APPENDIX 4.7. PHASING OUT ANCHORED LARGE-MESH GILL NETS IN THE NORTH CAROLINA SOUTHERN FLOUNDER FISHERY

July 21, 2021

I. ISSUE

Explore the impacts of phasing out anchored large-mesh gill nets from the North Carolina southern flounder fishery by the end of the current Incidental Take Permit (ITP) year.

II. ORIGINATION

This issue originated from a request brought forth by the North Carolina Marine Fisheries Commission (NCMFC).

III. BACKGROUND

At their March 2021 NCMFC special business meeting, the NCMFC requested the division explore the impacts of phasing out anchored large-mesh gill nets from the southern flounder fishery when the end of the current ITP. The current North Carolina ITP for the authorized incidental take of threatened and endangered sea turtles expires August 31, 2023, and the ITP authorizing incidental takes of threatened and endangered Atlantic sturgeon expires July 17, 2024 (NMFS 2013, 2014). The division is drafting an application for a new ITP to authorize incidental takes of sea turtles and Atlantic sturgeon for 10 years after the sea turtle ITP expires in 2023. If an option included in this issue paper is approved by the NCMFC, the use of anchored large-mesh gill nets could be phased out by the end of the current sea turtle ITP in August 2023. Due to the timing of the southern flounder season, 2022 may be the final year of the North Carolina southern flounder large-mesh gill net fishery if these measures are adopted by the NCMFC.

Early commercial fishermen tended to use pound nets, seines, gill nets, and spears (gigs) to harvest southern flounder in North Carolina (Chestnut and Davis 1975). Throughout the 1970s - early 1990s, pound-net gear ranked highest in the total landings of southern flounder. During the mid-1990s, gill net landings surpassed those of pound nets. Gill nets continued to maintain the highest ranking in landings until 2014, when pound nets once again moved into the top position. The third highest ranking gear for southern flounder is gigs. From 2008 to 2017, on average 53% of southern flounder landings have been from gill nets, 38% from pound nets, and 7% from gigs (Table 4 in the *Description of the Fishery* section, Figure 4.7.1). Landings from other gears accounted for on average 2% of the total landings and included crab and peeler pots, crab and shrimp trawls, rod and reel, fyke nets, and haul seines. Due in part to increased regulatory measures, landings from gill nets have declined from 68% to near 40% during this time frame.

Table 4. Annual commercial southern flounder landings in pounds by gear type, 2008–2017. Numbers in parentheses are the percent of the total landings for each gear in a given year. (Source: North Carolina Trip Ticket Program)

Year	Gill Net	Pound Net	Gigs	Other	Total
2008	1,770,204 (68%)	685,546 (26%)	82,846 (3%)	63,793 (2%)	2,602,390
2009	1,658,074 (69%)	591,534 (25%)	84,303 (4%)	62,329 (3%)	2,396,240
2010	958,271 (57%)	571,151 (34%)	128,081 (8%)	32,054 (2%)	1,689,557
2011	652,810 (52%)	464,546 (37%)	113,414 (9%)	16,680 (1%)	1,247,450
2012	879,373 (53%)	569,388 (35%)	149,387 (9%)	47,989 (3%)	1,646,137
2013	1,096,060 (50%)	924,887 (42%)	118,489 (5%)	46,955 (2%)	2,186,391
2014	659,394 (39%)	860,216 (51%)	135,273 (8%)	18,628 (1%)	1,673,511
2015	392,339 (33%)	667,847 (56%)	130,277 (11%)	12,422 (1%)	1,202,885
2016	361,570 (40%)	398,258 (44%)	126,983 (14%)	10,953 (1%)	897,765
2017	552,292 (40%)	697,814 (50%)	136,094 (10%)	8,416 (1%)	1,394,617
Average	898,039 (53%)	643,119 (38%)	120,515 (7%)	32,022 (2%)	1,693,694

*Percentages may not total 100% due to rounding.

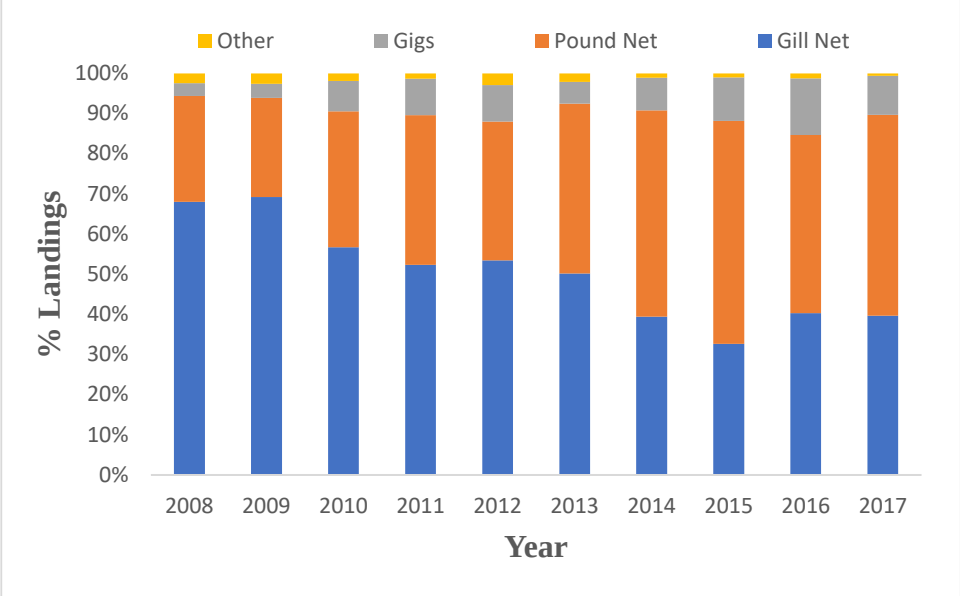

Figure 4.7.1. Percent of annual southern flounder commercial landings by gear type, 2008-2017.

Phasing out a single gear in the southern flounder fishery does not impact sustainable harvest of the southern flounder stock if a quota management system is implemented. Harvest by all gears can be allowed if the total harvest level not exceed the TAL and dead discards and harvest combined do not exceed the TAC. Phasing out anchored large-mesh gill nets would allow the sub allocation for that gear to be applied to the remaining gears in the commercial fishery. This would result in additional TAL for pound nets and/or mobile gears, but the dead discards of

southern flounder occurring through other large-mesh gill net fisheries (i.e shad, catfish) would be applied to the TAC.

North Carolina additionally allows the recreational use of commercial gears. RCGL holders may use large and small mesh gill nets as well as shrimp trawls and crab pots to harvest species including southern flounder. Between 2002 and 2008, large-mesh gill nets comprised 74% of southern flounder harvested using RCGL gears, with small mesh gill nets (21%), crab pots (4.0%), and shrimp trawls (1%) constituting the remainder among RCGL gears. The number of flounder *spp*. harvested between 2002 and 2008 ranged from 18,414 to 53,785 fish annually (Figure 4.7.2).

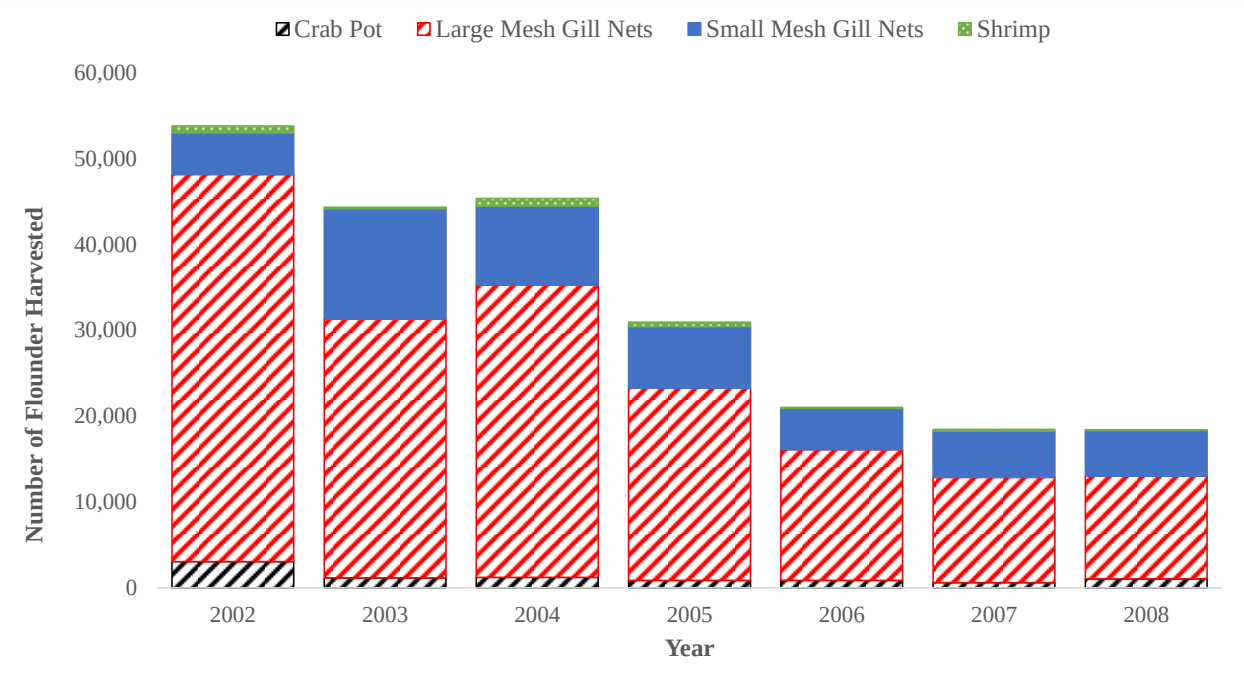

Figure 4.7.2. Number of flounder *spp*. harvested by RCGL gear type, 2002-2008.

Estimates of RCGL harvest have not been available since 2008 and thus impacts are not quantifiable. If phasing out of the large-mesh gill net commercial fishery is not approved, the use of RCGL gill nets to harvest southern flounder may still be disallowed through Amendment 3 under sustainable harvest. For more information on RCGL and southern flounder see the *Description of the Fisheries* section and the *Sustainable Harvest in the North Carolina Southern Flounder Fishery* issue paper.

IV. AUTHORITY

North Carolina General Statutes
§ 113-134 RULES
§ 113-173 RECREATIONAL COMMERCIAL GEAR LICENSE
§ 113-182 REGULATION OF FISHING AND FISHERIES
§ 113-182.1 FISHERY MANAGEMENT PLANS

§ 143B-289.52 MARINE FISHERIES COMMISSION – POWERS AND DUTIES

North Carolina Marine Fisheries Commission Rules
15A NCAC 03H .0103 PROCLAMATIONS, GENERAL
15A NCAC 03M .0503 FLOUNDER
15A NCAC 03O. 0302 AUTHORIZED GEAR

V. DISCUSSION

At the March 2021 special meeting, the NCMFC requested that the division evaluate the potential to phase out the use of large-mesh gill nets in the southern flounder fishery by the end of the current ITP during development of Amendment 3. The possible elimination of specific gears (i.e., anchored large-mesh gill nets) for harvesting southern flounder for either the commercial or recreational fishery is statutorily granted to the NCMFC by G.S. 143B-289.52. The division provides the best available data for a fishery (gear) to meet the mandate for producing a sustainable harvest of the southern flounder stock and to evaluate impacts to habitat.

Large-mesh gill nets are regulated by NCDMF through proclamation authority provided by the NCMFC to the Division Director. Phasing out large-mesh gill nets in the southern flounder fishery would be accomplished using this authority by prohibiting the use of large-mesh gill nets for harvesting southern flounder. This would impact RCGL holders as well since large-mesh gill nets would not be an allowable gear to harvest southern flounder. Regulations involving the RCGL are found in G.S. 113-173 and NCMFC Rule 15A NCAC 03O.0302 that authorize certain commercial fishing gear for recreational use. A rule change(s) by the NCMFC is required to completely prevent a specific gear from being used across all fisheries in the state by commercial and RCGL license holders. Additional information on the RCGL can be found in the *Description of the Fisheries* section *and Achieving Sustainable Harvest in the North Carolina Southern Flounder* issue paper.

Southern Flounder Large-Mesh Gill Net Fishery
During 2008-2017, an annual average of 808 participants (range: 591- 992) reported southern flounder landings from gill nets. These participants landed southern flounder from 14,643 trips on average from 2008-2017, though not all trips that landed southern flounder were targeting them (Figure 4.7.3). The number of trips landings southern flounder has declined from a high of 23,691 trips in 2009 to a low of 8,422 trips in 2016 (Table 5 in the *Description of the Fishery* section)

Table 5 Annual trips, average landings per trip (APT), and number of participants (#PAR) by gear type in the commercial southern flounder fishery, 2008–2017. (Source: North Carolina Trip Ticket Program)

Year	Trips[1] / APT / #PAR[2]	Gill Net Trips/ APT/ #PAR	Pound Net Trips / APT / #PAR	Gig Trips / APT / #PAR	Other Trips / APT / #PAR
2008	28,966 / 90 / 1,235	23,493/ 75 / 924	1,508 / 455 / 83	1,459 / 57 / 140	2,510 / 25 / 413
2009	29,395 / 82 / 1,299	23,691 / 70 / 992	1,746 / 339 / 85	1,450 / 58 / 143	2,510 / 25 / 426
2010	20,408 / 83 / 1,182	15,134 / 63 / 837	1,610 / 355 / 84	2,283 / 56 / 226	1,384 / 23 / 329
2011	15,810 / 79 / 1,039	11,403 / 57 / 759	1,370 / 339 / 63	2,076 / 55 / 212	963 / 17 / 250
2012	20,926 / 79 / 1,202	14,713 / 60 / 855	1,754 / 325 / 84	3,000 / 50 / 288	1,462 / 33 / 291
2013	23,579 / 93/ 1,286	16,968 / 65 / 933	2,111 / 438 / 82	2,408 / 49 / 270	2,094 / 22 / 343
2014	18,121 / 92 / 1,222	11,778 / 56 / 799	1,806 / 476 / 88	2,655 / 51 / 316	1,887 / 10 / 373
2015	13,880 / 87 / 1,029	8,465 / 46 / 674	1,803 / 370 / 81	2,616 / 50 / 307	1,002 / 12 / 249
2016	13,336 / 67 / 945	8,422 / 43 / 591	1,423 / 280 / 77	2,657 / 48 / 323	838 / 13 / 227
2017	17,963 / 78 / 1,048	12,363 / 45 / 713	1,908 / 366 / 88	2,752 / 49 / 310	943 / 9 / 237
Average	20,238 / 84 / 1,149	14,643 / 61 / 808	1,704 / 377/ 82	2,336 / 52 / 254	1,559 / 21 / 314

[1] The number of trips, average landings per trip, and number of participants are from all trips that recorded southern flounder across all gear types including pound nets, gill nets, gigs, and other.
[2] The annual number of participants cannot be summed by gear as many individuals fish multiple gears per trip.

In order to characterize common species caught in the southern flounder gill net fishery, a targeted southern flounder trip reported to the NCTTP was defined as any large-mesh gill net trip where southern flounder represented the most abundant species (by weight). This definition accounted for greater than 93% of all southern flounder landings from large-mesh gill nets from 2013 to 2017. Generally, trips targeting southern flounder increased through the summer and peak in the fall (September and October) coinciding with the migration of southern flounder from the estuaries to the ocean prior to spawning as shown in Figure 4.7.3. During the remainder of the year, southern flounder were harvested in gill nets as part of other directed fisheries but were most commonly taken as part of a mixed finfish fishery. From 2013 to 2017, 73% of the large-mesh gill net trips landed southern flounder and 54% met the definition of a targeted trip for southern flounder. From June through October, greater than 75% of all trips made were

targeted flounder trips. Only during December (closed season) and January through April, were directed southern flounder trips not the dominate trip type in the large-mesh gill net fishery. Trips during these months tend to be dominated by catches of catfishes, striped bass, and American shad, among other species.

Both finfish and shellfish species may be caught as bycatch in gill net trips targeting southern flounder. This bycatch may be retained or discarded as a result of economic, regulatory, or personal considerations. While southern flounder dominates the catch, the estuarine gill net fishery represents a mixed fishery with multiple species being taken on any given trip. Species include red drum, black drum, catfish species (including invasive blue catfish), sheepshead, spotted seatrout, American and hickory shad, striped bass, bluefish, striped mullet, and an additional 40+ species (Figure 4.7.4). Phasing out anchored large-mesh gill nets would impact the harvest of these other species as well. In addition, continuing to set large-mesh gill nets in areas where southern flounder are present could have an impact on rebuilding the stock as the species would be required to be discarded. Southern flounder caught in gill nets have an initial at net mortality associated with entanglement and an approximate 23% post-release mortality (Flowers et al. 2019).

Protected Species and Incidental Take Permits

Since the 1970s, the NCDMF has been proactive in developing ways to minimize impacts to threatened and endangered marine species. The NCDMF works closely with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and other state and federal agencies to develop regulations that minimize impacts to protected species and still allow for economically important fisheries. Of the many federal and state protected species, sea turtles and sturgeon are considered to have the greatest potential to interact with the North Carolina southern flounder fishery. Gill nets may capture protected species as a result of entanglement in the webbing or buoy and anchor lines.

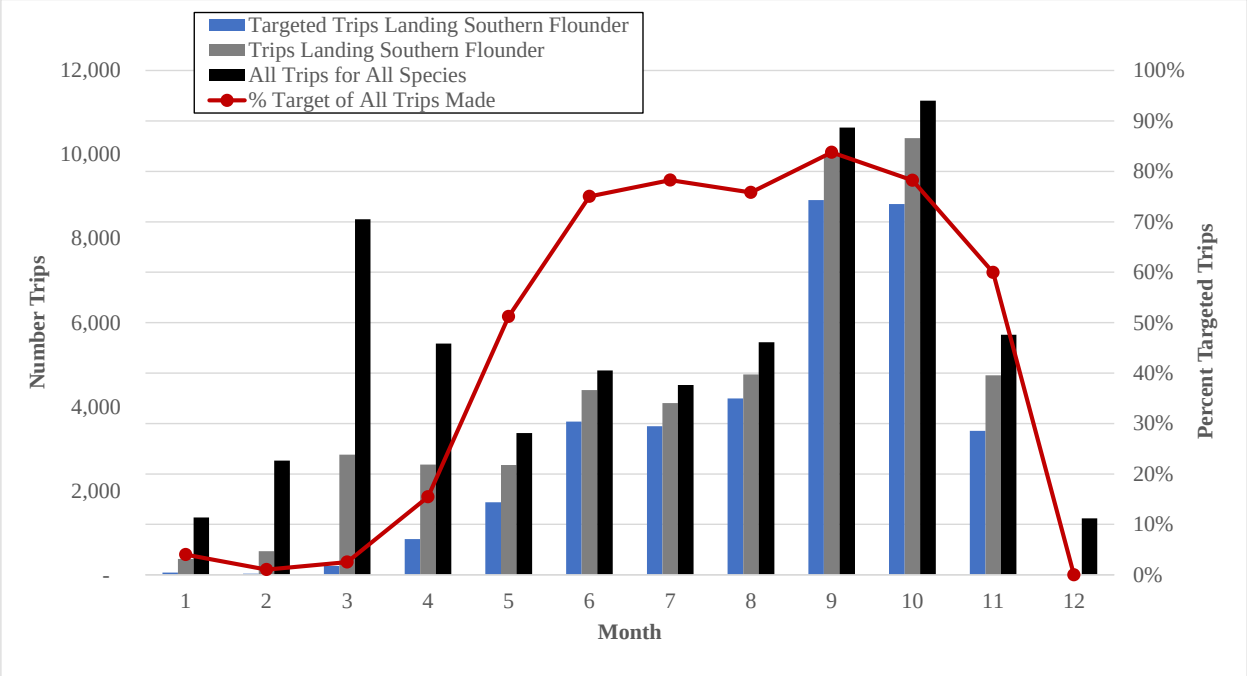

Figure **4.7.3**. Total gill net trips compared to gill net trips targeting or landing southern flounder.

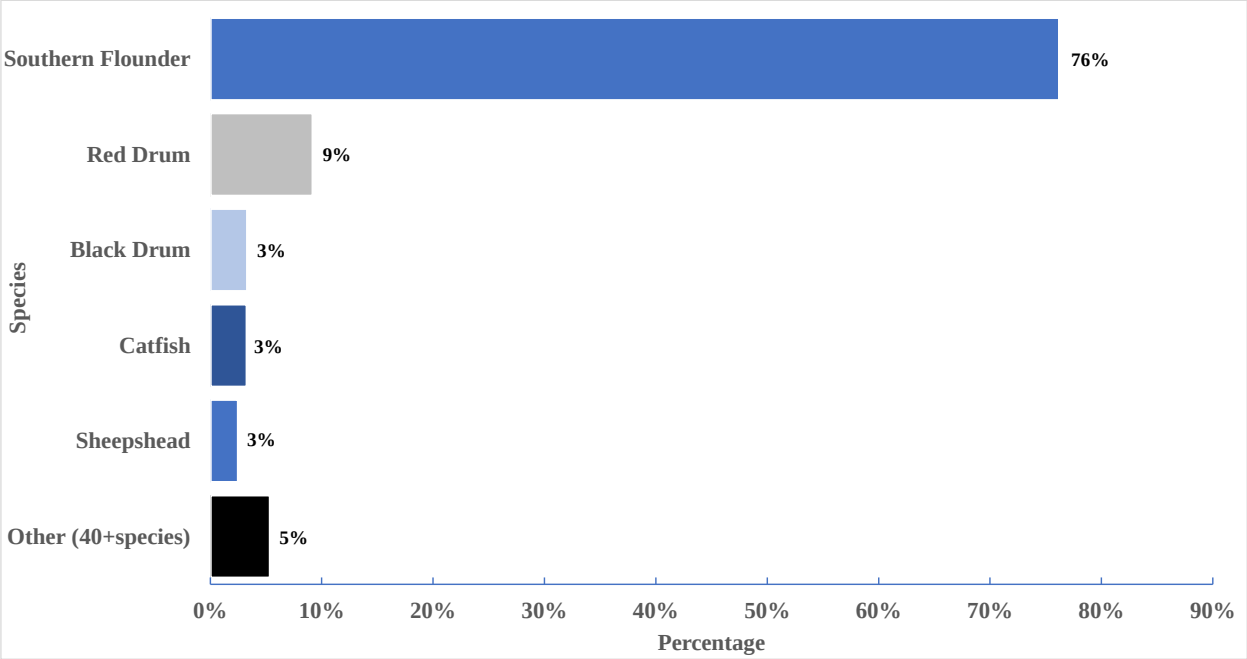

Figure 4.7.4. Top species harvested from anchored large-mesh gill nets where southern flounder are the most abundant species, 2013-2017.

Incidental capture of protected sea turtles and Atlantic sturgeon commonly occurs in the southern flounder gill net fishery. The fishery has undergone various regulations since the early 2000s to monitor and minimize impacts to protected sea turtles. The NCDMF currently allows the estuarine anchored gill net fishery to operate under the authorization from permits (ITP; Section 10(a)(1)(B) of the ESA) granted to the state by NOAA Fisheries for the incidental take of sea

turtles and Atlantic sturgeon associated with otherwise lawful commercial gill net fishery in North Carolina inshore state waters (NMFS 2013, 2014). The permits outline authorized levels of annual incidental takes in these fisheries. The state as permit holder must monitor, minimize, and mitigate incidental takes as set forth in the conservation plan provided in the permit. The permits are in effect for a 10-year period: the sea turtle permit was issued in September 2013 and the Atlantic sturgeon permit was issued in July 2014. Since September 2014 (2015 license year), the division has been issuing estuarine gill net permits to any commercial fisherman or RCGL holder who wants to fish anchored gill nets (https://files.nc.gov/ncdeq/Marine-Fisheries/fisheries-management-proclamations/2014/M-24-2014-EGNP.pdf). During 2016-2021, an average of 2,619 permits were issued annually (Table 3 in the *Description of the Fishery* section). These permits provide the division with the number of participants who may choose to participate in the gill net fishery using large-mesh or small-mesh gill nets. Not all commercial license holders who obtain an estuarine gill net permit report flounder landings using the gear. For information specific to the North Carolina Incidental Take Permit for sea turtle interactions in the estuarine gill net fishery see: https://www.federalregister.gov/documents/2013/09/17/2013-22592/endangered-species-file-no-16230. For specific details related to the Atlantic sturgeon incidental take permit see: https://www.federalregister.gov/documents/2014/07/28/2014-17645/endangered-species-file-no-18102.

Table 3. Number of commercial and recreational commercial gear license estuarine gill net permits by license year (July 1 to June 30). (Source: Fisheries Information Network)

License Year (July 1 - June 30)	Permits Issued RCGL	Permits Issued SCFL/RSCFL	Permits Issued Total
2016	597	2,314	2,911
2017	457	2,221	2,678
2018	458	2,258	2,716
2019	370	2,162	2,532
2020	331	2,128	2,459
2021	368	2,048	2,416
Average	430	2,189	2,619

Habitat Impacts

Phasing out anchored large-mesh gill nets in the southern flounder fishery would not offer significant habitat protections. Studies on the effect of anchored (or fixed) gill nets on habitat degradation indicate their impact is minor for softbottom and SAV habitat (Barnette 2001; West et al. 1994; ASMFC 2000).

Economic Impacts

Economic impacts of phasing out the anchored large-mesh gill net fishery for southern flounder would be negative to all commercial license holders who participate in the fishery. The landings could be transferred to the pound net or other mobile gear fisheries, increasing the economic benefits of those gears. The economic impacts may include up to 808 participants on average in

the gill net fishery but the participants may choose to enter the gig and or pound net fishery if they do not already participate in them (Table 5 in the *Description of the Fishery* section). This could alter the average ex-vessel dockside value of $4,476,342 from the southern flounder commercial fishery by moving the gill net values to another gear category where price per pound may be higher on average (Table 8 in the *Description of the Fishery* section). Over the last 10 years, the gill net fishery has accounted for a total of $22,293,673.52 of ex-vessel value from the southern flounder fishery (Table 4.7.1). If large-mesh gill nets are no longer allowed to harvest southern flounder these values may shift to another gear. These effects are a guide as some license holders participate in multiple fisheries.

In terms of evaluating the economic impact of removing all inshore large-mesh gill nets from North Carolina, traditional methods of quantifying this change would not be adequate. Specifically, a change of this magnitude would no longer result in marginal shifts in landings from specific fisheries in the state. Rather, this regulation would likely lead to large-scale behavioral adjustments from a range of stakeholders in the seafood supply chain, causing market shifts, changes in spending and employment, and an overall reorganizing of the state's inshore fisheries. While there would likely be large benefits in certain facets, such as stock health and recreational access, the costs associated with restructuring part of the state's inshore fishing fleet are nearly impossible to predict and go beyond traditional economic impact assessments.

Table 8. Economic impacts associated with commercial southern flounder fishing in North Carolina from 2008–2017. Data below represent the actual effort data from southern flounder harvest, along with the estimated economic impacts to North Carolina using IMPLAN statistical software. Data from the 2016 NOAA Fisheries Economics of the U.S. report, along with internal division survey data, are also used to generate estimates. Note: impact estimates across categories are not additive.

Year	Pounds Landed	Ex-vessel Value	Participants	Estimated Sales Impact	Estimated Income Impacts	Estimated Employment Impact	Estimated Value Added Impact
2008	2,602,390	$5,650,295	1,235	$25,473,137	$10,483,954	1,544	$19,654,727
2009	2,396,240	$4,609,932	1,299	$20,547,716	$8,550,927	1,545	$16,161,407
2010	1,689,557	$3,695,889	1,182	$15,743,327	$6,531,811	1,380	$12,223,365
2011	1,247,450	$2,753,128	1,039	$11,771,643	$4,884,958	1,186	$9,140,235
2012	1,646,137	$4,451,482	1,202	$18,795,084	$7,827,308	1,440	$14,613,360
2013	2,186,391	$5,673,190	1,286	$23,172,478	$9,654,261	1,591	$17,977,144
2014	1,673,511	$4,839,672	1,222	$19,547,618	$8,134,986	1,482	$15,109,459
2015	1,202,885	$3,823,567	1,029	$15,852,258	$6,621,987	1,235	$12,379,619
2016	897,765	$3,610,533	945	$10,724,064	$6,301,409	1,129	$11,716,727
2017	1,394,617	$5,655,751	1,048	$20,489,984	$9,494,322	1,335	$17,676,161
Average	1,693,694	$4,476,342	1,149	$18,211,731	$7,848,592	1,387	$14,665,220

Table 4.7.1. Ex-vessel values for gigs, gill nets, pound nets, and other gear from the North Carolina southern flounder fishery, 2008-2017.

	Gear				
Year	**Gigs**	**Gill Net**	**Other**	**Pound Net**	**Total**
2008	$173,360.40	$3,798,463.23	$132,612.99	$1,545,858.19	$5,650,294.81
2009	$159,031.29	$3,160,714.37	$116,727.33	$1,173,458.93	$4,609,931.91
2010	$267,481.76	$2,067,067.19	$66,800.66	$1,294,539.05	$3,695,888.65
2011	$256,846.25	$1,397,565.13	$34,239.01	$1,064,477.33	$2,753,127.72
2012	$388,313.40	$2,343,199.01	$126,800.50	$1,593,169.23	$4,451,482.14
2013	$320,379.72	$2,742,686.75	$114,816.10	$2,495,307.19	$5,673,189.76
2014	$414,205.88	$1,884,626.34	$53,262.79	$2,487,576.97	$4,839,671.98
2015	$417,188.88	$1,235,835.53	$38,535.39	$2,132,006.71	$3,823,566.52
2016	$506,533.39	$1,442,921.16	$42,422.91	$1,618,655.33	$3,610,532.80
2017	$547,308.32	$2,220,594.81	$32,975.26	$2,854,872.71	$5,655,751.10
Total	**$3,450,649.29**	**$22,293,673.52**	**$759,192.93**	**$18,259,921.64**	**$44,763,437.39**

Impacts to the stock due to changes in gill net regulations can be difficult to quantify due to many factors including behavior shifts in the fishery participants. Luczkovich et al. 2021 developed a pair of socio-ecological model scenarios that showed differing impacts based on no additional effort using alternative gears and increasing effort using alternative gears in Core Sound, NC. If effort using alternative gears was not increased the model predicted increases to the stock size, but if effort using alternative gears did increase the model predicted reductions to the stock size, depending on the behavior changes within the industry (Luczkovich et al. 2021). This study showed a species response to management actions can be contrary to management goals. That is, prohibiting the use of gill nets may alter the behavior of fishermen and make them use alternate gears with higher impacts on the target species or the ecosystem as a whole (Luczkovich et al. 2021).

VI. PROPOSED MANAGEMENT OPTIONS

Option 1. Phase out anchored large-mesh gill nets from the southern flounder fishery at the end of the current sea turtle ITP.

+ Would allow for increased harvest from other commercial gears
+ Would increase protections of threatened and endangered species
+ May increase the economic impact of the remaining gears
+ May reduce user conflict
+ May reduce costs associated with the large mesh observer program or allow increased coverage for other gears
+/- Gear elimination not based on sustainable harvest
+/- Would require adjusting the sub-allocations for the commercial fishery
+/- Would impact harvest of non-target species

- Would eliminate a historical gear from the southern flounder fishery
- Would impact the largest group by number of trips and participants in the commercial fishery
- Gill nets would still be allowed for other species so discards of southern flounder may still occur
- Would decrease the economic benefit of the commercial gill net fishery
- Some regions may be impacted more than others

Option 2. Status Quo, continue to allow anchored large-mesh gill nets to harvest southern flounder in the North Carolina southern flounder fishery.

+ Continued use of large-mesh gill net fishery to harvest southern flounder
+ Maintain economic impacts of the large-mesh gill net fishery
+ Less impacts to the largest user group in numbers and trips
+/- Continued harvest of non-target species
+/- Less impacts to sub-allocations
- Continued impacts to threatened and endangered species
- May not allow for increased harvest of other gears

VII. NCMFC SELECTED MANAGEMENT STRATEGY

VIII. LITERATURE CITED

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APPENDIX 4.7. SUGGESTED STATUTORY CHANGES

No statutory changes suggested at this time. This may change based on what the NCMFC approves at final adoption.