag Limits

The following positive and negative impacts apply to all of option 5; specific impacts are listed under each sub-option.

+ Meets requirements for reductions
- Decreases potential access to recreational anglers
- May increase discards

5A. Reduce recreational bag limit of flounder to one fish per person per day.

+ Provides the greatest chance of rebuilding and maintaining growth in the stock
+ May allow for quickest rebuilding of spawning stock biomass
+ May limit harvest during times of increased abundance from rebuilding
- May slow rebuilding if fish are continued to be harvested

5B. Reduce recreational bag limit of flounder to no more than three fish per person per day.

+ Reduces harvest for anglers who were successful at catching three flounder per trip
- Does not limit future harvest during times of increased abundance from rebuilding
- May delay rebuilding of spawning stock biomass

5C. Reduce recreational bag limit of flounder to no more than two fish per person per day.

+ Reduces harvest for anglers who were successful at catching two flounder per trip
- Does not limit future harvest during times of increased abundance from rebuilding
- May delay rebuilding of spawning stock biomass

5D. Status quo, keep the recreational bag limit of flounder at no more than four fish per person per day

+ Regulations are consistent with Amendment 2
- Does not limit future harvest during times of increased abundance from rebuilding
- May delay rebuilding of spawning stock biomass

Option 6. Recreational Commercial Gear

6A. Allow the RCGL to be used to harvest flounder only during a period of time when the commercial and recreational fisheries are both open.

+ Consistent with Amendment 2
+ Allows continued access to fishery
- Cannot account for harvest or discards from RCGL gear
- May increase discards if gear is allowed and bag limits are reduced
- Potential protected species interactions
- If allowed there will be disparity among areas

6B. Prohibit the use of RCGL for the harvest of southern flounder.

+ Eliminates harvest from RGCL gears
- Cannot account for harvest or discards from RCGL gear
- Removes access to fishery for license holders
- May increase discards if species cannot be harvested but gear is still allowed

VII. RECOMMENDATIONS

*NCDMF Initial Recommendation**

- Set an annual harvest quota for the commercial and recreational sectors with further refinements in how the harvest will be constrained for each.

Commercial Fisheries:

- Combine mobile gears (gill nets, gigs, and "other" gears) into one gear category and maintain pound nets as their own separate commercial fishery.
- Divide mobile gears into two areas using the ITP boundary line for management units B-D (Figure 4.1.5).
- Divide the pound net fishery into three areas maintaining consistency with areas in Amendment 2 (Figure 4.1.6).
- Implement trip limits for pound nets and gigs only to maximize reopening after reaching division closure threshold.
- Do not implement a slot limit.

Recreational Fisheries:

- Implement seasons for the recreational gig and hook-and-line fisheries to constrain them to an annual quota.
- Reduce the recreational bag limit of flounder to one fish per person per day.
- Do not implement a slot limit.
- Do not allow harvest of southern flounder using RCGL.

**Includes management measures and clarifications in the carried forward from Amendment 2.*

VIII. LITERATURE CITED

Blackhart, K., D.G. Stanton, and A.M. Shimada. 2005. NOAA Fisheries Glossary, U.S. Dept. of Commerce, NOAA Tech. Memo. F/SPO-69, 61 p.

Craig, J.K., W.E. Smith, F.S. Scharf, and J.P. Monaghan. 2015. Estuarine residency and migration of southern flounder inferred from conventional tag returns at multiple spatial scales. Marine and Coastal Fisheries 7:450–463.

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.

Lee, L. M., S. D. Allen, A. M. Flowers, and Y. Li. 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. 426 p.

NCDMF (North Carolina Division of Marine Fisheries). 2005. North Carolina southern flounder (*Paralichthys lethostigma*) fishery management plan. North Carolina Division of Marine Fisheries, Morehead City, NC. 260 p.

NCDMF. 2013. North Carolina southern flounder (*Paralichthys lethostigma*) fishery management plan: Amendment 1. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC. 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, NC. 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, NC. 43 p.

NCDMF. 2019. North Carolina southern flounder (*Paralichthys lethostigma*) fishery management plan: Amendment 2. North Carolina Department of Environmental Quality, Division of Marine Fisheries, Morehead City, NC. 62 p.

Watanabe, W.O., P. Carrol, and H.V. Daniels. 2001. Sustained, natural spawning of southern flounder *Paralichthys lethostigma* under an extended photothermal regime. Journal of World Aquaculture Society 32:153–166.

Wong, R. 2009. Slot limit management for recreational summer flounder harvest. Delaware Division of Fish and Wildlife.

APPENDIX 4.1.A. *MANAGEMENT MEASURES AND STRATEGIES CONSIDERED BUT NOT DEVELOPED*

Appendix 4.1.A was developed to provide additional data analysis and discussion on management measures and strategies that have been explored. These strategies do not have sufficient data necessary to support moving forward at this time but may provide research needs so they can be considered in future updates to the Southern Flounder Fishery Management Plan.

STATUS QUO

An option of "status quo," which means continue only what is in Amendment 2, is not presented in this issue paper. Final adoption of Amendment 2 to the Southern Flounder Fishery Management Plan authorized development of Amendment 3 with more comprehensive management strategies.

LIMITED ENTRY

North Carolina General Statute 113-182.1 states the NCMFC can only recommend the General Assembly limit participation in a fishery if the NCMFC determines sustainable harvest in the fishery cannot otherwise be achieved. Sustainable harvest can be achieved without the use of limited entry; therefore, limited entry is not an option at this time. For further information see *Appendix 1: Management Issues Considered but Not Developed*.

DYNAMIC QUOTA

A dynamic quota refers to a total allowable catch that fluctuates among years relative to the abundance of the resource and fishing pressure. In the case of southern flounder, the quota for a given year would be primarily driven by the strength of the year classes being subjected to fishing pressure. As with the static quota, all of the same drawbacks, including issues with monitoring the landings on a daily basis and the high degree of variability in the daily landings, go along with implementing a dynamic quota. In addition, to adequately manage a dynamic quota, the division would need to determine if the fishery-independent surveys used to estimate recruitment in the 2019 stock assessment can accurately predict year-class strength for quota management purposes. The terminal year estimates of recruitment from stock assessments tend to be the most uncertain; the use of recruitment indices to determine a dynamic quota is not a viable possibility. Due to limited availability of real time data that is reflective of the southern flounder stock, a dynamic quota is not a viable management option.

CHANGES TO SIZE LIMITS

Calculations necessary for developing projections based on increasing the current minimum size limit, decreasing the current minimum size limit, or developing a slot limit cannot be calculated on an individual state basis. The current stock assessment does not include a spatial component and, as a result, the lack of this spatial component means all size limit changes would be relative to the entire stock of southern flounder. Currently, there are multiple minimum size limits in place across the unit stock, ranging from 12- to 15-inches TL. If an increase or decrease in the minimum size limit, or a slot limit, for N.C. waters is considered, it is necessary to note that calculations referencing reductions that affect the fishing mortality rates of spawning stock biomass are not possible. Any changes made would be based on previous years' data for fish

within North Carolina harvest estimates and may or may not have intended impacts on the rebuilding of the stock. It would not be possible to attribute changes to size limits as the cause of changes to stock size.

Using North Carolina harvest estimates, calculations were performed to determine what additional effect size limit changes would have on the TAL in North Carolina. As stated above, these calculations do not account for the entire unit stock and are only for guidance as the effect over the entire unit stock would be non-quantifiable. The discussion below addresses these effects, as well as potential drawbacks to decreasing the minimum size and increasing the minimum size.

Decrease in Minimum Size Limit

A decrease in the minimum size limit potentially would allow increased harvest on males while decreasing the pressure on the larger females. Females attain larger sizes that males do. If the minimum size limit is decreased to less than 15 inches TL, then more males could be harvested. It cannot be guaranteed that males will be harvested but merely available to harvest. Depending on the minimum size chosen, males could account for 25% to 40% of the fish available for harvest (Figure 4.1.10 *in Sustainable Harvest* issue paper). In addition, a reduction in the minimum size limit may allow increased harvest on summer flounder. As recreational size limits have increased through regulatory changes over the years, the ratio of harvest between summer and southern flounder has changed (Figure 14 *in Description of Fisheries* section). This change is because the summer flounder inhabiting North Carolina waters are typically smaller than southern flounder.

The size limit has been 15 inches TL since 2011 and multiple size limit changes have occurred over the time series making it difficult to determine any effect lowering the size limit would have. Any calculations performed would introduce a high level of imprecision and be based on data that may not be representative of the current fishery. There are numerous concerns with decreasing the minimum size limit, especially for the recreational sector. These concerns revolve around the large volume of recreational discards of fish that are currently under the 15-inch TL minimum size limit (approximately 1.9 million fish in 2017). Lowering the minimum size limit would make these fish available to harvest potentially turning these discards into harvest. This would in turn increase the harvest from the recreational fishery and, therefore, not meet the projected reductions necessary for rebuilding.

Increase in Minimum Size Limit

An increase in the minimum size limits is not recommended for the commercial fishery. In 2017, 80% of the fish harvested in the commercial fishery were less than 18 inches TL (Figure 4.1.11 *in Sustainable Harvest* issue paper). Increasing the minimum size limit would increase the volume of releases from this fishery. In addition, continued increase in the minimum size limit would place increased harvest on the largest fish in the stock, which would disproportionately be females. For the commercial fishery, an increase in the minimum size limit would result in additional dead discards, particularly in the gill-net fishery that has a discard mortality rate of 23% (Lee et al. 2018).

Public comment for increasing the minimum size limit in the recreational fishery has been received numerous times over the years, with an increase to 18-inches most often mentioned. For the recreational fishery, increasing the minimum size limit would increase the volume of releases from this fishery, many of which may be mortalities and would decrease angler success. In 2017, 71% of the southern flounder harvested (by weight, pounds) by the recreational fishery were under 18-inches TL (Figure 4.1.12 *in Sustainable Harvest* issue paper). If the recreational minimum size limit were to be set at 18-inches TL, an additional 28,000 pounds of dead discards would be created based on 2017 data with a total harvest savings of approximately 283,352 pounds over the year. To determine what impact changing the minimum size limit to 18-inches TL would have on the TAL, seasonal calculations were re-evaluated. Several seasons were identified, in addition to the season currently established (Aug. 16 to Sept. 30) in Amendment 2, that would meet the overall harvest target reduction of 142,206 pounds (Table 4.1.A1). Although an increase in the minimum size limit has the potential to increase the length of a season, there is increased error around these estimates. Additionally, as the stock rebuilds, the seasons identified may not continue to meet the target harvest reduction due to increased angler success (Figure 4.1.A1).

Table 4.1.A1. Season and total harvest for an 18-inch TL minimum size limit based on 2017 data

Season	Total Harvest (pounds)
No Closure	167,774
Aug 16–-Sep 30	47,401
Aug 1–-Sep 30	49,149
Jul 16–-Sep 30	64,576
Jul 1–-Sep 30	91,376
Aug 1–Oct 15	52,914
Aug 16–Oct 15	51,167
Jul 1–Aug 31	47,493
Jul 1–Sep 15	66,396
Sep 1–Oct 31	58,760
Sep 1–Nov 15	68,808

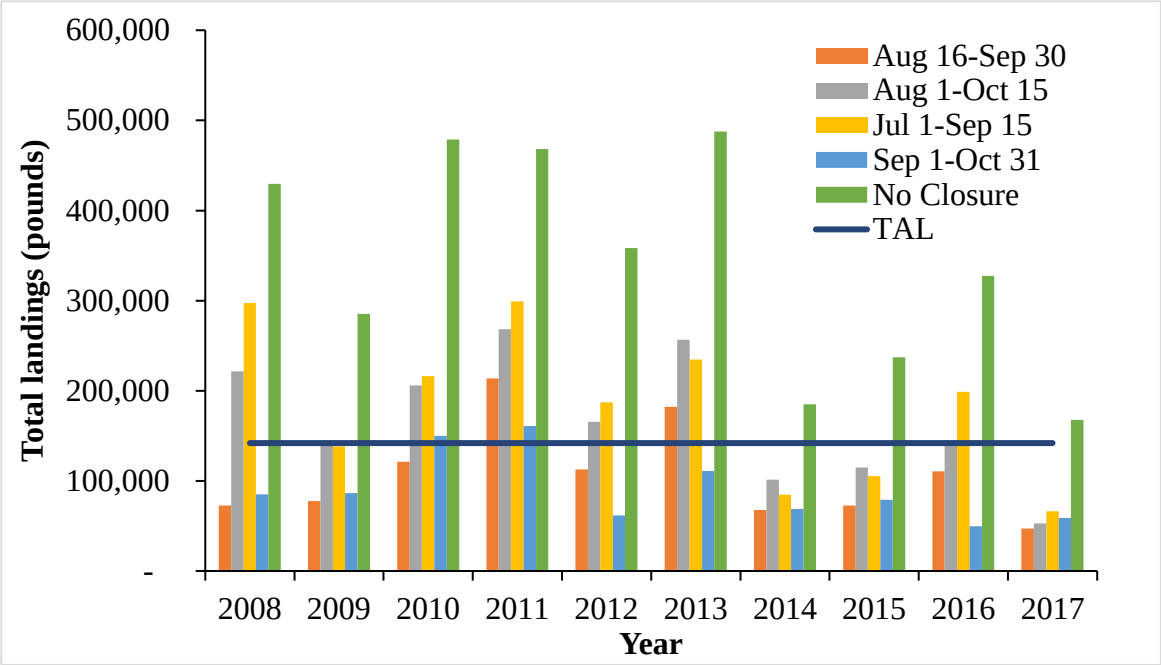


Figure 4.1.A1. Total hook-and-line harvest for seasonal options based on data for 18-inch minimum size limit from 2008–2017. Years 2010, 2011, and 2013 represent years of above average harvest. TAL of 142,206 pounds is represented by the blue solid line.

COMMERCIAL GEAR LIMITATIONS

Current gear configurations, including 6.0 ISM for large mesh gill nets, 5 and ¾ ISM escape panels in pound nets combined with a 15-inch TL minimum size limit for flounder, have reduced the volume of discards observed. Although the only fishery for which discards can currently be estimated is the large mesh gill-net fishery, anecdotal evidence supports limited discards in the pound net fishery. Due to the apparent effectiveness of the current gear configurations and the current minimum size limit, additional changes to gear are not recommend at this time; however, if size limits are considered for the estuarine flounder fishery, changes to gear configurations may be warranted.

DEVELOPMENT OF FISHING DAYS (WEEKEND/WEEKDAYS/HOLIDAYS) FOR THE RECREATIONAL FISHERY

The adoption of Southern Flounder Amendment 2 by the NCMFC mandated a 72% reduction in pounds for both the commercial and recreational sectors to achieve sustainability of the stock within 10 years. To achieve this reduction within the recreational fishery, Marine Recreational Information (MRIP) data from 2008-–2017 were analyzed to determine appropriate bag limits that operate in concurrence with seasonal closures. A reduction in pounds necessitated incorporation of the discard mortality estimates across specific bag and season combinations. The harvest of southern flounder exhibits a distinct seasonality and the bulk of the harvest occurs during the summer months. To achieve an acceptable reduction in harvest, seasonal scenarios focused on reducing harvest during the summer months. This analysis demonstrated that the only scenario in which the recreational TAL was not exceeded was through a four-fish bag limit on

southern flounder within a season spanning Aug. 16 through Sept. 30. At the request of the NCMFC, the division explored the possibility of protracting the recreational season through combinations of weekday and weekend day types. Additional input from the Southern Flounder Advisory Committee recommended a weekday specific season during the summer months with an allowance for weekend only fishing during the fall.

MRIP catch rate estimates were obtained through a variety of weightings reflective of angler avidity including location, day type (weekend vs. weekday), and time of day. MRIP produces catch estimates by applying the weighted catch rates to estimates of effort obtained through the Fishing Effort Survey (see *Description of the Fishery* section). Importantly, the MRIP definition of day type includes Friday as a weekend day type due to angler avidity aligning more closely with observations from Saturday and Sunday. As such, it is disproportionately weighted with expanded catch rate estimates reflecting this increased avidity. Thus, it is of particular note that Friday is included as a weekend day type when data are deconstructed for analysis. Initial analyses sought to achieve targeted reductions for particular day types as a proportion of day type specific contributions. Specifically, a weekend target of 76,000 pounds and a weekday target of 46,000 pounds would achieve the overall target reduction of 142,206 pounds. This analysis demonstrated that when individual day types were given equal consideration regarding targeted reductions, there was no deviation from initial reduction projections using the combined data set; however, when individual day types were considered within the context of the recreational hook-and-line TAL (142,206 lb), it is possible to achieve a variety of scenarios that extend the season for over three months and still achieve desired reductions but with increased error around the produced estimates.

The scenario that most closely approaches the harvest allowance includes a summer season from July 16 through Sept. 30 that permits harvest only during MRIP defined weekdays (Monday, Tuesday, Wednesday, and Thursday). This weekday season will provide a projected harvest of 92,354 pounds. A subsequent season consisting of MRIP defined weekend days (Friday, Saturday, Sunday) will begin on Oct. 15 and last until Nov. 30. This fall weekend season will provide a projected harvest of 27,803 pounds. The combined harvest of 121,666 pounds will fall below the TAL of 142,206 pounds (Table 4.1.A2; Figure 4.1.A2).

Alternate management scenarios incorporate species-specific harvest (i.e., summer, southern., Gulf) and are further evaluated in the *Increased Recreational Access* issue paper. When constituent flounder species are given consideration in establishing bag limits, the potential exists to craft additional seasons that further extend the seasonal harvest of flounder. Verifying the recreational angling community's ability to differentiate among North Carolina's three flounder species will be requisite before single species management options can be explored.

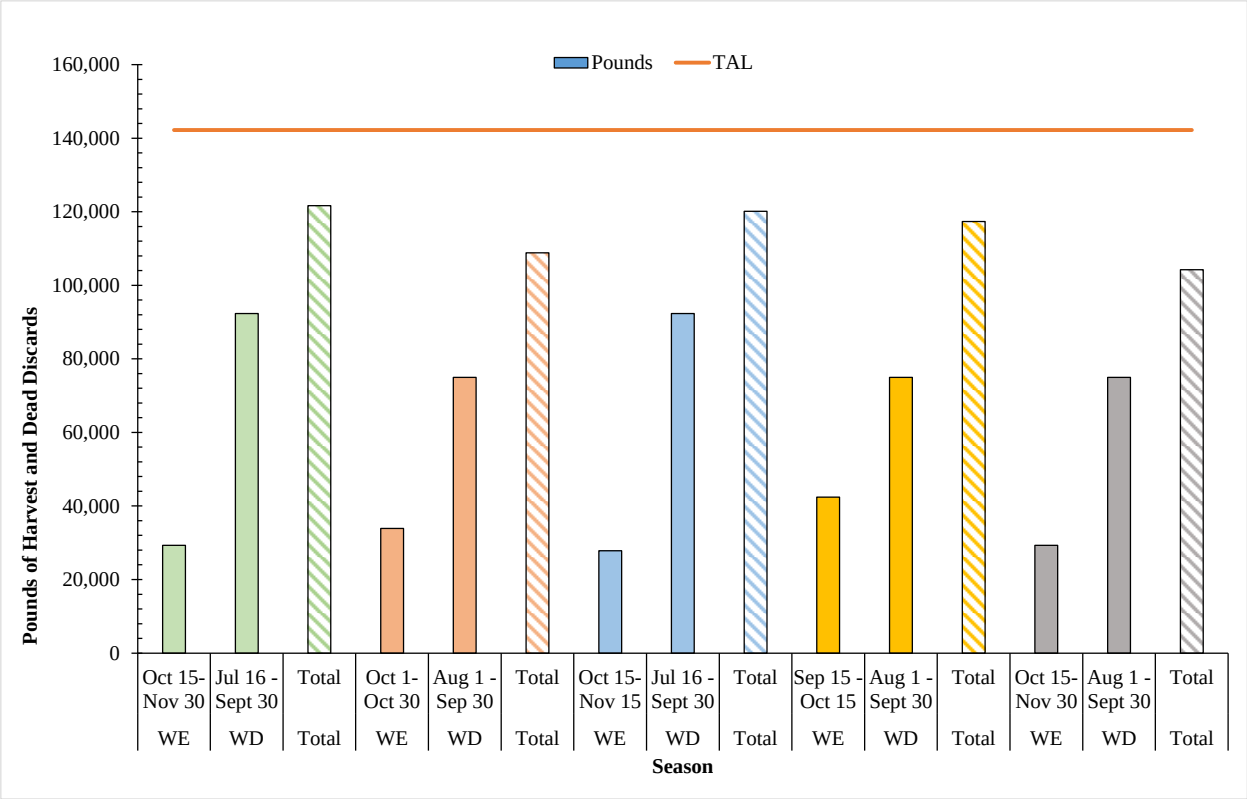


Figure 4.1.A2. Southern flounder harvest projections from seasons using day-type specific combinations. (Note: WD = Weekdays and WE = Weekends).

Table 4.1.A2. Southern flounder harvest projections from seasons using day-type specific combinations.

Day Type	Season	Pounds
Weekend	Oct 15 –Nov 30	29,313
Weekday	Jul 16–Sept 30	92,354
	Total	121,666
Weekend	Oct 1–Oct 30	33,903
Weekday	Aug 1– - Sep 30	74,953
	Total	108,856
Weekend	Oct 15 –Nov 15	27,803
Weekday	Jul 16–Sept 30	92,354
	Total	120,157
Weekend	Sep 15–Oct 15	42,386
Weekday	Aug 1–Sept 30	74,953
	Total	117,339
Weekend	Oct 15- Nov 30	29,313
Weekday	Aug 1 - Sept 30	74,953
	Total	104,266

The scenarios provided will allow greater access to the resource by providing concessions for for-hire stakeholders who rely heavily on weekday clientele during the summer months while also affording anglers access to the fall flounder fishery. The primary concern with this approach is that under the initial season combining all day types provided anglers with a defined window within which to fish, thus increasing the likelihood of achieving targeted reductions. The extension of a season across multiple months between specific day types increases the opportunity for individuals to alter their behavior to capitalize on the resource, which has the potential to compromise projected reductions. It may be beneficial to consider options with a lower projected harvest to provide a buffer against temporal displacement across a protracted season. This is also suggested as the reductions are based on the terminal year (2017) of the assessment. During periods of higher abundance (e.g., 2013), weekday and weekend estimates vary greatly and are often greater than allowed for the recreational hook-and-line TAL (Figure 4.1.A3).

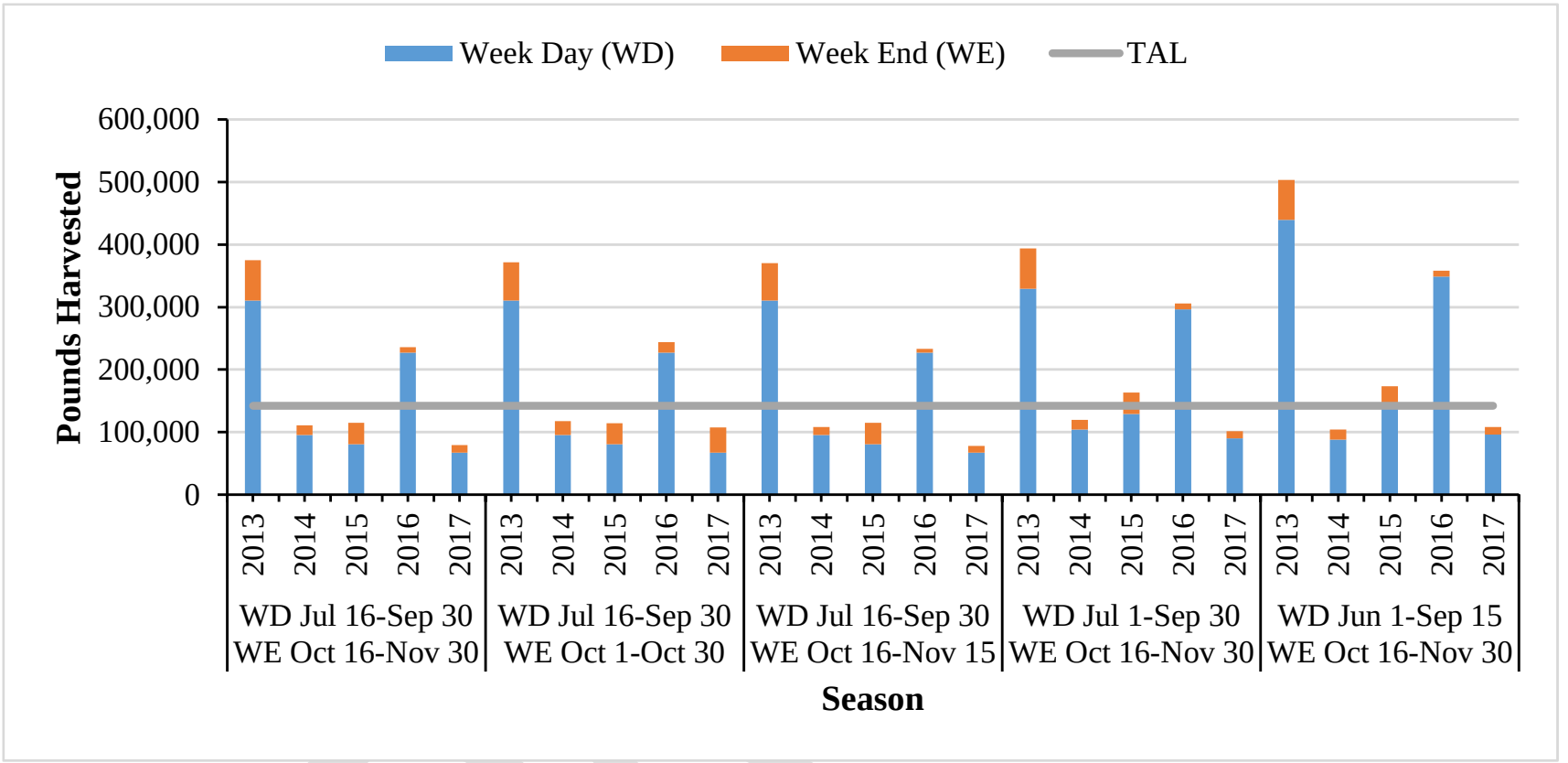


Figure 4.1.A3. Annual variability in harvest of southern flounder (pounds) during identified day type combinations, 2013–2017. (Note: WD = Weekdays and WE = Weekends)

RECREATIONAL FISHERY VESSEL LIMITS

Potential implementation of vessel limits for all recreational gear were evaluated. The Private/Rental boat mode in MRIP is responsible for the largest portion of the recreational landings of southern flounder. The vessels intercepted by MRIP had an average of two anglers present from 2008 through 2017; however, the number of anglers ranged from one to 11 (Table 4.1.A3). It is the trips where more than two anglers are present that cause concern. In the southern flounder recreational fishery, the use of a trip limit may be useful to maintain the quota allocation for the hook-and-line and gig fisheries. Vessel limits may have a larger impact to recreational southern flounder harvest if bag limits are not reduced from four fish per person per day. Much like reduction in bag limits, effects of vessel limits are not quantifiable at this time as estimates would be based on prior years which will not be reflective of the fishery moving forward. Due to this, implementing trip limits would serve to reduce the chances of exceeding the TAL for the recreational fishery and thus reduce the chances of significant impacts in subsequent seasons due to required accountability measures. As stock abundance increases during the rebuilding period, it is likely angler success will increase as well. If angler success improves, any gains achieved through limited open seasons will be lessened, limiting the actual recovery of the species. Harvest must be constrained using multiple measures in the recreational fisheries while rebuilding occurs; however, if the recreational bag limit is reduced to one fish then the implementation of vessel limits may not be necessary. If reductions in bag limits are not implemented and vessel limits are imposed, the vessel limits themselves may not be adequate to limit harvest as rebuilding occurs. Under the proposed quota system, any overages that occur, even if under vessel limit constraints, will be applied to subsequent years. Data suggest that limiting harvest and thus reducing the chances of exceeding the recreational TAL is best suited with a reduction in bag limit.

Table 4.1.A3. Average, minimum, and maximum number of anglers present on a vessel in the Private/Rental Boat mode for the recreational southern flounder fishery from 2008–2017.

Year	Average	Minimum	Maximum
2008	2	1	8
2009	2	1	9
2010	2	1	11
2011	2	1	10
2012	2	1	6
2013	2	1	7
2014	2	1	6
2015	2	1	6
2016	2	1	5
2017	2	1	6
Total	2	1	11