# FISHERY MANAGEMENT PLAN UPDATE
# SOUTHERN FLOUNDER
# AUGUST 2024

## STATUS OF THE FISHERY MANAGEMENT PLAN

### Fishery Management Plan History

| | | |
|---|---|---|
| Original FMP Adoption: | February 2005 | |
| Amendments: | Amendment 1 | February 2013 |
| | Amendment 2 | August 2019 |
| | Amendment 3 | May 2022 |
| Revisions: | None | |
| Supplements: | Supplement A to the FMP | February 2011 |
| | Supplement A to Amendment 1 | August 2017 |
| Information Updates: | None | |
| Schedule Changes: | None | |
| Comprehensive Review: | 2027 | |

Southern flounder (*Paralichthys lethostigma*) in North Carolina are managed under Amendment 3 to the North Carolina Southern Flounder Fishery Management Plan (FMP; NCDMF 2022). Development of Amendment 3 began upon approval of Amendment 2 to address comprehensive, long-term management strategies to continue the rebuilding of the southern flounder stock started under Amendment 2. Amendment 2 was intended to reduce harvest pressure on the North Carolina portion of the stock quickly before more robust measures were developed (NCDMF 2019). Amendment 2 and Amendment 3 management was based on the 2019 coast-wide stock assessment. The original assessment pooled-sex model (Lee et al. 2018) was updated with data through 2017 and incorporated the new Marine Recreational Information Program (MRIP) estimates that were available (Flowers et al. 2019).

At its May 26, 2022, business meeting, the North Carolina Marine Fisheries Commission (MFC) adopted Amendment 3 to the Southern Flounder FMP as proposed by the North Carolina Division of Marine Fisheries (DMF).

Amendment 3 actions to achieve sustainable harvest include:

- 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 Incidental Taker Permit (ITP) boundary line for management units B-D.
- Divide the pound net fishery into three areas maintaining consistency with areas in Amendment 2.
- Maintain 72% reduction and current sub-allocation for the pound net fishery with direction from the MFC as follows: "In 2024, as the shift in allocation is set to start the Division will provide recommendations to the MFC on approaches to maintaining a sustainable sub-allocation for the commercial pound net fishery, as needed based on the economic and biotic conditions at that time".

- Implement trip limits for pound nets and gigs 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.
- Reduce the recreational bag limit of flounder to one fish per person per day.
- Do not allow harvest of southern flounder using a Recreational Commercial Gear License (RCGL).
- One-fish recreational ocellated bag limit during March 1 through April 15 in ocean waters only using hook-and-ling gear and a one-fish bag limit consisting of any species of flounder during the southern flounder recreational season.
- Do not establish inlet corridors for southern flounder during spawning migrations.
- Adopt the adaptive management framework based on the peer-reviewed and approved stock assessment.
- At the November 2020 business meeting, the MFC requested analysis of various recreational and commercial allocation percentages. In March 2021, the MFC voted on and approved sector allocations of 70/30 commercial to recreational for 2021 and 2022 and shifting to 60/40 for 2023, and 50/50 parity beginning in 2024.
- Based on recognition of a series of coincident concerns specific to the initial steps in rebuilding the southern flounder fishery, the MFC voted in February 2022 to delay the transition to 50/50 parity by two years (time for at least one cycle of larval to female maturity). The selected allocations will be 70/30 for 2023 and 2024, 60/40 for 2025, and 50/50 parity starting in 2026.
- Do not implement a slot limit and maintain the 15-inch total length (TL) current minimum size limit.
- Continue to allow anchored large-mesh gill nets to harvest southern flounder in the North Carolina southern flounder fishery.

## Management Unit

In Amendment 3 to the North Carolina Southern Flounder FMP, the management unit was defined as North Carolina coastal waters. However, due to increased information relative to genetic identification and tagging studies the unit stock for the 2018 stock assessment was changed to include all waters from North Carolina through the East coast of Florida (Lee et al. 2018; Ross et al. 1982; Monaghan 1996; Schwartz 1997; Craig and Rice 2008; Anderson and Karel 2012; Wang et al. 2015; Midway et al. 2014; Wang et al. 2018).

## Goal and Objectives

The goal and objectives of Amendment 3 to the North Carolina Southern Flounder FMP were approved by the MFC at their February 2020 business meeting (NCDMF 2022). The goal 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 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 (*Paralichthys albigutta*), and summer flounder (*Paralichthys 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 and genetic data and aging structures, the biological unit stock for southern flounder includes fish from North Carolina 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, unpublished data). 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 and 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 collected from fall fisheries suggests that with the onset of maturity, females migrate out of inlets to ocean waters in the fall. 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 (NCDMF, unpublished data). Southern flounder can produce approximately 3 million eggs per female in multiple spawning events in a season, and spawning is thought to take place between November and April (Midway and Scharf 2012; Watanabe et al. 2001; Gunther 1945; Hettler and Barker 1993; 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 (Daniels 2000; Glass et al. 2008). Larvae enter inlets in winter and early spring to settle throughout the sounds and rivers (Burke et al. 1991; Miller et al. 1991; Taylor et al. 2010; Lowe et al. 2011). Not much is known about the movement of juveniles less than 8 inches, but these fish may primarily remain near settlement locations. Some larger juveniles have been shown to move short distances within a water body and some studies have shown limited movements while southern flounder are residing within an estuary (Monaghan 1996; McClellan 2001; Craig et al. 2015). 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 flounder are mature by ages 1 and 2 (at approximately 16 inches TL; Monaghan and Armstrong 2000; Midway and Scharf 2012). Fish collected in the ocean tend to be larger and older, with females growing larger than males. The largest female southern flounder observed in North Carolina was a 33-inch TL and largest male was 20-inch TL (Lee et al. 2018; Flowers et al. 2019; Schlick et al. 2024). The maximum observed age was 9 years for a female and 6 years for a male; 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).

Juvenile and adult southern flounder typically feed by camouflaging themselves on the bottom and ambushing their prey with a quick upward lunge (Burke 1995; Arrivillaga and Baltz 1999). Southern flounder diets switch to fish when they are between 3- and 4-inches TL (Ellis 2007; Fitzhugh et al. 1996; Wenner et al. 1990). Adult southern flounder feed almost exclusively on other fish but will consume shrimp as well.

## Stock Status

Following the recommendation of the peer review panel, the southern flounder working group recommended that the stock size threshold and target be defined in terms of Spawning Stock Biomass (SSB) associated with the fishing mortality target and threshold. Based on the results of the 2019 stock assessment, the probability that fishing mortality in 2017 is above the threshold value of 0.53 is 96.4%, whereas there is a 100% chance the fishing mortality in 2017 is above the target value of 0.35. The probability that the SSB in 2017 is below the threshold or target value (3,900 and 5,452 metric tons, respectively) is 100%. Therefore, the current status of the southern flounder stock is overfished, and overfishing is occurring (Figures 1 and 2).

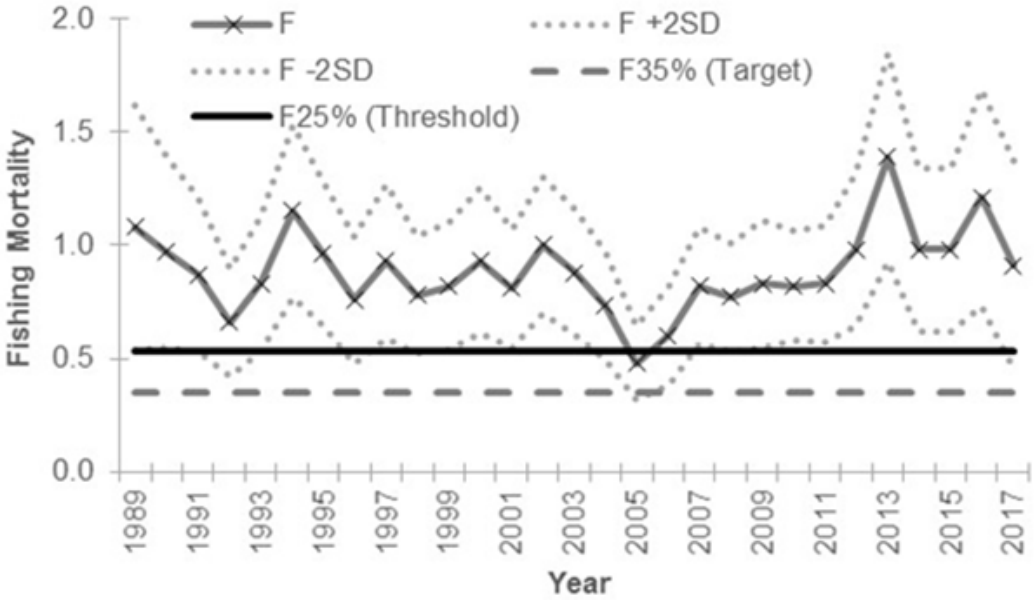


Figure 1. Estimated fishing mortality rates (numbers-weighted, ages 2–4) compared to established reference points, 1989–2017. (Source: Flowers et al. 2019).

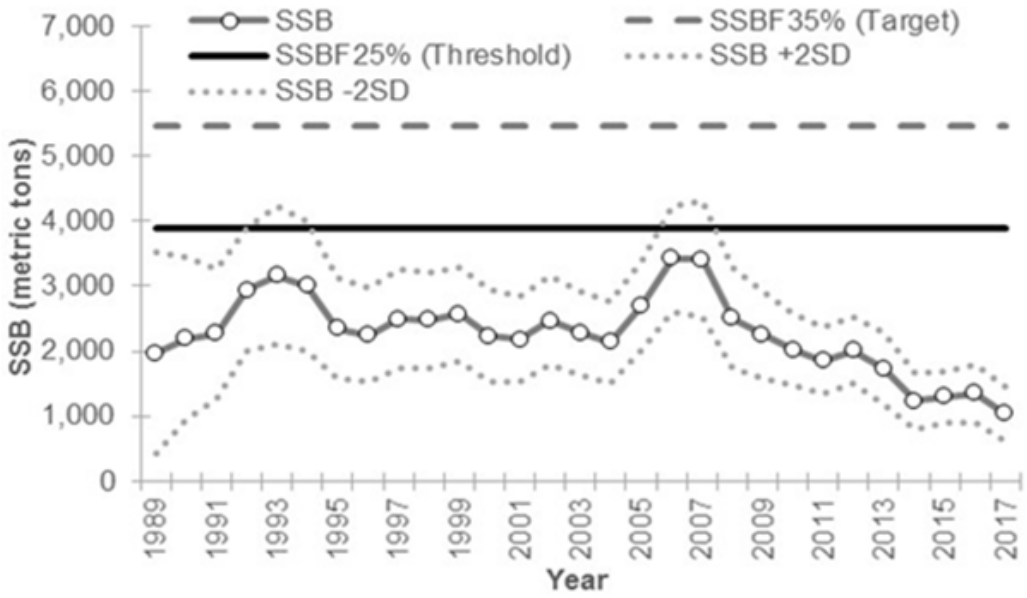


Figure 2. Estimated spawning stock biomass compared to established reference points, 1989–2017. (Source: Flowers et al. 2019).

## Stock Assessment

The 2009 stock assessment used a statistical catch-at-age model run using the Age Structured Assessment Program (Takade-Heumacher and Batsavage 2009). Results showed the stock to be overfished with overfishing occurring throughout the time series. These were the most recent assessment results included in Amendment 1. The 2014 Southern Flounder Stock Assessment used a statistical catch-at-age model run using Stock Synthesis (NCDMF 2015). Upon review of the assessment, external peer reviewers and the DMF determined the model could not fully account for stock mixing during spawning, nor quantify migration of southern flounder to and from North Carolina waters. Consequently, the assessment was not accepted for determining stock status.

As a result, a coast-wide southern flounder stock assessment was developed and included data and expertise of state agency staff from North Carolina. South Carolina, Georgia, and Florida, as well as researchers from the University of North Carolina at Wilmington and Louisiana State University. The multistate assessment was an attempt to further address the geographical distribution of the unit stock and was peer reviewed in December 2017. This assessment used a statistical catch-at-age model run using the Age Structured Assessment Program (Lee et. al. 2018).

The Southern Flounder Review Panel accepted the pooled-sex run of the ASAP model presented at the Review Workshop and was approved as a valid basis of management for at least the next five years, with the expectation that the model will be updated with data through 2017 to provide the best, most up to date estimate of stock status for management. The reviewers also noted that management advice based on the 2015 terminal year would be out of date by the time it could be implemented and that expected changes to recreational catch estimates (MRIP) should be incorporated into the assessment model and management response.

During 2018, the southern flounder stock assessment sub-committee updated all necessary data inputs for the ASAP model. The pooled-sex model was updated with data through 2017 and incorporated the new MRIP estimates that were available; the results indicated the stock is

overfished and overfishing is still occurring (Figures 1 and 2; Flowers et al. 2019). Analyses that provided projections of reductions to fishing mortality necessary to end overfishing and to determine what reductions would be necessary to rebuild the spawning stock biomass and end the overfished status were completed (Flowers et al. 2019).

In early 2024, the southern flounder stock assessment sub-committee conducted a second update to the ASAP model with data through 2022. The 2024 update continued to show declining trends in spawning stock biomass (SSB) and recruitment since 2006; however, fishing mortality (*F*) decreased significantly in the last two years of the assessment (Schlick et al. 2024). 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. Additionally, while the trends in stock status have not changed since the last update, not enough time has elapsed under current management schemes to determine their effectiveness. A new benchmark assessment is recommended no sooner than 2026.

## DESCRIPTION OF THE FISHERY

### Current Regulations

Commercial regulations include a 15-inches TL minimum size limit from internal waters and 14-inches TL minimum size limit from ocean waters, 6-inch stretched mesh minimum mesh size for gill nets, closed season in internal waters unless opened by proclamation. The 2024 commercial season opening date has yet to be determined, though paybacks will be required for any overage to the TAC. The commercial fishery has operated under a quota since the fall of 2022 with two gear categories; mobile gears which are divided into two management areas using the B-D boundary line from the turtle and sturgeon ITPs and the pound net fishery which will be divided into three management areas consistent with Amendment 2. There are no current trip limits in internal waters, but they can be implemented for pound nets and gigs only upon reaching a predetermined division closure threshold to reopen the fishery without exceeding the quota and a 100-pound trip limit in ocean waters unless the individual has a License to Land Flounder from the Atlantic Ocean; commercial ocean landings are allowed using trawl gear only.

Recreational regulations include a 15-inches TL minimum size limit, one-fish creel limit from all joint and coastal waters, closed season for internal and ocean waters except if opened by proclamation. The recreational flounder fishery has operated under seasons to constrain the fishery to a quota since 2022. The 2024 recreational season will not occur due to the overage of the recreational quota in 2023. With the paybacks that are required under Amendment 3, there is not enough quota available to the sector to have a season. The pounds that are available will be taken up by dead discards that occur during the year.

### Commercial Fishery

All landings reported as caught in inshore waters are considered to be southern flounder by the DMF Trip Ticket Program. Data from the fishery-dependent sampling program indicate that southern flounder make up less than one percent of the catch from ocean waters, while summer flounder and Gulf flounder account for approximately two percent or less of the flounder harvested from internal waters (NCDMF, unpublished data). Most southern flounder landings are from gill nets and pound nets, although gigs and other inshore gears (e.g., trawls) catch flounder in smaller numbers. Historically, pound nets were the dominant gear but landings from gill nets were higher from 1994 to 2013 (Figure 3). Peak commercial landings occurred in 1994 (Table 1; Figure 3). Since 1994, pound net landings decreased greatly, while gill net landings

remained relatively high until 2010. Decreases in gill net landings from 2010 to 2012 were mainly due to lower landings in the Albemarle Sound. The Sea Turtle Settlement Agreement (2010) added regulations to gill nets in portions of the state, resulting in lower effort in many areas; however, the Albemarle Sound was mostly unaffected by these regulations. The Albemarle Sound is typically where the majority of southern flounder gill net harvest occurs. In 2013, gill net harvest increased in the Albemarle Sound, but decreased in Pamlico Sound and Core Sound; pound net landings also increased in 2013. Since 2014, gill net harvest has decreased in all areas of the state, especially in the Albemarle Sound due to widespread gill net closures to avoid catches of red drum and protected species interactions. Pound net harvest surpassed gill net harvest 2014 through 2020 (Figure 3). Gig harvest of southern flounder has generally increased, especially since 2010. Harvest by other commercial gears has generally decreased to its lowest point in 2023 and currently makes up a small portion of commercial harvest. Commercial harvest from 2019 to 2023 was impacted due to regulations implemented through Amendment 2 and Amendment 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 3 the commercial fishery was separated into two mobile gear management areas (northern and southern) and three-pound net management areas. In 2023, the northern and southern mobile gear management areas were open a total of 21 days. The northern pound net management area was open 21 days, the central 24 days, and the southern eight days. The northern and central pound net and southern mobile gear management areas exceeded their allowed landings. Additionally, the commercial southern flounder fishery exceeded their overall quota.

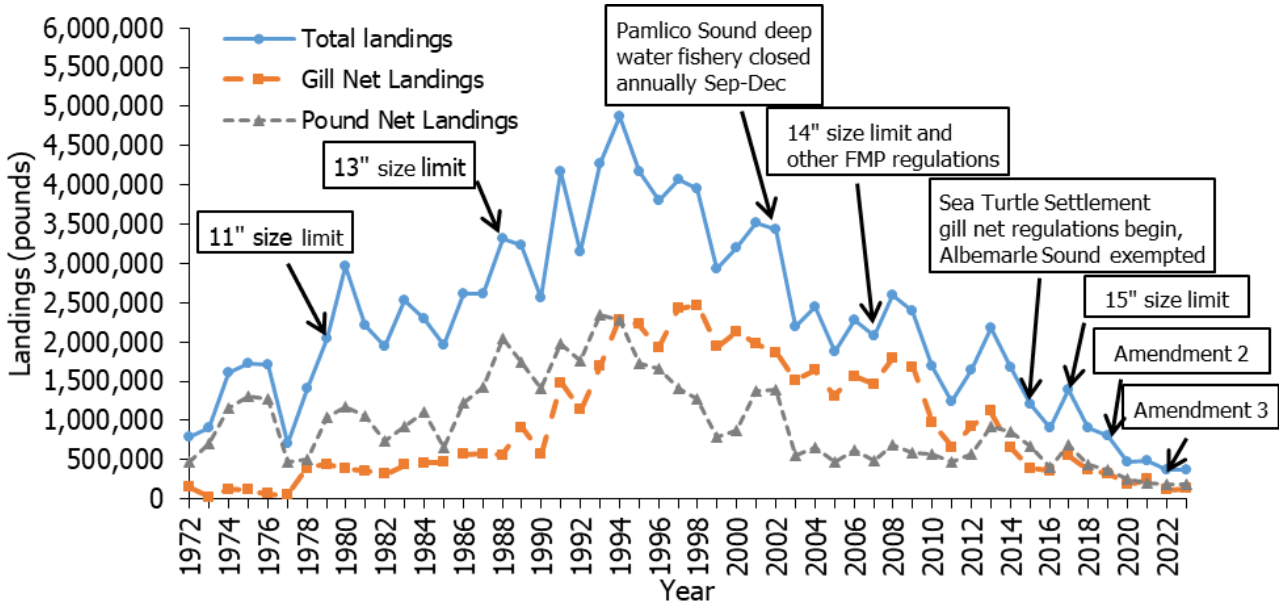


Figure 3. Southern flounder harvest (pounds) for total commercial fishery and top two gears (gill nets and pound nets) from North Carolina Trip Ticket Program 1972–2023 with major fishery regulation changes.

Table 1. Southern flounder recreational harvest and number released (Marine Recreational Information Program for hook and line and the NCDMF Gig Mail Survey) and commercial harvest (North Carolina Trip Ticket Program) for 1989–2023. All weights are in pounds.

| | Recreational | | | | | | Commercial | |
|---|---|---|---|---|---|---|---|---|
| | Hook and Line | | | Gig | | | | |
| Year | Number Landed | Number Released | Weight Landed (lb) | Number Landed | Number Discards | Weight Landed (lb) | Weight Landed (lb) | Total Weight Landed (lb) |
| 1989 | 119,047 | 125,192 | 199,850 | | | | 3,225,955 | 3,425,805 |
| 1990 | 138,106 | 152,895 | 216,960 | | | | 2,560,459 | 2,777,419 |
| 1991 | 257,319 | 791,778 | 489,865 | | | | 4,163,374 | 4,653,239 |
| 1992 | 115,329 | 433,576 | 219,720 | | | | 3,145,020 | 3,364,740 |
| 1993 | 83,811 | 370,372 | 127,860 | | | | 4,272,368 | 4,400,228 |
| 1994 | 168,237 | 562,915 | 323,869 | | | | 4,878,606 | 5,202,475 |
| 1995 | 127,106 | 459,800 | 271,703 | | | | 4,166,947 | 4,438,650 |
| 1996 | 173,400 | 449,876 | 339,228 | | | | 3,807,009 | 4,146,237 |
| 1997 | 209,038 | 873,901 | 560,323 | | | | 4,076,791 | 4,637,114 |
| 1998 | 96,124 | 411,939 | 205,569 | | | | 3,952,563 | 4,158,132 |
| 1999 | 78,321 | 209,956 | 184,969 | | | | 2,933,276 | 3,118,245 |
| 2000 | 326,712 | 942,560 | 607,053 | | | | 3,205,789 | 3,812,842 |
| 2001 | 304,791 | 990,335 | 567,568 | | | | 3,522,136 | 4,089,704 |
| 2002 | 366,671 | 1,415,247 | 789,539 | | | | 3,436,751 | 4,226,290 |
| 2003 | 293,793 | 860,052 | 621,985 | | | | 2,198,501 | 2,820,486 |
| 2004 | 347,492 | 1,537,924 | 827,593 | | | | 2,454,585 | 3,282,178 |
| 2005 | 298,307 | 997,132 | 675,856 | | | | 1,870,754 | 2,546,610 |
| 2006 | 352,942 | 1,287,601 | 761,069 | | | | 2,287,823 | 3,048,892 |
| 2007 | 279,916 | 1,075,735 | 572,064 | | | | 2,083,043 | 2,655,107 |
| 2008 | 349,860 | 2,532,079 | 807,867 | | | | 2,602,274 | 3,410,141 |
| 2009 | 329,117 | 1,889,921 | 692,704 | | | | 2,396,240 | 3,088,944 |
| 2010 | 556,812 | 2,835,142 | 1,149,899 | 18,079 | 3,051 | 41,582 | 1,689,557 | 2,881,038 |
| 2011 | 388,647 | 2,087,604 | 942,373 | 51,954 | 9,726 | 119,494 | 1,247,450 | 2,309,317 |
| 2012 | 290,035 | 2,434,621 | 701,698 | 46,338 | 2,674 | 106,577 | 1,646,137 | 2,454,413 |
| 2013 | 374,215 | 2,357,529 | 869,223 | 54,419 | 2,759 | 125,164 | 2,186,579 | 3,180,966 |
| 2014 | 209,228 | 1,856,280 | 447,337 | 42,306 | 2,715 | 97,304 | 1,673,511 | 2,218,152 |
| 2015 | 249,166 | 1,709,189 | 558,303 | 28,707 | 2,356 | 66,026 | 1,202,952 | 1,827,281 |
| 2016 | 299,273 | 2,178,145 | 695,713 | 29,642 | 3,737 | 68,177 | 899,932 | 1,663,822 |
| 2017 | 221,321 | 1,988,000 | 451,126 | 24,136 | 655 | 55,513 | 1,396,384 | 1,903,023 |
| 2018 | 217,805 | 1,002,753 | 495,289 | 23,243 | 525 | 53,459 | 903,842 | 1,452,590 |
| 2019* | 163,045 | 1,353,286 | 387,203 | 20,179 | 1,042 | 46,412 | 800,080 | 1,233,695 |
| 2020* | 152,244 | 1,678,494 | 398,769 | 11,511 | 90 | 26,475 | 479,905 | 905,150 |
| 2021* | 266,421 | 1,940,051 | 560,440 | 11,338 | 926 | 26,077 | 485,024 | 1,071,541 |
| 2022* | 70,945 | 2,792,144 | 166,102 | 3,422 | 109 | 7,871 | 362,062 | 536,034 |
| 2023* | 77,885 | 2,185,629 | 192,168 | *3,422* | *109* | *7,871* | 374,279 | 574,318 |
| Mean | 238,642 | 1,336,276 | 516,539 | 26,335 | 2,177 | 60,572 | 2,359,656 | 2,900,423 |

* Years with harvest seasons in place; 2022 was the start of quota management.
2023 gig survey estimates are not available, so 2022 values were used as proxies for quota management purposes.

Trends in commercial trips 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 majority of trips that harvest flounder are from gill nets. Gill net trips have been variable around a decreasing trend since 2010. Pound net trips decreased until 2002, since they have been variable on a lower level. Gigging trips have been variable around an increasing trend since 2010. The number of trips for all gears targeting southern flounder have 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.

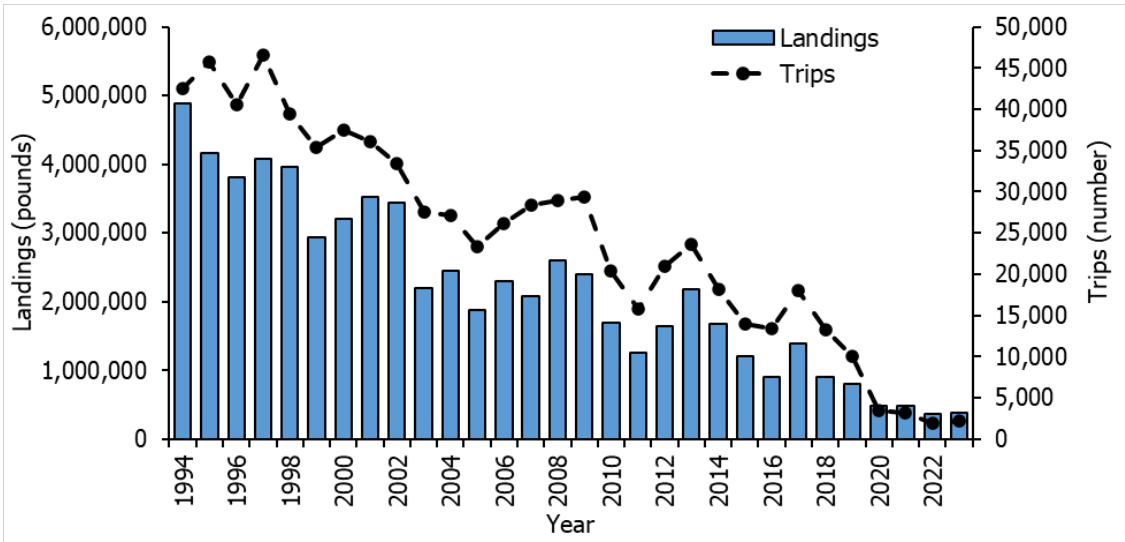


Figure 4. Southern flounder commercial trips (numbers) and landings (pounds) from N.C. Trip Ticket Program, 1994–2023.

## Recreational Fishery

Recreational harvest of southern flounder is mainly by hook and line and gigs, with a small amount of harvest by spearfishing or RCGL gears (prior to 2022). DMF does not have information on long-term trends of the gig fishery; MRIP rarely encounters gig fishermen. A DMF mail-based survey of gigging that began in 2010 indicates the gig harvest from 2010-2022 averaged 10% of the recreational harvest (with hook-and-line harvest making up the remainder). In 2023, a new licensing system was implemented and the license database was restructured. This restructuring disrupted the division's ability to query the full license dataset to establish a sampling frame of eligible anglers for the mail surveys. As a result, we were unable to administer the mail surveys and expand potential responses and survey estimates are not available for this year. Since the mail survey estimates are used in determining if the recreational fishery exceeded their TAC, data from 2022 was used as a proxy for the unavailable 2023 data in determining the total removals for the year.

Hook-and-line harvest can be split into ocean and inshore harvest, with most southern flounder harvested inshore (Figure 5). Hook-and-line harvest peaked in 2010 (Table 1). Recreational harvest was impacted in 2020 and 2021 due to regulations implemented through Amendment 2 to the North Carolina Southern Flounder FMP. In addition, 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. Like the commercial fishery, Amendment 3 implemented a quota for the recreational fishery through a season. The season in 2022 was 30 days. In 2023, the season for the recreational fishery was 14 days; due to overages in 2022, the 2023 total allowable catch (harvest plus discards) was adjusted from 170,655 pounds to 114,315 pounds. In 2023, 192,168 pounds of southern flounder were landed recreationally by hook and line (Table 1). The recreational fishery exceeded its expected harvest by 127,294 pounds in 2023.

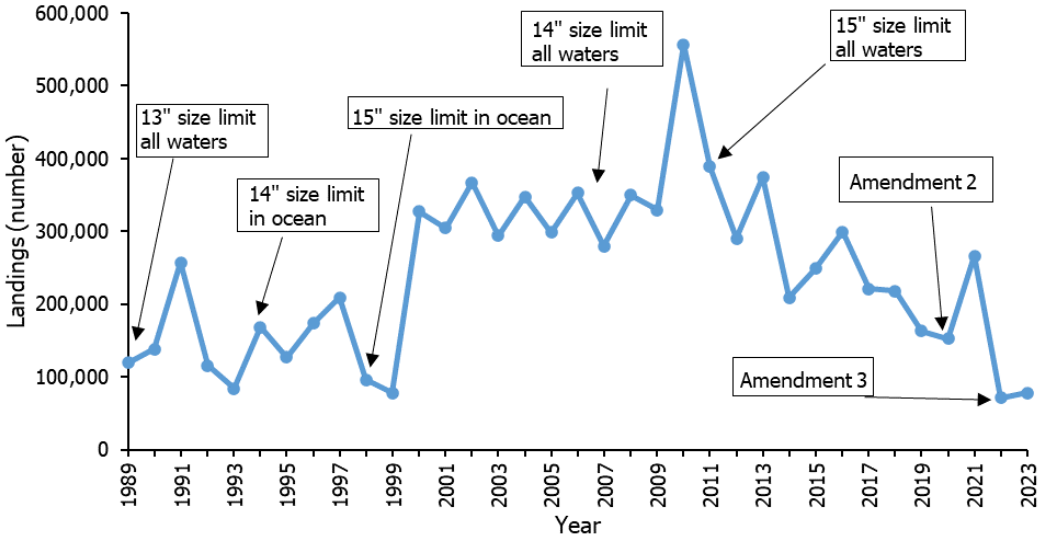


Figure 5. Southern flounder recreational hook and line harvest in numbers of fish from MRIP data 1989–2023 and major fishery regulation changes.

Trends in recreational trips are somewhat difficult to interpret because they represent all *Paralichthid* flounder species commonly caught in North Carolina (southern, summer, and gulf). This is because anglers simply report targeting 'flounder' rather than a particular species of flounder. 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 roughly similar throughout most of the time-series, but trips have been declining since 2014 while harvest has been variable. (Figure 6). Recreational estimates across all years have been updated and are now based on the Marine Recreational Information Program (MRIP) new Fishing Effort Survey-based calibrated estimates. For more information on MRIP see https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

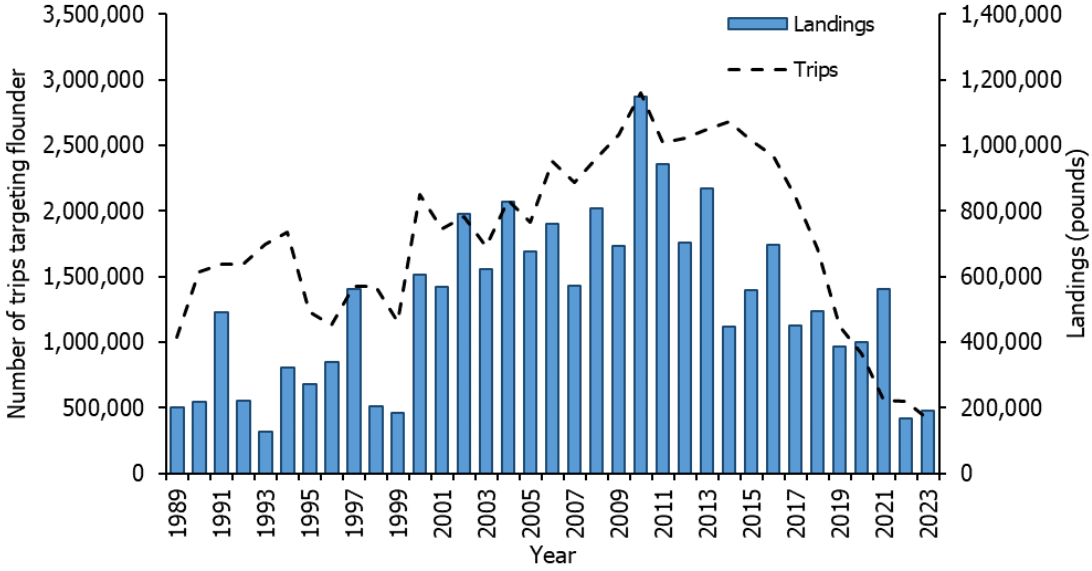


Figure 6. Recreational hook and line harvest (in numbers of fish) and all trips that harvested or released Paralichthid flounder species, from MRIP data 1989–2023. Data from prior to 2004 were calibrated to align with MRIP estimates post-2004.

## MONITORING PROGRAM DATA

### Fishery-Dependent Monitoring

Commercial fishing activity is monitored through fishery-dependent sampling conducted by the division since 1982. Data collected in this program allow the size and age distribution of southern flounder to be characterized by gear and fishery. Several DMF sampling programs collect biological data on commercial and recreational fisheries that catch southern flounder. The primary programs that collect length and age data for harvested southern flounder include: 461 (gill net and seine), 476 (gig and spear), 432 (pound net), and 437 (long haul seine). Programs 466 the North Carolina Onboard Observer Program and 570 the North Carolina Shrimp Trawl Characterization Study collect length data on harvested and discarded flounder. Other commercial sampling programs focusing on fisheries that do not target southern flounder rarely collect biological data. The DMF sampling of the recreational fishery through the MRIP collects length data on southern flounder. The DMF mail-based gigging survey collects harvest data for the recreational gig fishery but does not collect length or age data. Age data from the recreational fishery are collected mainly via voluntary angler donations through the DMF Carcass Collection Program.

There were no clear trends in commercial length data from 2005 to 2022 (Table 2). In 2023, 51% of southern flounder were harvest by pound nets, followed by gill nets (37%), gigs (12%), and other gear accounted for >1% (Figure 7). An increase in mean TL was observed due to the changes in minimum commercial size regulation, increasing to 15-inches TL in 2016 (Table 2; Figure 8). During 2023, a greater proportion of the total catch consisted of 17-inch fish than in previous years (Figure 8).

Table 2. Southern flounder total length (inches) data for DMF commercial fishery sampling programs 2005–2023 (includes harvest and some discard information).

| Year | Mean Length | Minimum Length | Maximum Length | Total Measured |
|---|---|---|---|---|
| 2005 | 16 | 2 | 31 | 28,972 |
| 2006 | 16 | 5 | 31 | 39,572 |
| 2007 | 16 | 4 | 29 | 23,768 |
| 2008 | 16 | 1 | 28 | 39,302 |
| 2009 | 16 | 4 | 28 | 33,403 |
| 2010 | 16 | 5 | 29 | 27,176 |
| 2011 | 16 | 5 | 30 | 32,000 |
| 2012 | 16 | 4 | 30 | 29,865 |
| 2013 | 16 | 1 | 32 | 33,776 |
| 2014 | 16 | 1 | 28 | 26,354 |
| 2015 | 16 | 2 | 30 | 19,717 |
| 2016 | 17 | 6 | 27 | 14,712 |
| 2017 | 17 | 3 | 30 | 14,775 |
| 2018 | 17 | 2 | 27 | 8,892 |
| 2019 | 16 | 8 | 26 | 8,355 |
| 2020 | 17 | 10 | 28 | 4,163 |
| 2021 | 16 | 11 | 27 | 4,360 |
| 2022 | 17 | 7 | 27 | 4,133 |
| 2023 | 17 | 2 | 36 | 5,225 |

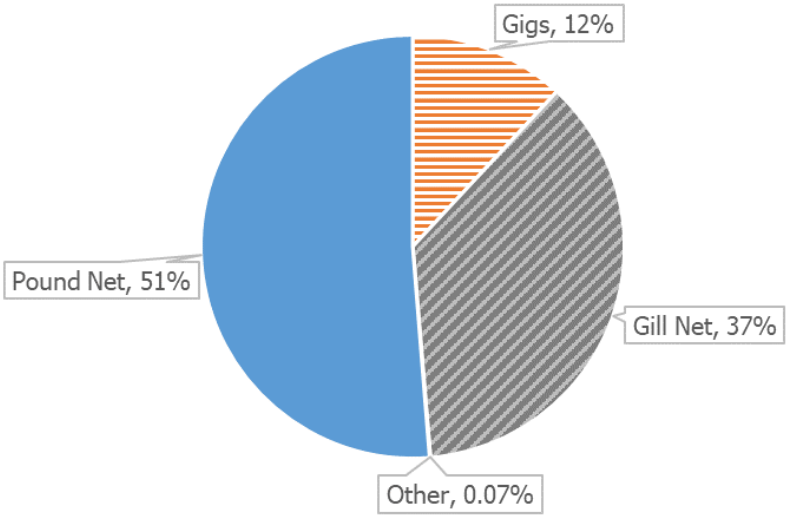


Figure 7. North Carolina commercial harvest of southern flounder in 2023 by gear type.

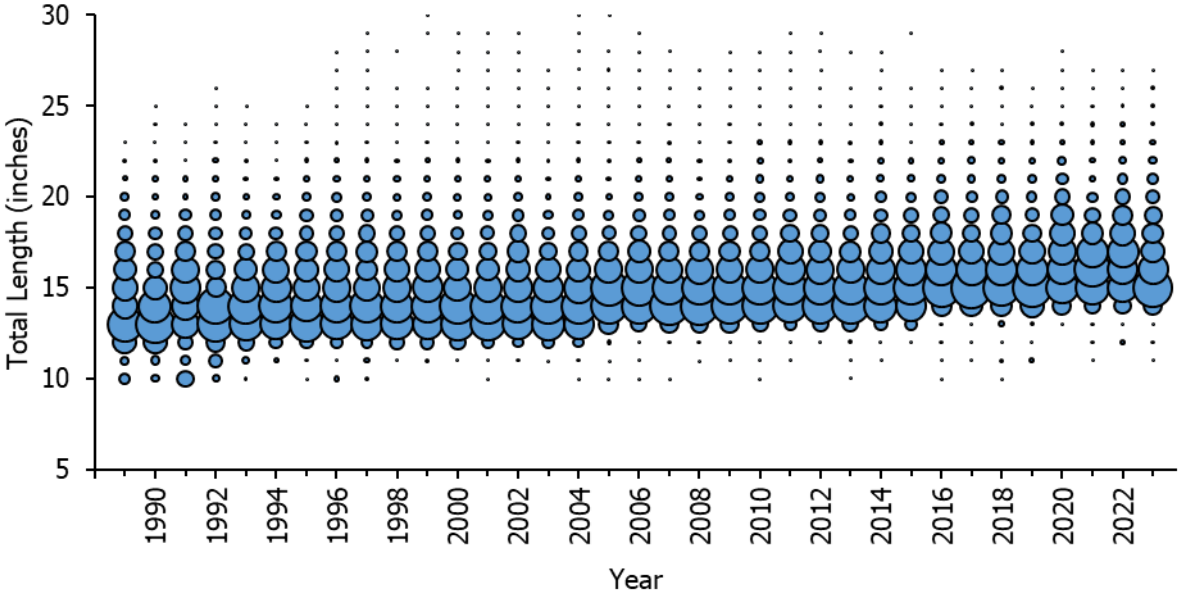


Figure 8. Commercial length frequency (total length, inches) of southern flounder harvested in North Carolina, 1991–2023. Bubbles represent fish at length and the bubble size is proportional to the number of fish at that length.

There were no clear trends in recreational length data from 2005 to 2021 (Table 3); starting in 2022 a higher proportion fish greater than 20-inches has been observed. Annual mean lengths collected through age sampling programs have been consistent, 2023 average length of 18 inches TL was consistent with previous years. MRIP length frequency data show harvest of smaller fish has declined as changes to minimum size limits has occurred (Table 3; Figure 9).

Table 3. Southern flounder total length (inches) data for MRIP recreational fishery sampling in North Carolina, 2005–2023.

| Year | Mean Length | Minimum Length | Maximum Length | Total Measured |
|---|---|---|---|---|
| 2005 | 17 | 13 | 26 | 202 |
| 2006 | 16 | 10 | 31 | 343 |
| 2007 | 17 | 14 | 24 | 220 |
| 2008 | 17 | 13 | 27 | 311 |
| 2009 | 17 | 12 | 26 | 306 |
| 2010 | 17 | 11 | 28 | 754 |
| 2011 | 17 | 14 | 26 | 478 |
| 2012 | 18 | 14 | 30 | 400 |
| 2013 | 17 | 13 | 27 | 390 |
| 2014 | 17 | 14 | 26 | 199 |
| 2015 | 17 | 14 | 24 | 177 |
| 2016 | 17 | 14 | 25 | 225 |
| 2017 | 17 | 14 | 26 | 215 |
| 2018 | 17 | 13 | 27 | 276 |
| 2019 | 18 | 14 | 24 | 131 |
| 2020 | 18 | 12 | 26 | 187 |
| 2021 | 17 | 15 | 26 | 168 |
| 2022 | 18 | 15 | 24 | 110 |
| 2023 | 18 | 15 | 24 | 61 |

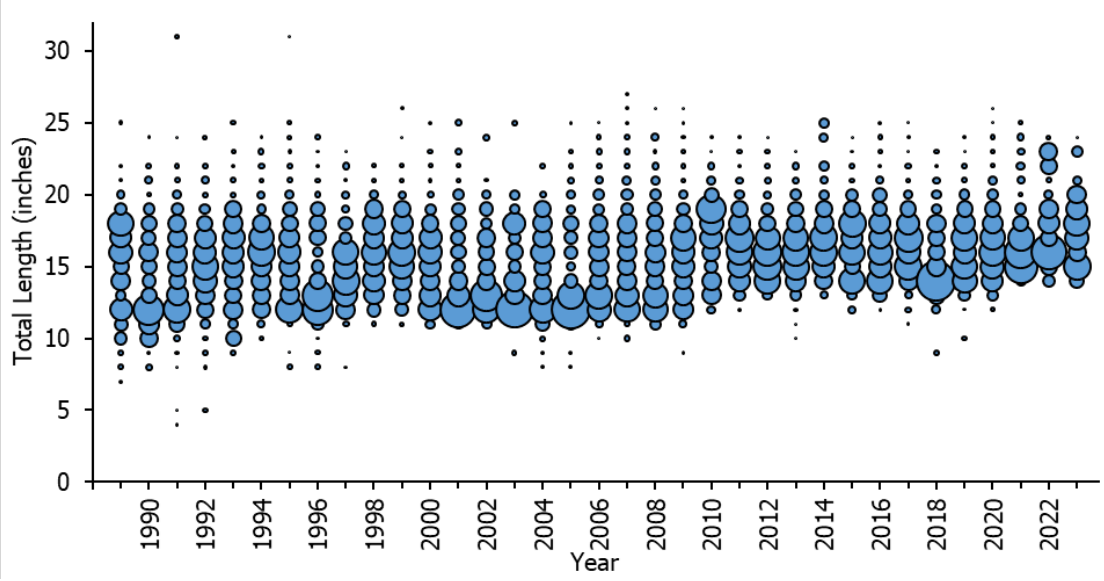


Figure 9. Recreational length frequency (total length, inches) of southern flounder harvested in North Carolina from MRIP, 1989–2023. Bubbles represent fish at length and the bubble size is proportional to the number of fish at that length.

## Fishery-Independent Monitoring

Several DMF independent sampling programs collect biological data on southern flounder. The primary surveys that collect length data for southern flounder and that were evaluated as indices of abundance in recent stock assessments were: 120 (Estuarine Trawl Survey), 195 (Pamlico Sound Survey), 135 (Albemarle Sound Independent Gill Net Survey, and 915 (Pamlico Sound and

Rivers Independent Gill Net Surveys). Program 135 was dropped from this update as the program has had significant changes in sample design that limits its catches of southern flounder thus reducing its usefulness as a data source for this species moving forward. Age data primarily is collected in Program 915, although the other three surveys do collect age data. Methodology for analyzing trends in relative abundance for each survey changed with the 2018 stock assessment when generalized linear models (GLMs) were used to calculate relative yearly relative abundance index values. These indices were not updated, as a result, nominal relative abundance index values have been included in this report.

There were no clear trends in fishery-independent length data from 2005 to 2023 (Table 4). Annual mean lengths were fairly consistent and 2022 had the second largest mean length in the time-series. However, the number of fish measured in 2020 was the lowest of any year from 2005 to 2022. The reduced number of measurements from independent samples is reflective of the sampling impacts due to the pandemic.

Table 4. Southern flounder total length (inches) data for DMF fishery-independent sampling programs 2005–2023. 2020/2021 sampling impacted by Executive Order (EO) 116, issued March 10, 2020; most lengths in 2020 were collected in the juvenile sampling programs.

| Year | Mean Length | Minimum Length | Maximum Length | Total Measured |
|---|---|---|---|---|
| 2005 | 8 | 0 | 25 | 3,769 |
| 2006 | 9 | 0 | 23 | 3,560 |
| 2007 | 7 | 0 | 22 | 3,812 |
| 2008 | 10 | 0 | 27 | 4,270 |
| 2009 | 10 | 1 | 27 | 3,230 |
| 2010 | 9 | 1 | 23 | 4,168 |
| 2011 | 12 | 1 | 28 | 2,604 |
| 2012 | 10 | 1 | 26 | 4,878 |
| 2013 | 9 | 1 | 27 | 3,534 |
| 2014 | 9 | 1 | 25 | 2,339 |
| 2015 | 9 | 1 | 24 | 2,133 |
| 2016 | 11 | 2 | 30 | 1,426 |
| 2017 | 9 | 1 | 22 | 2,238 |
| 2018 | 9 | 0 | 24 | 2,123 |
| 2019 | 10 | 0 | 24 | 2,664 |
| 2020 | 5 | 1 | 18 | 595 |
| 2021 | 9 | 0 | 24 | 2,529 |
| 2022 | 11 | 0 | 24 | 3,733 |
| 2023 | 11 | 1 | 27 | 2,835 |

Data collected by Program 915 were used for an index of relative (juvenile and adult) abundance in the January 2019 stock assessment. The survey is designed to characterize the size and age distribution for key estuarine species in Pamlico Sound and its major river tributaries. Sampling began in Pamlico Sound in 2001 and was expanded to the current sampling area (including tributaries) in 2003. Each array of nets consists of floating gill nets in 30-yard segments of 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, and 6.5-inch stretched mesh, for a total of 240 yards of nets. Catches from an array of gill nets comprise a single sample; two samples (one shallow, one deep) totaling 480 yards of gill net are completed each trip. Gill nets are typically deployed within an hour of sunset and fished the following morning. Efforts are made to keep all soak times within 12 hours. All gill nets are constructed with a hanging ratio of 2:1.

Gill net sets are determined using a random stratified survey design, based on area and water depth. Each region is overlaid with a one-minute by one-minute grid system (equivalent to one square nautical mile) and delineated into shallow (less than six feet) and deep (greater than six feet) strata. Deep strata were not included in analysis for this report. Sampling in Pamlico Sound is divided into two regions: Region 1, which includes areas of eastern Pamlico Sound adjacent to the Outer Banks from southern Roanoke Island to the northern end of Portsmouth Island; and Region 2, which includes Hyde County bays from Stumpy Point Bay to Abel's Bay and adjacent areas of western Pamlico Sound. Each of the two regions is further stratified into four similar sized areas, denoted by either Hyde or Dare and numbers one through four. The rivers are divided into four areas in the Neuse River, three areas in the Pamlico River, and one area for the Pungo River. Although the survey is conducted in all months except January, only July-September data were used to analyze the index of abundance trends because these months had the peak catches of southern flounder. The survey was expanded to include areas in the southern portion of the state in 2008, but these data were not analyzed for the index due to the short time-series. The relative abundance index for Program 915 peaked in 2010 and the low point was in 2016 for the time-series analyzed (2003-2022) and has an overall decreasing trend (Figure 10). The relative abundance index for 2021 was above the series average (3.73 southern flounder per set) for the first time since 2013, but 2022 had the lowest relative abundance since 2016. In 2023, the relative abundance index was 3.82, above the time series average.

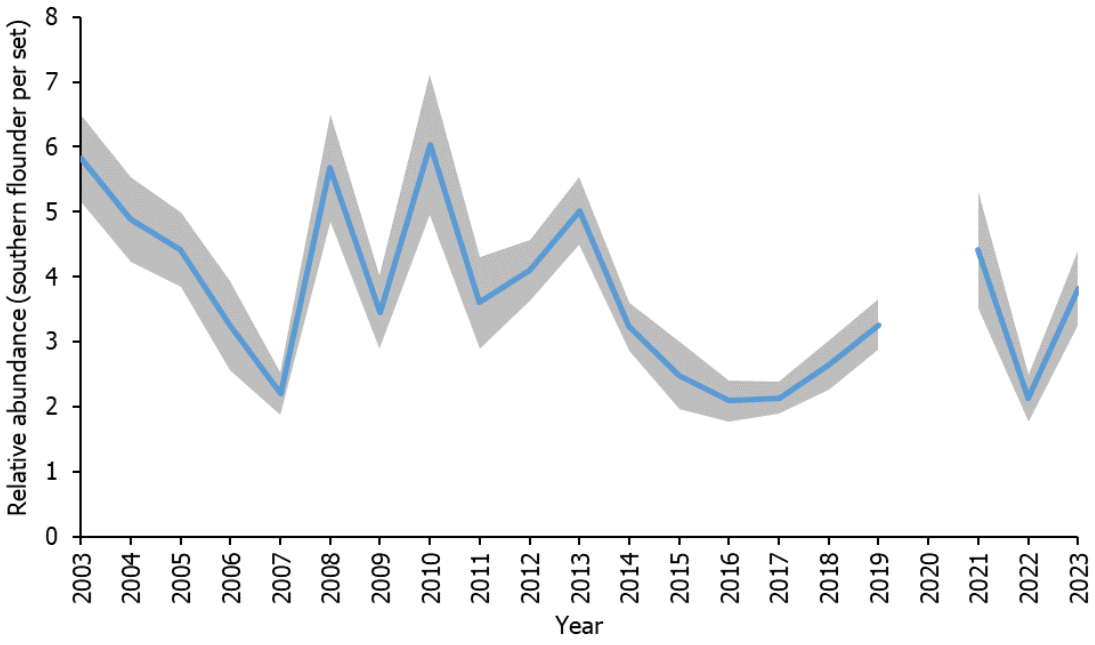


Figure 10. Annual nominal relative abundance index with standard error shaded in gray for southern flounder (juveniles and adults) caught in the North Carolina Pamlico Sound Independent Gill Net Survey, 2003–2023. Note: 2020 and 2021 sampling impacted by Executive Order (EO) 116, issued March 10, 2020.

During 2020, and the first part of 2021 no index of abundance is available for southern flounder from the fishery-independent assessment (Program 915). Sampling in this program was suspended in February 2020 due to COVID-19 restrictions and protected species interactions but resumed July 2021.

Data collected by Program 120 were used for a relative Juvenile Abundance Index (JAI) in the January 2019 stock assessment. The Estuarine Trawl Survey (Program 120) is a fishery-independent multispecies monitoring program that has been ongoing since 1971 in the months of May and June. One of the key objectives of this program is to provide a long-term database of annual juvenile recruitment for economically important species. This survey samples fixed stations, a set of 104 core stations with additional stations as needed. The core stations are sampled from western Albemarle Sound south through the South Carolina border each year without deviation one sample for each station each month during the months of May and June. This survey targets juvenile finfish, blue crabs, and Penaeid shrimp. A two-seam 10 and one-half foot head rope trawl with a one-fourth inch mesh in the body and one-eighth inch mesh in the tail bag is used. A one-minute tow is conducted covering a distance of 75 yards. All species collected are sorted, identified, and a total number is recorded for each species. For target species, a subset of at least 30 to 60 individuals is measured. Environmental data is collected, including salinity, dissolved oxygen, temperature, wind speed and direction. Data from this survey were used to produce a southern flounder JAI from 1989 to 2023. The JAI for Program 120 peaked in 1996 and the low point was in 2023 for the time-series analyzed (1989-2022) and shows a declining but variable trend (Figure 11). The JAI has been below the time-series average (2.63 flounder per tow) for the last 10 years. The JAI in 2023 (0.50 southern flounder per tow) decreased compared to 2022; and is the lowest in the time series. The 2020 JAI was the second lowest in the 30-year time series, however, sampling was impacted by the COVID pandemic, and the full sampling regime was not completed. Sampling typically occurs over the months of May and June. Due to the pandemic all sampling was conducted in June. The impacts to the JAI due to the changes to the sampling regime are unknown.

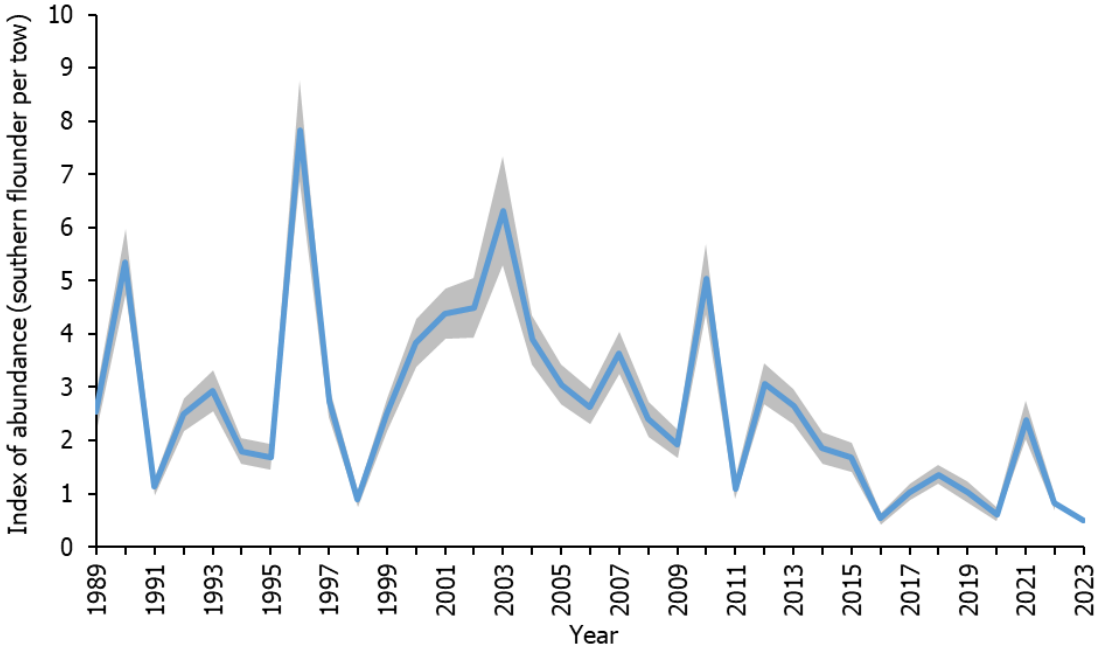


Figure 11. Annual nominal relative abundance index with standard error shaded in gray for southern flounder (juveniles and adults) caught in the North Carolina Estuarine Trawl Survey, 1989–2023. Note: 2020 sampling impacted by Executive Order (EO) 116, issued March 10, 2020.

Data collected by Program 195 were not used as a JAI in the January 2019 stock assessment but continues to provide an additional data source to monitor trends in the population. Program 195

conducts trawls using a random-stratified survey design in waters of Pamlico Sound and major river tributaries in June and September. Only data from September were used for the JAI in the 2014 stock assessment. Stations are randomly selected from strata based upon depth and geographic location. Randomly selected stations are optimally allocated among the strata based upon all previous sampling in order to provide the most accurate abundance estimates (PSE <20). Tow duration is 20 minutes; using double rigged demersal mongoose trawls (9.1m head rope, 1.0m X 0.6m doors, 2.2-cm bar mesh body, 1.9-cm bar mesh cod end and a 100-mesh tail bag extension. Data from this survey were used to produce a southern flounder JAI from 1989 to 2023. The JAI for Program 195 peaked in 1996 and the low point was in 1998 for the time-series analyzed (1989-2023; Figure 12). However, annual relative abundance for six of the last 10 years has been above the time series average (2.29 southern flounder per tow). The JAI for 2020 and 2021 are incomplete as sampling was conducted only in a portion of the areas typically sampled due to the pandemic. The impacts to the JAI due to the changes to the sampling regime are unknown.

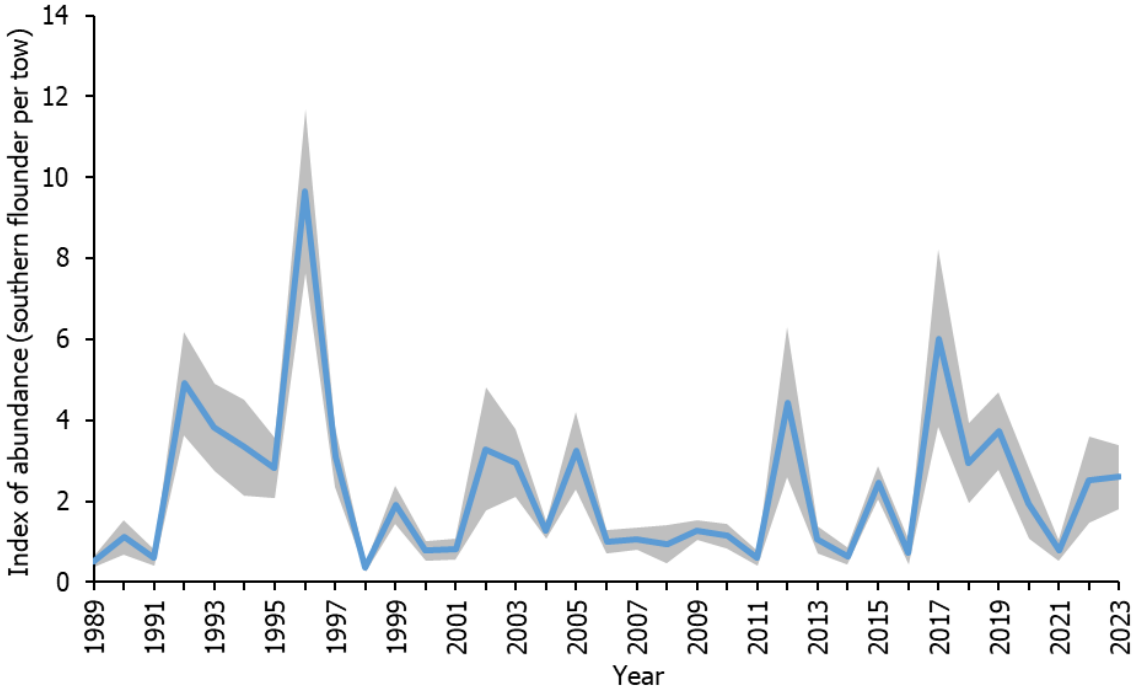


Figure 12. Annual nominal relative abundance index with standard error shaded in gray for southern flounder (juveniles and adults) caught in the North Carolina Pamlico Sound Survey, 1991–2023. Note: 2020 and 2021 sampling impacted by Executive Order (EO) 116, issued March 10, 2020.

In order to describe the age structure of harvest and indices, southern flounder age structures are collected from various fishery independent (scientific surveys) and dependent (fisheries) sources throughout the year. In 2023, southern flounder were aged ranging in age from 0 to 7 years (Table 5); ages for 2023 are still preliminary. Growth in length is rapid for the first year of life and then slows. The relationship of length and age for southern flounder is unpredictable with much overlap in age for a given length (Figure 13).

Table 5. Age data for southern flounder from DMF sampling 2005–2023.

| Year | Mean Age | Minimum Age | Maximum Age | Total Aged |
|---|---|---|---|---|
| 2005 | 2 | 0 | 7 | 803 |
| 2006 | 2 | 0 | 6 | 877 |
| 2007 | 2 | 0 | 8 | 744 |
| 2008 | 2 | 0 | 7 | 1,107 |
| 2009 | 1 | 0 | 6 | 492 |
| 2010 | 1 | 0 | 7 | 1,233 |
| 2011 | 1 | 0 | 6 | 912 |
| 2012 | 1 | 0 | 6 | 1207 |
| 2013 | 1 | 0 | 6 | 972 |
| 2014 | 1 | 0 | 7 | 1,280 |
| 2015 | 2 | 0 | 6 | 834 |
| 2016 | 2 | 0 | 5 | 773 |
| 2017 | 1 | 0 | 7 | 1,178 |
| 2018 | 1 | 0 | 5 | 965 |
| 2019 | 1 | 0 | 6 | 2,119 |
| 2020 | 2 | 0 | 5 | 1,210 |
| 2021 | 2 | 0 | 7 | 1,739 |
| 2022 | 2 | 0 | 7 | 1,478 |
| 2023 | 1 | 0 | 7 | 1,364 |

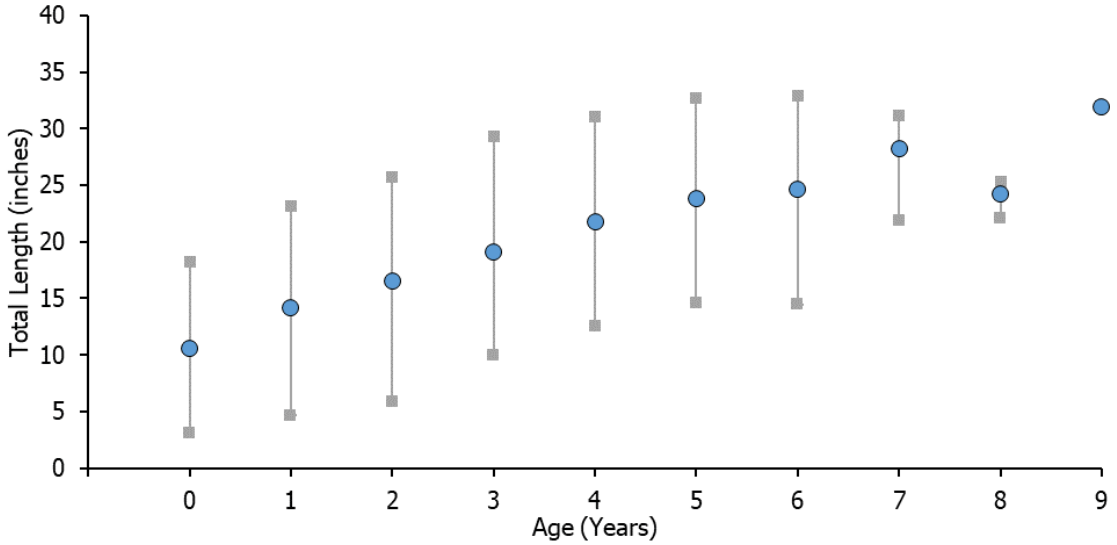


Figure 13. Southern flounder length at age based on all age samples collected in North Carolina, 1991–2022. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed size for each age. Otoliths from 2023 are not included in this figure as ages are still preliminary.

## Tagging Data

Since 2014, 8,597 southern flounder have been tagged (Table 6; Figure 14A). Six-hundred and one of these fish have been recaptured (Table 6; Figure 14B). The average time that a southern flounder is at large (time between the initial tagging event and recapture) is approximately five

months or 147 days, though some fish have been at large for as long as five years. On average, southern flounder travel less than 20 miles between the initial tagging event and recapture, and most are caught in the same water body they are tagged. There have been several flounder over the last nine years that have been recaptured south of North Carolina. In 2023, 586 fish were tagged and 30 fish were recaptured. The number of days at large, as well as the distance the flounder traveled, were the lowest in the time series.

From 2014 – 2021, tagging of southern flounder was done by division staff, with the help of several universities. In 2022, a pilot program was started for southern flounder to incorporate volunteer anglers. Positive results from the initial group has meant that moving forward the division will be incorporating more volunteer anglers for southern flounder.

Table 6. Total number of southern flounder tagged and recaptured, 2014-2023. Recapture information includes average and maximum days at large and distance traveled.

| Year Tagged | Total Fish Tagged (#) | Total Fish Recaptured (#) | Average Days At Large | Max Days At Large | Average Distance Traveled (miles) | Max Distance Traveled (miles) |
|---|---|---|---|---|---|---|
| 2014 | 930 | 128 | 168 | 904 | 25 | 518 |
| 2015 | 730 | 58 | 180 | 1,753 | 21 | 238 |
| 2016 | 715 | 73 | 132 | 697 | 19 | 262 |
| 2017 | 1,455 | 47 | 188 | 1,038 | 17 | 108 |
| 2018 | 466 | 69 | 108 | 780 | 6 | 109 |
| 2019 | 729 | 32 | 183 | 428 | 22 | 157 |
| 2020 | 1,054 | 65 | 151 | 414 | 14 | 195 |
| 2021 | 1,106 | 51 | 107 | 393 | 17 | 155 |
| 2022 | 824 | 44 | 113 | 431 | 18 | 143 |
| 2023 | 586 | 30 | 47 | 198 | 2 | 16 |

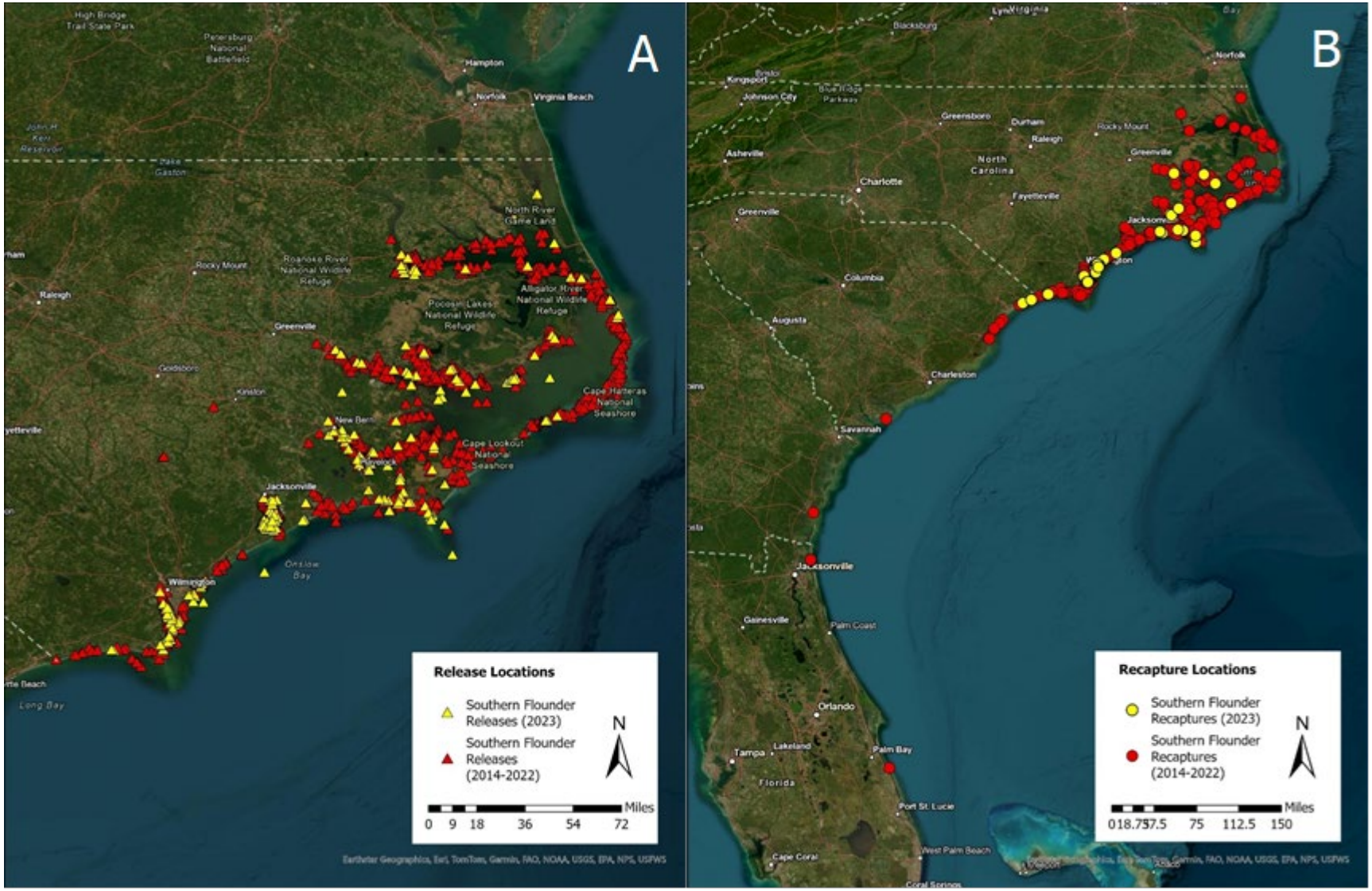


Figure 14. Release (A) and recapture (B) locations of southern flounder tagging events, 2014-2023.

## RESEARCH NEEDS

The management strategies and implementation status from Amendment 3 to the N.C. Southern Flounder FMP can be found in Table 6. The following research recommendations were included in Amendment 3; status of need is provided in parentheses. Those recommendations followed by an asterisk (*) were identified as the top five high priority research recommendations and are discussed further below.

### High

- 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. — Underway*
- Expand, improve, or add fisheries-independent surveys of the ocean component of the stock.*
- Determine locations of spawning aggregations of southern flounder. — Underway*
- Complete an age validation study using known age fish.*
- Research and evaluate data on the sub-legal fish in the recreational fishery as it relates to potential future reductions in minimum size limits. — Underway

### Medium

- Promote data sharing and research cooperation across the South Atlantic southern flounder range (North Carolina, South Carolina, Georgia, and Florida).
- Further research on factors that impact release mortality of southern flounder in the recreational hook-and-line fishery.
- Research on deep hooking events of different hook types and sizes on southern flounder.
- Coast-wide at-sea observations of the flounder pound net fishery.
- Develop a survey that will provide estimates of harvest and discards for the recreational gig fisheries in North Carolina, South Carolina, Georgia, and Florida.
- Develop a survey that will provide estimates of harvest and discards from gears used to capture southern flounder for personal consumption.
- Collect additional discard data (ages, species ratio, lengths, fates) from other gears (in addition to gill nets) targeting southern flounder (pound net, gigs, hook and line, trawls).
- Expand, improve, or add inshore and offshore surveys of southern flounder to develop indices for future stock assessments.
- Collect age and maturity data from the fisheries-independent Southeast Area Monitoring and Assessment Program (SEAMAP) Trawl Survey given its broad spatial scale and potential to characterize offshore fish.
- Conduct studies to better understand ocean residency of southern flounder.
- Consider the application of areas-as-fleets models in future stock assessments given the potential spatial variation (among states) in fishery selectivity and fleet behavior in the southern flounder fishery.
- Consider the application of a spatial model to account for inshore and ocean components of the stock as well as movements among states.

- Work to reconcile different state-level/regional surveys to better explain differences in trends.
- Evaluate the utility of circle hooks in the southern flounder recreational hook-and-line fishery.
- Development of alternative gears to catch southern flounder. — some research completed; more may be needed
- Study revenue variability and profitability of commercial southern flounder fishing in North Carolina based on catch characteristics.
- Generate a stated preference survey of North Carolina recreational anglers to understand perceived value of targeting southern flounder compared to other estuarine finfish species.

**Low**

- Develop a recreational catch per unit effort (CPUE; e.g., from MRIP intercepts or the Southeast Regional Headboat Survey if sufficient catches are available using a species guild approach to identify trips, from headboat logbooks, etc.) as a complement to the more localized fishery independent indices.
- Explore reconstructing historical catch and catch-at-length data prior to 1989 to provide more contrast in the removals data.
- Study potential species interactions among Paralichthid flounders to explain differences in population trends where they overlap.
- Explore potential impacts stocking may have on the southern flounder population and the costs associated with implementing a stocking program.
- Continued otolith microchemistry research to gain a better understanding of ocean residency of southern flounder. — Underway
- Implement fishery dependent sampling of the commercial spear fishery for flounder in the ocean.
- Determine harvest estimates and implement fishery dependent sampling of the recreational spear fishery for flounder in the ocean.
- Further research on flatfish escapement devices in crab pots that minimize undersized flounder bycatch and maximize the retention of marketable blue crabs.
- Expand tagging study to ocean component of the stock to estimate emigration, immigration, movement rates, and mortality rates throughout the stock's range.
- Develop protocol for archiving and sharing data on gonads for microscopic observation of maturity stage of southern flounder for North Carolina, South Carolina, Georgia, and Florida.
- Examine the variability of southern flounder maturity across its range and the effects this may have on the assessment model.
- Further research on the size distribution of southern flounder retained in pound nets with 5.75-Inch Square Mesh (ISM) and 6-ISM escape panels.
- Research on the species composition and size distribution of fish and crustaceans that escape pound nets through 5.75-ISM and 6-ISM escape panels.
- Develop a survey that will estimate harvest and discards from commercial gears used for recreational purposes.
- Continue at-sea observations of the large-mesh gill-net fishery including acquiring biological data on harvest and discards. — Underway

- Develop survey that better represents the for-hire industry.
- Continued gear research in the design of gill nets and pound nets to minimize protected species interactions. — some research completed; more may be needed
- Investigate the impacts of warming water temperature on the southern flounder stock.
- Develop a study that evaluates inlets and their relationship to southern flounder migration.
- Develop studies to investigate the impacts of emerging compounds on southern flounder.

**Research recommendations from the January 2018 stock assessment:**

- Develop a survey that will provide estimates of harvest and discards for the recreational gig fisheries in North Carolina, South Carolina, Georgia, and Florida.
- Conduct sampling of the commercial and recreational ocean spear fishery harvest and discards.
- Develop a survey that will estimate harvest and discards from commercial gears used for recreational purposes.
- Develop a survey that will provide estimates of harvest and discards from gears used to capture southern flounder for personal consumption.
- Improve estimates of the B2 component (catches, lengths, and ages) for southern flounder from the MRIP.
- Collect additional discard data (ages, species ratio, lengths, fates) from other gears (in addition to gill nets) targeting southern flounder (pound net, gigs, hook-and-line, trawls).
- Develop and implement consistent strategies for collecting age and sex samples from commercial and recreational fisheries and fisheries-independent surveys to achieve desired precision for stock assessment.
- Complete an age validation study using known age fish.
- Implement a tagging study to estimate emigration, movement rates, and mortality rates throughout the stock's range.
- Expand, improve, or add inshore and offshore surveys of southern flounder to develop indices for future stock assessments.
- Expand, improve, or add fisheries-independent surveys of the ocean component of the stock.
- Collect age and maturity data from the fisheries-independent SEAMAP Trawl Survey given its broad spatial scale and potential to characterize offshore fish.
- Conduct studies to better understand ocean residency of southern flounder.
- Determine locations of spawning aggregations of southern flounder.
- Develop protocol for archiving and sharing data on gonads for microscopic observation of maturity stage of southern flounder for North Carolina, South Carolina, Georgia, and Florida.
- Examine the variability of southern flounder maturity across its range and the effects this may have on the assessment model.
- Investigate how environmental factors (wind, salinity, temperatures, or oscillations) may be driving the stock-recruitment dynamics for southern flounder.
- Promote data sharing and research cooperation across the South Atlantic southern flounder range (North Carolina, South Carolina, Georgia, and Florida).

- Consider the application of areas-as-fleets models in future stock assessments given the potential spatial variation (among states) in fishery selectivity and fleet behavior in the southern flounder fishery.
- Consider the application of a spatial model to account for inshore and ocean components of the stock as well as movements among states.

The peer review panel concluded that the working group's research recommendations were appropriate and endorsed all of them. In addition to identifying some research needs as high priority, the peer review panel offered the following additional research recommendations:

- Conduct studies to quantify fecundity and fecundity-size/age relationships in Atlantic southern flounder.
- Work to reconcile different state-level/regional surveys to better explain differences in trends.
- Develop a recreational CPUE (e.g., from MRIP intercepts or the Southeast Regional Headboat Survey if sufficient catches are available using a species guild approach to identify trips, from headboat logbooks, etc.) as a complement to the more localized fishery independent indices.
- Explore reconstructing historical catch and catch-at-length data prior to 1989 to provide more contrast in the removals data.
- Study potential species interactions among Paralichthid flounders to explain differences in population trends where they overlap.

## MANAGEMENT

Amendment 3 was adopted by the MFC in May 2022. This Amendment includes more comprehensive management strategies which will be implemented via proclamation throughout 2022 (Table 7).

In concurrence with the incorporated actions from Amendment 1, Supplement A to Amendment 1 as modified by the August 17, 2017, settlement agreement, and Amendment 2, sustainable harvest was implemented in Amendment 3 to maintain 72% reductions in fishing mortality ($F$=0.18) in the commercial and recreational fisheries to a level that ends overfishing within two years and allows the SSB to increase between the threshold and the target within 10 years of adoption of Amendment 2.

To meet the reduction in fishing mortality, quotas with accountability measures were established for the commercial and recreational sectors for the first time in the North Carolina Southern Flounder Fishery as well as a reduction in the recreational bag limit from four fish per person per day to one fish per person per day and the elimination of RCGL holders from harvesting southern flounder (Table 7). These reductions in total removals allow for increased escapement of spawning stock and expansion of the age structure to continue rebuilding of the stock.

Table 7. Management action taken as a result of Amendment 3 to the N.C. Southern Flounder FMP.

| MANAGEMENT STRATEGY | OUTCOME |
|---|---|
| Management measures limiting the number of fishing days per week and the amount of yardage allowed for large mesh gill nets in various areas of the state | Implemented through proclamation (refer to Amendment 1) |
| A minimum distance (area dependent) between gill net and pound net sets, per NCMFC Rule 15A NCAC 03J .0103 (d) | Implemented through proclamation (refer to Amendment 1) |
| A recreational minimum size limit of 15 inches TL | Implemented through proclamation (Refer to Amendment 1) |
| Increase minimum mesh size to harvest southern flounder to 6.0-inch stretched mesh | Implemented through Proclamation (Refer to Supplement A to Amendment 1) |
| Increase minimum size limit for commercial fisheries to 15 inches | Implemented through Proclamation (Refer to Supplement A to Amendment 1) |
| Increase minimum mesh size for escape panels to 5.75-inch stretched mesh | Implemented through Proclamation (Refer to Supplement A to Amendment 1) |
| 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 the seasons implemented. Exceptions will be allowed for commercial large mesh gill net fisheries that target American and hickory shad and catfish species if these fisheries are only allowed to operate during times of the year and locations where bycatch of southern flounder is unlikely | Implemented through Proclamation (Refer to Amendment 2) |
| Making it unlawful to possess flounder in internal and ocean waters during the closed recreational season. | Implemented through Proclamation (Refer to Amendment 2) |
| Making it unlawful to possess flounder harvested from the internal waters of the state during the closed commercial season | Implemented through Proclamation (Refer to Amendment 2) |
| Making it unlawful to use any method of retrieving live flounder from pound nets that cause injury to released fish (no picks, gigs, spears, etc.) | Implemented through Proclamation (Refer to Amendment 2) |
| Reduce commercial anchored large-mesh gill net soak times to single overnight soaks where nets may be set no sooner than one hour before sunset and must be retrieved no later than one hour after sunrise the next morning in the Neuse, Tar/Pamlico rivers and the Albemarle Sound areas that have previously been exempt | Implemented through Proclamation (Refer to Amendment 2) |
| Reduce the maximum yardage allowed in the commercial anchored large-mesh gill net fishery by 25% for each Management Unit; allowing a maximum of 1,500-yards in Management Units A, B, and C, and a maximum of 750-yards in Management Units D and E unless more restrictive yardage is specified through adaptive management through the sea turtle or sturgeon Incidental Take Permits (ITP). | Implemented through Proclamation (Refer to Amendment 2) |

| MANAGEMENT STRATEGY | OUTCOME |
|---|---|
| Reduce daily bag limit for recreational harvest of southern flounder to 1 flounder per person per day | Implemented through Proclamation (Amendment 3) |
| Implement quota for the commercial mobile gear and pound net fisheries and define management areas | Implemented through Proclamation (Refer to Amendment 3) |
| Implement recreational (hook and line, gig) seasons to constrain them to an annual quota | Implemented through Proclamation (Refer to Amendment 3) |
| Eliminate harvest of southern flounder through the use of a Recreational Commercial Gear License | Implemented through Proclamation (Refer to Amendment 3) |
| Implement trip limits for gigs and pound nets only to maximize reopening only after reaching division closure threshold | Implemented through proclamation (Refer to Amendment 3) |
| Implement a one-fish ocellated bag limit during March 1 through April 15 in ocean waters only using hook-and-ling gear | Implemented through proclamation (Refer to Amendment 3) |
| Adopt the adaptive management framework based on the peer-reviewed and approved stock assessment | Implemented through proclamation (Refer to Amendment 3) |
| The MFC approved a motion to set the allocation for Amendment 3 at 70% commercial and 30% recreational at the February 26, 2021, business meeting | Implemented through proclamation (Refer to Amendment 3) |
| Continue to allow anchored large-mesh gill nets to harvest southern flounder in the North Carolina southern flounder fishery | Implemented through proclamation (Refer to Amendment 3) |

## FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATIONS

At its May 2022 business meeting the MFC adopted Amendment 3 to the N.C. Southern Flounder FMP. Actions approved through this plan were implemented through proclamation in 2022.

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