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Disclaimer: Data in this Fishery Management Plan may have changed since publication based on updates to source documents.

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EXECUTIVE SUMMARY

*** This section is completed prior to final approval***

INTRODUCTION

This is Amendment 4 to the Southern Flounder Fishery Management Plan (FMP). By law, each FMP must be reviewed at least once every five years (G.S. 113-182.1). The NC Division of Marine Fisheries (DMF) reviews each FMP annually and a comprehensive review is undertaken about every five years. The last comprehensive review of the plan (Amendment 3; NCDMF 2022) was approved by the NC Marine Fisheries Commission (NCMFC) in 2022. FMPs are the ultimate product that brings all information and management considerations into one document. The DMF prepares FMPs for all commercially and recreationally significant species or fisheries that comprise state marine or estuarine resources adopted by the NC Marine Fisheries. All management authority for the North Carolina Southern Flounder fishery is vested in the State of North Carolina. The NCMFC adopts rules and policies and implements management measures for the Southern Flounder fishery in Coastal Fishing Waters in accordance with 113-182.1. Until Amendment 4 is approved for management, Southern Flounder are managed under Amendment 3 (NCDMF 2022).

Fishery Management Plan History

Original FMP Adoption: Amendments:	February 2005 Amendment 1 February 2013 Amendment 2 August 2019 Amendment 3 May 2022		
Revisions:	None		
Supplements:	Supplement A to the FMPFebruary 2011Supplement A to Amendment 1August 2017		
Information Updates:	None		
Schedule Changes:	Scheduled review was moved up from 2027 to begin concurrent development of Amendments 4 and 5 in 2024		
Comprehensive Review:	Five years after adoption of Amendment 5		

Past versions of the Southern Flounder FMP (NCDMF 2005, 2011, 2013, 2017, 2019, 2022) are available on the <u>DMF website</u>.

Management Unit

The management unit of this FMP includes all Southern Flounder inhabiting North Carolina coastal and joint fishing waters including the Atlantic Ocean.

Goal and Objectives

The goal of Amendment 4 is to manage the Southern Flounder fishery to achieve a self-sustaining population that provides sustainable harvest using science-based decision-making processes. The following objectives will be used to achieve this goal:

- Implement management strategies within North Carolina and encourage interjurisdictional management strategies that maintain/restore the Southern Flounder spawning stock with expansion of age structure of the stock and adequate abundance to prevent overfishing.
- Restore, enhance, and protect habitat and environmental quality necessary to maintain or increase growth, survival, and reproduction of the Southern Flounder population.

- Use biological, environmental, habitat, fishery, social, and economic data needed to effectively monitor and manage the Southern Flounder fishery and its ecosystem impacts.
- Promote stewardship of the resource through increased public outreach and interjurisdictional cooperation throughout the species range regarding the status and management of the Southern Flounder fishery, including practices that minimize bycatch and discard mortality.
- Promote the restoration, enhancement, and protection of habitat and environmental quality in a manner consistent with the Coastal Habitat Protection Plan.

DESCRIPTION OF THE STOCK

Biological Profile

Southern Flounder (*Paralichthys lethostigma*) is a bottom dwelling species of left eyed flounder found in the Atlantic Ocean, Gulf of Mexico, and estuaries from Virginia to northern Mexico (Blandon et al. 2001). This species is one of three commonly caught left eyed flounder in North Carolina; Southern Flounder, Gulf Flounder (*P. albigutta*), and Summer Flounder (*P. dentatus*). Southern Flounder supports important commercial and recreational fisheries along the U.S. South Atlantic and Gulf coasts and is particularly important to fisheries in North Carolina. Based on tagging, genetic, and age structure morphology data, the biological unit stock for Southern Flounder return to the east coast of Florida. Evidence also suggests some adult Southern Flounder return to the estuaries after spawning in the ocean, while others remain in the ocean (Watterson and Alexander 2004; Taylor et al. 2008; NCDMF 2024a). Tagged fish are typically recaptured south of original tagging locations and often in other states once in the ocean (Craig et al. 2015; Loeffler et al. 2019). Limited data from South Carolina or Georgia tagging programs suggest a low probability of adult movement from South Carolina or Georgia to North Carolina waters (Wenner et al. 1990; SCDNR Inshore Fisheries Section, unpublished data; Flowers et al. 2019).

DMF data indicates with the onset of maturity in the fall, females migrate to ocean waters to spawn. Spawning locations in the Atlantic Ocean are unknown; however, Benson (1982) observed the pelagic larval stage over the continental shelf where spawning is reported to occur. Data from satellite tagged Southern Flounder indicate a potential suite of migratory behaviors and habitat uses ranging from inshore estuarine environments to offshore outer continental shelf habitats (NCDMF 2024a). Southern Flounder can produce approximately 3 million eggs per female during multiple spawning events in a season, and spawning is thought to take place between November and April (Gunther 1945; Hettler and Barker 1993; Watanabe et al. 2001; Midway and Scharf 2012; Hollensead 2018). Larval Southern Flounder pass through inlets within 30 to 45 days of hatching and settle throughout the sounds and rivers in the winter and early spring (Burke et al. 1991; Miller et al. 1991; Daniels 2000; Glass et al. 2008; Taylor et al. 2010; Lowe et al. 2011). Juveniles likely spend at least one year in inshore waters before migrating to the ocean (McKenna and Camp 1992; Hannah and Hannah 2000; Watterson and Alexander 2004; Taylor et al. 2008).

Nearly half of female Southern Flounder are mature by ages 1 and 2 (at approximately 16 inches TL; Monaghan, Jr. and Armstrong 2000; Midway and Scharf 2012). Females grow larger than males and Southern Flounder collected in the ocean tend to be larger and older than fish caught in estuarine waters. The largest female Southern Flounder observed in North Carolina was 33-inches TL and the largest male was 20-inches TL (Lee et al. 2018; Flowers et al. 2019; Schlick et al. 2024). The maximum observed age was 9 years for females and 6 years for males. Southern Flounder captured in North Carolina represent the oldest ages observed throughout the range (Lee et al. 2018; Flowers et al. 2019; Schlick et al. 2024).

For additional information about Southern Flounder life history and biology see <u>NCDMF (2019)</u> and <u>NCDMF (2022)</u>.

Assessment Methodology

For additional assessment history see Lee et al. (2018) and Flowers et al. (2019).

Commercial and recreational landings and dead discards and data from eight fishery-independent surveys, were incorporated from all states across the biological unit stock (North Carolina south to the east coast of Florida). When considering population size and long-term viability, stock assessments most often use a measure of female spawning stock biomass (SSB) to determine the population's health. Female spawning stock biomass includes mature female fish capable of producing offspring. Fishing mortality (F) is a measure of how fast fish are removed from the population by fishing activities. Removals include fish that are kept, discarded dead, or die after release.

The stock assessment estimates of female SSB and \overline{F} were compared to levels, or reference points, that are considered sustainable. Reference points include a target and threshold. The threshold is the minimum level required for sustainability and when that level is achieved, the stock is considered healthy. The target is a level that minimizes risk and increases the probability of rebuilding or maintaining stock. If female SSB is less than the biomass threshold (SSB_{25%}), the stock is overfished. If the harvest rate is greater than the *F* threshold (*F*_{25%}), the rate of removals is too high, and overfishing is occurring. Overfishing is the removal of fish at an unsustainable rate that will ultimately reduce female SSB and result in an overfished stock.

Stock Status

The South Atlantic Southern Flounder stock is overfished, and overfishing is occurring as of 2017, the terminal year of the 2019 coastwide stock assessment update (Flowers et al. 2019). Results indicate SSB has decreased since 2006 and recruitment, while variable, has generally declined. Fishing mortality is less variable and decreased slightly in 2017.

The model estimated a value of 0.35 for $F_{35\%}$ (*F* target) and a value of 0.53 for $F_{25\%}$ (*F* threshold). The estimate of SSB_{35\%} (target) was 5,452 metric tons and the estimate of SSB_{25%} (threshold) was 3,900 metric tons.

The female SSB that represents the minimum level of sustainability for Southern Flounder was estimated at 8.6 million pounds. The stock assessment estimate of female SSB in 2017 was 2.3 million pounds (Figure 1). Because the 2017 estimate of female SSB is below the threshold reference point, the stock is considered overfished. The probability the 2017 estimate of SSB is below the threshold is 100%.

A second update to the ASAP model, with data through 2022, was completed in 2024. The update continued to show declining trends in SSB and recruitment since 2006; however, *F* decreased significantly in the last two years of the assessment (<u>Schlick et al. 2024</u>). Several trends and diagnostics from the model raised concerns, and division staff and partners from the other states decided to not use the new update for management. A new benchmark assessment is recommended no sooner than 2026.

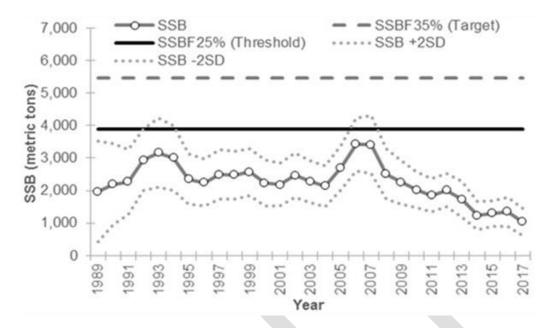


Figure 1. Estimated spawning stock biomass compared to established reference points, 1989-2017 (Flowers et al. 2019).

The assessment model estimated the *F* threshold at 0.53 (Figure 2). The 2017 *F* estimate was 0.91, which is above the *F* threshold. Because the 2017 *F* estimate is above the threshold, overfishing is occurring. The probability the 2017 *F* estimate is above the threshold is 96%. For additional information about the 2019 coastwide stock assessment see NCDMF (2019).

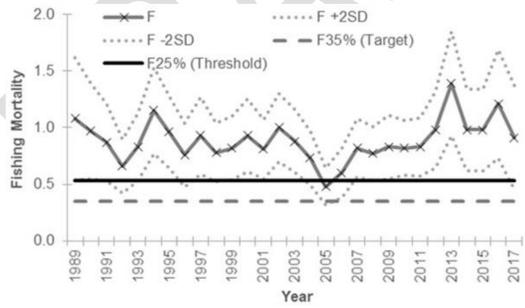


Figure 2. Estimated fishing mortality rates (numbers-weighted, ages 2-4) compared to established reference points, 1989-2017 (Flowers et al. 2019).

DESCRIPTION OF THE FISHERY

Additional in-depth analyses and discussion of North Carolina's historical commercial and recreational Southern Flounder fisheries can be found in previous versions of the Southern Flounder FMP (<u>NCDMF 2005</u>, <u>NCDMF 2019</u>, <u>NCDMF 2022</u>). Commercial and recreational landings can be found in the <u>License and Statistics Annual Report</u> (NCDMF 2024b).

Discussion of socio-economic information in the License and Statistics Annual Report describes the fishery as of 2023 and is not intended to be used to predict potential impacts from management changes. This and other information are legislatively mandated and included to help inform decision-making regarding the long-term viability of the state's commercial and recreationally significant species and fisheries. For a detailed explanation of methodology used to estimate economic impacts, refer to the License and Statistics Section Annual Report (NCDMF 2023).

For additional discussion of commercial and recreational Southern Flounder fishery landings trends see Appendix 1: Increasing Recreational Access to Southern Flounder Through Sector Allocation Parody.

Commercial Fishery

All flounder landings reported as caught in inshore waters are considered Southern Flounder by the DMF Trip Ticket Program. Data from fishery-dependent sampling indicate Summer Flounder and Gulf Flounder account for approximately two percent or less of the flounder harvested from internal waters, while Southern Flounder make up less than one percent of the catch from ocean waters (NCDMF, unpublished data).

Most Southern Flounder commercial landings are from gill nets and pound nets, although gigs and other inshore gears (e.g., trawls) land flounder in smaller numbers. Between 1972 and 2022, peak commercial landings occurred in 1994 (Figure 3). Over this timeframe, there have been fluctuations in whether pound nets or gill nets were the dominant gear in terms of pounds landed (Figure 3). Historically, pound nets were the dominant gear but gill nets became the dominant gear from 1994 to 2013 (Figure 3). The dominant gear switched back to pound nets from 2014 through 2020. Declining landings trends since 2010 were due, in part, to gill net regulations implemented to reduce the number of sea turtle and Atlantic Sturgeon interactions in this gear (78 FR 57132¹, 79 FR 43716²). Though less harvest overall comes from the gig fishery, harvest from this gear has generally increased over time, especially since 2010. Harvest by other commercial inshore gears decreased to its lowest point in 2023.

¹ https://www.federalregister.gov/documents/2013/09/17/2013-22592/endangered-species-file-no-16230

² https://www.federalregister.gov/documents/2014/07/28/2014-17645/endangered-species-file-no-18102

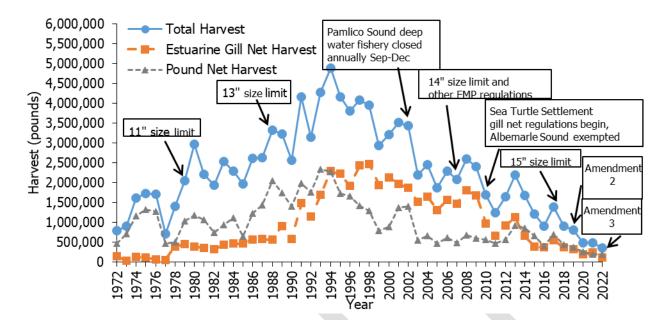


Figure 3. Southern Flounder landings (pounds) for total commercial fishery and top two gears (gill nets and pound nets) from the NC Trip Ticket Program 1972-2023 with major fishery regulation changes noted. Noted regulation changes do not represent a comprehensive list. For additional regulation changes see Lee et al. (2018).

Commercial harvest from 2019 to 2023 was impacted by regulations implemented through Amendments 2 and 3 to the NC Southern Flounder FMP. Amendment 2 implemented seasons in the commercial Southern Flounder fishery for the first time, and Amendment 3 introduced quota management of the fishery. Under Amendment 2, the commercial fishing season was open for a maximum of 33 days in 2020 (Proclamation FF-25-2020) and 21 days in 2021 (Proclamation FF-40-2021) depending on management area. Under Amendment 3 the commercial fishery was separated into two mobile gear management areas (northern and southern) and three-pound net management areas. During 2022 - 2024, the commercial fishery was open between six and 28 days, depending on management areas and gear type. For mobile gears, however, gill nets were not necessarily open all of those days.

	Mobile Gear		Pound Nets		
	Northern	Southern	Northern	Central	Southern
Year	Days open	Days open	Days open	Days open	Days open
2022	28	11	23	21	6
2023	21	21	21	24	8
2024	11	10	28	19	12

Table 1. Number of days the Southern Flounder commercial fishery was open in 2022-2024 by gear type and management area: mobile gear, northern and southern management areas; pound nets, northern, central, and southern management areas.

Trends in commercial trips reported between 1994 and 2023 have generally followed landings trends (Figure 4). Trips include the number of trip ticket records with landings reported; some trips may represent more than one day of fishing. The number of trips for all gears targeting Southern Flounder has decreased since regulatory changes due to Amendment 2 (seasonal management)

and Amendment 3 (quota management) were implemented limiting the number of days flounder could be harvested.

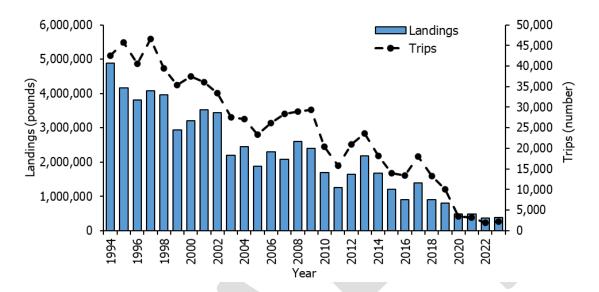


Figure 4. Southern Flounder commercial trips (numbers) and landings (pounds) from NC Trip Ticket Program, 1994-2023.

Recreational Fishery

Recreational harvest of Southern Flounder is mainly by hook-and-line and <u>gigs</u>, with a small amount of harvest by spearfishing or Recreational Commercial Gear License (RCGL) gears (prior to 2022).

Hook-and-line harvest can be split into ocean and inshore harvest, with most Southern Flounder harvested inshore. Between 1989 and 2023, hook-and-line harvest peaked in 2010 (Figure 5). Seasonal closures implemented through Amendment 2 to the NC Southern Flounder FMP impacted recreational harvest in 2020 and 2021. The season was shortened from 45 days in 2020 to 14 consecutive days in 2021 due to excessive overages that occurred during the 2020 season. Amendment 3 implemented fishing seasons to maintain recreational harvest within a quota and added paybacks to the following year for overages. The season in 2022 was 30 days and the 2023 season was shortened to 14 days. Due to overages in 2022, the 2023 TAC (landings plus dead discards) was adjusted from 170,655 pounds to 114,315 pounds. In 2023, 192,168 pounds of Southern Flounder were caught recreationally by hook-and-line, exceeding the expected catch by 127,294 pounds. Because of these overages, there was no recreational flounder season in 2024.

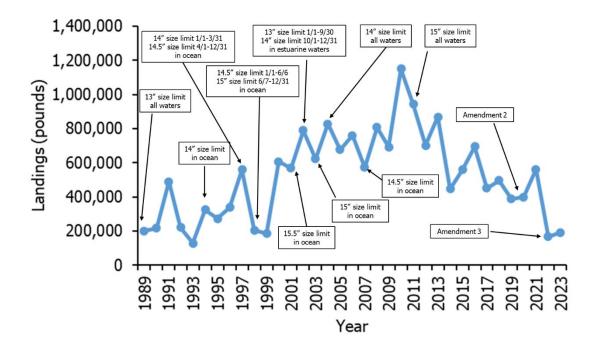


Figure 5. MRIP estimates of recreational hook-and-line Southern Flounder harvest (pounds) and major fishery regulation changes, 1989-2023. Noted regulation changes do not represent a comprehensive list. For additional regulation changes see Lee et al. (2018).

Trends in recreational trips are difficult to interpret because they represent all recreationally important Paralichthid flounder species commonly caught in North Carolina (Southern, Summer, and Gulf flounder). This is because anglers only report targeting 'flounder' rather than a particular flounder species. Trips can be defined in several ways, but in this document all trips that harvested or released any Paralichthid flounder species were included. Trends in trips and harvest are similar throughout the time-series, but trips have declined since 2014 while harvest has varied (Figure 6). Recreational estimates across all years have been updated and are now based on the 2018 MRIP Fishing Effort Survey-based calibrated estimates. For more information on MRIP see https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

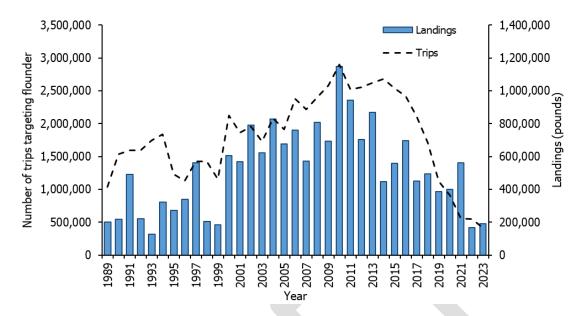


Figure 6. MRIP estimates of recreational hook-and-line harvest (pounds) and all trips that harvested or released Paralichthid flounder species, 1989-2023. Data prior to 2004 were calibrated to align with MRIP estimates post-2004.

SUMMARY OF ECONOMIC IMPACT

For detailed discussion of economic impacts of the commercial and recreational Southern Flounder fisheries see Appendix 1. For additional information see <u>NCDMF (2022</u>).

Commercial Fishery

Historically, the Southern Flounder commercial fishery has been a strong economic driver for the state and one of its largest fisheries. Within the direct impacts effort and production have on the value of the commercial flounder industry, there are several factors that can dictate total economic impact of this fishery on a broader market level and individual product level. As a popular seafood across the country, the value of flounder in North Carolina is influenced by broader trends of supply and demand. There is a wide range of competitive substitutes for North Carolina caught flounder, including flounder caught in other states, as well as seafood products with comparatively similar properties, such as halibut (*Hippoglossus* spp.) or sole (*Solea* spp.). Because of this, the value of flounder in North Carolina is not only influenced by in-state product availability but also regulations, seasons, and effort for the harvest of flounder and substitutes, it is difficult to accurately track how supply of other products directly influences in state prices.

In addition to broader dynamics of supply and demand that influence North Carolina's flounder market, there are specific factors that can adjust product value on different time scales. Method of catch often influences price, as consumers seek product caught with gears perceived to be more environmentally friendly, or gears that produce higher-quality flounder (Asche and Guillen 2011). This can lead to increased prices on flounder caught with certain gears.

Additionally, enterprise level marketing can impact product value. Fishermen and dealers market their business and product as they wish. When marketing strategies are successful, prices and value can increase, though this is on an individual level and demonstrates the volatility within the market. Such changes in value are demonstrated by the positive effects local product branding and direct-to-consumer strategies have produced in North Carolina (NCREDC 2013; Stoll et al. 2015). While these are just two examples of the variety of factors influencing value of North Carolina's flounder industry, they demonstrate the complicated dynamics at play, as many factors driving the price of flounder are not dictated by fishery managers, but by consumers and producers within the market.

Recreational Fishery

The top industries impacted by recreational Southern Flounder fishing in terms of output sales and employment are retail gasoline stores, retail sporting goods stores, retail food and beverage stores, real estate, and wholesale trade businesses. Due to the magnitude and popularity of the recreational flounder fishery in North Carolina, changes in access may lead to tangible, yet unquantifiable impacts to the value of other sport fisheries (Scheld et al. 2020). Broadly, participants target or catch flounder more than any other recreational species due to higher personal satisfaction gained from fishing for this species over others. However, it is unknown whether this benefit from flounder fishing would transfer to other fisheries if effort restrictions were put in place. There is a possibility that when faced with reduced access to flounder fishing, some anglers may choose not to fish, rather than seek out new target species, while others may target other species more frequently or switch to catch-and-release flounder fishing.

Through this complicated dynamic, the value and economic impact of other recreationally important species may increase or decrease. However, while it is important to acknowledge how flounder management may economically impact other fisheries, this interaction is not fully understood, and therefore, it cannot be determined how the value of other recreational species would shift with changes in access to flounder.

ECOSYSTEM PROTECTION AND IMPACT

Habitat use patterns of Southern Flounder vary by life stage over time and space. Growth and survival of Southern Flounder within the habitats they use is maximized when water quality parameters, such as temperature, salinity, and dissolved oxygen, are within optimal ranges. Good water quality is essential for supporting the various life stages of Southern Flounder (Figure 7) and maintaining their habitats. Natural processes and human activities can alter salinity or temperature conditions, elevate toxins, nutrients, turbidity, as well as lower dissolved oxygen levels which can degrade water quality.

For additional information about habitat use by life stage and optimal water quality parameters, see the Description of the Stock section of this FMP, <u>NCDMF (2019)</u>, or <u>NCDMF (2022)</u>. For a comprehensive review of ecosystem impacts from the Southern Flounder fishery, including habitat degradation and loss, water quality degradation, gear impacts on habitat, bycatch and discards of non-target species, protected species, climate change and resiliency, and habitat protection, see <u>NCDMF (2022)</u>.

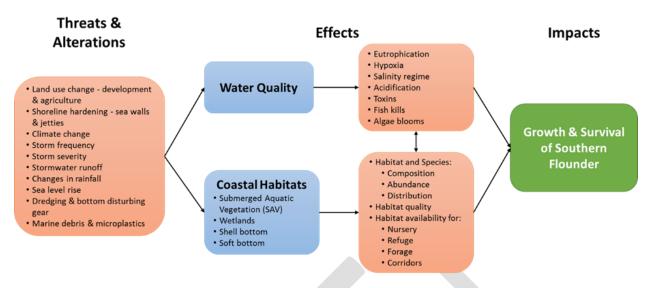


Figure 7. Effects of threats and alterations on water quality and coastal habitats and their ultimate impact on the growth and survival of Southern Flounder.

Coastal Habitat Protection Plan

The Fisheries Reform Act statutes require a CHPP be drafted by the NCDEQ and reviewed every five years (G.S. 143B-279.8). The CHPP is a resource and guide compiled by NCDEQ staff to assist the NCMFC, Environmental Management (EMC), and Coastal Resources commissions (CRC) in developing goals and recommendations for the continued protection and enhancement of fishery habitats in North Carolina. These commissions are required by state law (G.S. 143B-279.8) to adopt and implement management strategies specified in the CHPP as part of a coordinated management approach. Habitat recommendations related to fishery management can be addressed directly by the NCMFC. The NCMFC has passed rules providing protection for Southern Flounder habitat including the prohibition of bottom-disturbing gear in specific areas, and designation of sensitive fish habitat such as nursery areas and submerged aquatic vegetation (SAV) beds with applicable gear restrictions. Habitat recommendations not under NCMFC authority (e.g., water quality management and shoreline development) can be addressed by the other commissions through the CHPP process. The CHPP helps to ensure consistent actions among these commissions as well as their supporting NCDEQ divisions. The CHPP also summarizes the economic and ecological value of coastal habitats to North Carolina, their status, and potential threats to their sustainability (NCDEQ 2016).

FINAL AMENDMENT 4 MANAGEMENT STRATEGY

Section will be completed when the MFC selects preferred management and prior to DEQ secretary and legislative committees review

RESEARCH NEEDS

The research recommendations listed below are offered by the DMF to improve future management strategies of the southern fishery. They are considered high priority as they will help to better understand the Southern Flounder fishery and meet the goal and objectives of the FMP. A more comprehensive list of research recommendations is provided in the <u>Annual FMP Review</u> and DMF Research Priorities documents.

- Conduct studies to quantify fecundity and fecundity-size/age relationships in Atlantic Southern Flounder.
- Improve estimates of the discard (B2) component (catches, lengths, and ages) for Southern Flounder from MRIP.
- Expand, improve, or add fisheries-independent surveys of the ocean component of the stock.
- Determine locations of spawning aggregations of Southern Flounder.
- Complete and age validation study using known age fish.

MANAGEMENT FROM PREVIOUS PLANS

There are several management measures from Amendment 3 to carry forward in Amendment 4 that address fishing behavior and potential changes in effort to minimize the possibility of catching Southern Flounder in greater volume than predicted.

Unless otherwise stated, all Southern Flounder Amendment 3 management measures will be carried forward in Amendment 4 and remain in effect including, but not limited to, the following:

- A commercial and recreational 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 4.0 through 6.5 ISM, maintain a maximum of 1,500-yards in Management Units A, B, and C and a maximum of 750-yards in Management Units D1, D2, and E unless more restrictive yardage is specified through adaptive management or through the sea turtle or sturgeon Incidental Take Permit (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 shad (*Alosa sappidissima*), hickory shad (*A. mediocris*) 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 causes injury to released fish (e.g., picks, gigs, spears, etc.);
- Unlawful for commercial fishery to possess any species of flounder harvested from the internal waters of the state during the closed Southern Flounder season;
- 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 sub-units Northern D1 and Southern D1, maintaining consistency with Amendment 2 and Amendment 3 boundary line;
- Divide the pound net fishery into three areas maintaining consistency with areas in Amendment 2 and 3;
- Maintain 72% reduction and current sub-allocation for the pound net fishery.
- Implement trip limits for pound nets, gigs, and hook and line only to maximize reopening after reaching division closure threshold;

- Implement a single season for the recreational gig and hook-and-line fisheries to constrain them to an annual quota;
- Maintain the recreational bag limit of flounder at one fish per person per day;
- Do not allow harvest of Southern Flounder using RCGL;
- Should landings be available, allow potential for spring ocellated flounder season to occur from March 1-April 1 in ocean waters only using hook-and-line gear with one-fish ocellated only bag limit;
- Maintain the adaptive management framework based on the peer-reviewed and approved stock assessment;

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