Additional Management Options for
Achieving Sustainable Harvest of Southern Flounder
Revised

Issue

Updated management options for achieving sustainable harvest for the commercial southern flounder fishery

Background

The North Carolina Marine Fisheries Commission (NCMFC) approved Draft Amendment 1 to the North Carolina Southern Flounder Fishery Management Plan (FMP) to send to the Secretary of the North Carolina Department of Environment and Natural Resources (NCDENR) and the Joint Legislative Commission on Seafood and Aquaculture (JLCSA) for review on November 4, 2010. As stated in the Draft Amendment 1, reductions in the overall harvest of southern flounder based on 2007 landings are necessary in order to achieve sustainable harvest. The NCMFC preferred management strategy for achieving sustainable harvest in the commercial fishery was to allow the large mesh gill net management measures from the sea turtle lawsuit settlement agreement (settlement agreement) implemented by Proclamation M-8-2010 on May 15, 2010 to provide the required harvest reduction (as well as maintain the minimum mesh size of 5.5-inch stretched mesh for large mesh gill nets from April 15 to December 15 as provided in Issue 10.10). These measures were expected to be in place for the foreseeable future and result in an overall commercial harvest reduction of 22.2% based on 2007 commercial landings. The preferred management strategy for the recreational fishery was a statewide minimum size limit of 15 inches and a six-fish creel limit, which results in an overall recreational harvest reduction of 20.2%, based on 2007 recreational landings. Supplement A to the Southern Flounder FMP implemented the 15-inch minimum size limit and six-fish creel limit for the recreational fishery on February 21, 2011. However, large mesh gill net management measures have changed as the settlement agreement evolved through time and was implemented by several proclamations:

M-8-2010 May 15, 2010:	With the exception of western Albemarle and Currituck sounds, this proclamation limited the use of large mesh gill nets (4-6½-inch stretched mesh) to four nights per week, Monday through Thursday. It also limited the height of those gill nets to 15 meshes, required leaded bottom lines, and prohibited floats (except those used for identification) north of the Highway 58 Bridge. It also reduced the amount of gill net yardage allowed to 2,000 yards north of the Highway 58 Bridge and 1,000 yards south of it, and required 25-yard spaces between no more than 100-yard sections of gill net.
M-2-2011 January 20, 2011:	In order to have a shad harvest season, Albemarle Sound Management Area (ASMA), Pamlico Sound and its tributaries (including Pamlico, Pungo, Bay and Neuse rivers) and the Cape Fear River were exempted from the four-day fishing week, the mesh height, lead line and float requirements, and the 100-yard continuous length limit. These exemptions were in place until March 28, 2011.

M-27-2011 September 12, 2011:	Large mesh gill net restrictions were no longer required in Albemarle, Croatan and Roanoke sounds north and west of Highway 64/264 bridges as well as Pamlico, Bay and Neuse rivers.
M-30-2011 September 18, 2011:	An extra day (Monday) was allowed for setting large mesh gill nets south of Beaufort Inlet.
M-6-2012 February 2, 2012:	In order to have a shad harvest season, the ASMA, Pamlico Sound and its tributaries (including Pamlico, Pungo, Bay and Neuse rivers), upper New River and the Cape Fear River were exempted from the four-day fishing week, the mesh height, lead line and float requirements, and the 100-yard continuous length limit. These exemptions were in place until March 28, 2012.
M-23-2012 May 20, 2012:	Southern Core Sound (D1) was closed to large mesh gill nets and the 2,000-yard maximum length restriction was reduced to 1,000 yards from Beaufort to the Highway 58 Bridge.

Proclamations M-27-2011 and M-30-2011 exempted additional areas from the gill net management measures, and allowed an extra fishing day in the southern part of the coast. Proclamations M-2-2011 and M-6-2012 allowed for seasonal exemptions for the prosecution of the shad fishery. In May of 2012, Proclamation M-23-2012 closed southern Core Sound to the use of large mesh gill nets and the maximum allowable yardage of large mesh gill nets from Beaufort to the Highway 58 Bridge was decreased from 2,000 to 1,000 yards. These changes in gill net management make current management inconsistent with Draft Amendment 1 as approved by the NCMFC as *status quo* (large mesh gill net management measures implemented by Proclamation M-8-2010). It was considered *status quo* because at the time of approval, Proclamation M-8-2010 was in place.

Also occurring since the NCMFC approval of Amendment 1 was the declaration of Atlantic sturgeon as endangered, under the federal Endangered Species Act of 1973 (ESA) in April, 2012. Albemarle, Croatan and Roanoke sounds, along with the Pamlico, Bay and Neuse rivers were exempted from the sea turtle lawsuit settlement agreement restrictions by Proclamation M-27-2011, but those areas represent the locations where Atlantic sturgeon interactions are most likely to occur. River herring and American eel are also being considered for ESA listing by National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service and if listed, may well require additional fishery management considerations.

The North Carolina Division of Marine Fisheries (NCDMF) has applied for incidental take permits for the North Carolina estuarine gill net fishery for both sea turtles and Atlantic sturgeon. It is uncertain whether NMFS will grant these permits to NCDMF and if granted, what additional restrictions these permits may have on the commercial southern flounder fishery. Any future management changes to estuarine gill nets enacted to reduce protected species interactions are likely to impact commercial harvest and effort to some extent. Previously these uncertainties were the reason draft Amendment 1 was not sent to the NCDENR secretary and the Joint Legislative Commission on Governmental Operations, which has replaced the JLCSA.

With Draft Amendment 1 on hold since 2010, the NCDMF Southern Flounder Plan Development Team (PDT) met June 1, 2012 to discuss a process for completing draft Amendment 1 with the

purpose to finalize management measures for achieving sustainable harvest of the southern flounder stock. The PDT decided that an update to the "Achieving Sustainable Harvest" issue paper (Issue 10.1) in Draft Amendment 1 was necessary to document the changes that have occurred since the NCMFC's last action and to provide information to support the contention that effort has measurably decreased and may be adequate to meet the required reductions for sustainable harvest since the implementation of Proclamation M-8-2010 and those proclamations that followed. This paper only addresses the commercial sector of the fishery and does not address the recreational sector since management measures for the required reductions in that fishery were implemented via Proclamation FF-29-2011, effective February 21, 2011 as part of Supplement A to the Southern Flounder FMP. This paper provides additional information not available in the original issue paper and does not include discussion of management options already discussed in that paper. Please refer to the original issue paper for other management options.

Authority

G.S. 113-134. RULES
G.S. 113-182. REGULATION OF FISHING AND FISHERIES
G.S. 143B-289.52. MARINE FISHERIES COMMISSION—POWERS AND DUTIES
N.C. Marine Fisheries Commission Rules 2011 (15A NCAC)
15A NCAC 03M .0503 FLOUNDER

Discussion

The 2005 Southern Flounder FMP started the clock for a required rebuilding schedule of 10 years from the start date of adoption of that plan to achieve sustainable harvest. The 2009 N.C. Southern Flounder Stock Assessment indicated the stock remains overfished and overfishing is occurring (Takade-Heumacher and Batsavage 2009). Another stock assessment will need to be conducted to determine whether or not sustainable harvest is being achieved. The management strategy to achieve sustainable harvest in Draft Amendment 1 was to rely on Proclamation M-8-2010 to achieve the necessary harvest reductions. Continued management in the form of effort reduction to reduce sea turtle interactions in different areas (Figure 1) and Atlantic sturgeon interactions will very likely reduce effort and southern flounder landings in the gill net fishery.

Gill net effort decreased considerably after the implementation of Proclamation M-8-2010 based on gill net effort comparisons pre- versus post-settlement agreement (May 2010). It is important to note that M-8-2010 and all subsequent proclamations only applied to passive large mesh gill nets or set nets. Compared to the period from May-December 2009, 2010 effort for the same period decreased 51% (Table 1). This held true for the January-April 2011 period (post-M-8-2010) compared to January-April 2010 (pre-M-8-2010); during this time frame there was a 55% reduction in estuarine gill net effort (Table 2). Overall, for 2011 (first complete year with settlement agreement restrictions) there was a 48% reduction in effort compared to 2009 (the last full year before M-8-2010 went into effect) and a 55% reduction in effort compared to 2007 (Table 3).

Although changes in large mesh gill net management have occurred since December 2010, effort remains low in the estuarine passive gill net fishery (Table 4). Effort for 2011 decreased by 40% from 2009 and by 42% from 2007 levels.

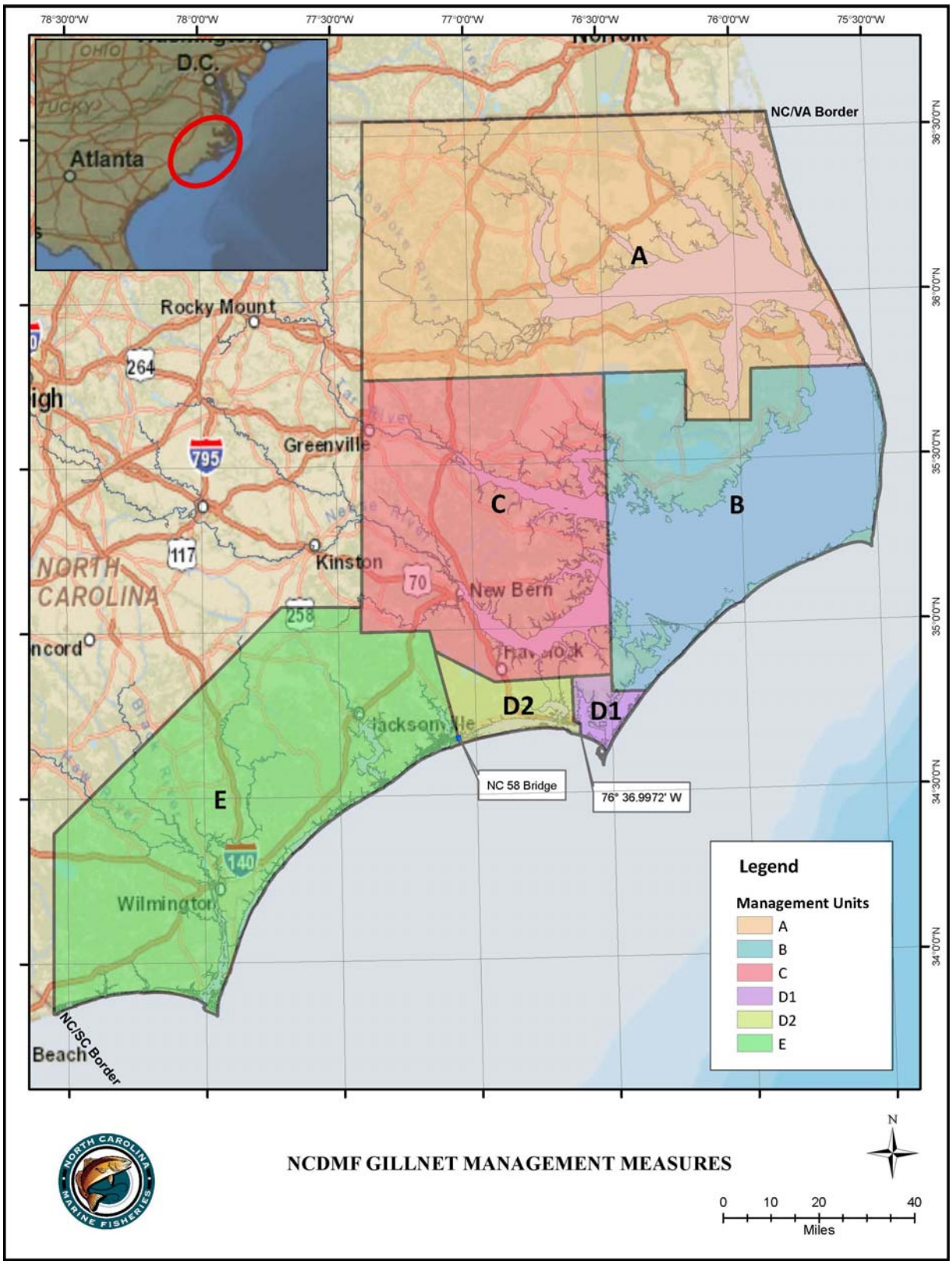

Figure 1. NCDMF Sea Turtle Management Areas

Table 1. Set gill net yardage comparison (thousands of yards) and percent change (total yards) from previous year and from 2007 by sea turtle management area May-December, 2007-2011.

Year	Area	Large Mesh Yards (4-6.5 ISM)	Yards/day	% Change from Previous Year	% Change from 2007
2007	Overall	27,637	115	-	-
	A	11,180			
	B	5,671			
	C	2,870			
	D1	5,623			
	D2	513			
	E	1,780			
2008	Overall	32,489	135	18	18
	A	13,561			
	B	6,446			
	C	2,249			
	D1	7,986			
	D2	530			
	E	1,718			
2009	Overall	31,343	130	-4	13
	A	13,446			
	B	5,955			
	C	2,912			
	D1	6,006			
	D2	737			
	E	2,286			
2010	*Overall*	*15,513*	*64*	*-51*	*-44*
	A	*5,662*			
	B	*5,392*			
	C	*1,253*			
	D1	*2,189*			
	D2	*304*			
	E	*714*			
2011	*Overall*	*12,463*	*52*	*-20*	*-55*
	A	*1,929*			
	B	*4,897*			
	C	*1,578*			
	D1	*2,762*			
	D2	*483*			
	E	*814*			

- *Italics indicate periods after Proclamation M-8-2010*

Table 2. Set gill net yardage comparison (thousands of yards) and percent change (total yards) from previous year and from 2007 by sea turtle management area January-April, 2007-2011.

Year	Area	Large Mesh Yards (4-6.5 ISM)	Yards/day	% Change from Previous Year	% Change from 2007
2007	Overall	7,808	63	-	-
	A	4,947			
	B	943			
	C	1,306			
	D1	310			
	D2	51			
	E	250			
2008	Overall	6,509	52	-17	-17
	A	3,335			
	B	1,351			
	C	1,050			
	D1	588			
	D2	30			
	E	155			
2009	Overall	4,776	39	-27	-39
	A	2,537			
	B	734			
	C	1,019			
	D1	248			
	D2	32			
	E	205			
2010	Overall	7,659	62	60	-2
	A	5,070			
	B	1,163			
	C	766			
	D1	448			
	D2	47			
	E	166			
2011	*Overall*	*3,477*	*28*	*-55*	*-55*
	A	*2,383*			
	B	*406*			
	C	*457*			
	D1	*110*			
	D2	*11*			
	E	*110*			

- *Italics indicate period after Proclamation M-8-2010*

Table 3. Set gill net yardage comparison (thousands of yards) and percent change (total yards) from previous year and from 2007 by sea turtle management area, January-December, 2007-2011.

Year	Area	Large Mesh Yards (4-6.5 ISM)	Yards/day	% Change from Previous Year	% Change from 2007
2007	Overall	35,445	97		
	A	16,127			
	B	6,614			
	C	4,177			
	D1	5,932			
	D2	565			
	E	2,031			
2008	Overall	38,998	107	10	10
	A	16,896			
	B	7,797			
	C	3,299			
	D1	8,574			
	D2	560			
	E	1,873			
2009	Overall	36,119	99	-7	2
	A	15,984			
	B	6,689			
	C	3,931			
	D1	6,255			
	D2	769			
	E	2,491			
2010	Overall	23,173	63	-36	-35
	A	10,731			
	B	6,555			
	C	2,019			
	D1	2,637			
	D2	351			
	E	880			
2011	*Overall*	*15,941*	*44*	*-31*	*-55*
	A	*4,312*			
	B	*5,303*			
	C	*2,035*			
	D1	*2,873*			
	D2	*494*			
	E	*924*			

- *Italics indicate first complete year after Proclamation M-8-2010*

Table 4. Set gill net trips comparison and percent change by sea turtle management area, January-December, 2007-2011.

Year	Area	Large Mesh Gill Net Trips (4-6.5 ISM)	Trips/day	% Change from Previous Year	% Change from 2007
2007	Overall	24,750	68		
	A	10,828			
	B	4,756			
	C	4,104			
	D1	2,739			
	D2	507			
	E	1,816			
2008	Overall	25,919	71	5	5
	A	11,474			
	B	5,359			
	C	3,102			
	D1	3,841			
	D2	502			
	E	1,641			
2009	Overall	24,166	66	-7	-2
	A	10,173			
	B	4,571			
	C	3,809			
	D1	2,785			
	D2	681			
	E	2,147			
2010	Overall	19,062	52	-21	-23
	A	9,017			
	B	4,980			
	C	2,078			
	D1	1,527			
	D2	345			
	E	1,115			
2011	*Overall*	*14,422*	*40*	*-24*	*-42*
	A	*4,725*			
	B	*4,053*			
	C	*2,230*			
	D1	*1,693*			
	D2	*520*			
	E	*1,201*			

- *Italics indicate first complete year after Proclamation M-8-2010*

Based on this, it is assumed that the implementation of Proclamation M-8-2010 and subsequent proclamations have resulted in a substantial reduction in effort and harvest in the set gill net fishery. Although changes in large mesh gill net management have occurred since December 2010, effort remains low overall in the estuarine gill net fishery (Table 5). Overall, gill net landings have decreased by 55% with the number of trips showing a decrease by 50% since 2007. Since 2009, the year before the settlement agreement was implemented, a 61% decrease in landings and a 52% decrease in effort (trips) have occurred. As the NCDMF becomes more proactive in the protection of endangered species through management of estuarine gill nets, effort is expected to remain low.

Table 5. Landings in pounds, number of vessels and number of trips by estuarine gill nets, 2007-2011.

Year	Estuarine Gill Nets		
	pounds	vessel	trips
2007	1,454,393	1,084	22,609
2008	1,770,204	1,034	23,493
2009	1,657,962	1,105	23,690
2010	958,271	929	15,134
2011	653,687	828	11,414

It should be noted that landings for two other major commercial gears, pound nets and gigs, were similar between 2007 and 2011 (Table 6). This provides support that the settlement agreement regulations were largely responsible for the reductions in landings from estuarine gill nets and not simply a reflection of a decline in the availability of southern flounder in 2011.

One thing to consider when addressing sustainable harvest in the commercial southern flounder fishery is a potential increase in fishing effort in the pound net and gig fisheries that might cause recoupment of any potential reductions in the set gill net fishery. The NCDMF has observed a 13% increase in gig landings and 12% increase in the number of gigging trips since 2007. The number of vessels fishing with gigs rose by 23% (Table 6). Since 2009, gig landings have increased by 34% with effort in number of trips increasing by 43%. However, gigs continue to be a minor contributor to the overall southern flounder harvest, accounting for 8% and 9% of the annual harvest in 2010 and 2011, respectively. In 2007, gigs accounted for approximately 5% of the total harvest.

Pound net landings decreased slightly from 2007 by 4% with effort in number of trips decreasing only by 10% (Table 6). Since 2009, landings by pound nets have decreased by 22% with effort down by 23% (Table 6). Landings from gears other than gill nets, pound nets and gigs and the number of trips have decreased by 59% and 60%, respectively. Since 2009, other gears have shown a 73% decrease along with 62% decrease in the number of trips (Table 6).

Table 6. Landings, pounds and number of trips for gigs, pound nets and other gears 2007-2011.

Year	Gigs			Pound Nets			Other*		
	pounds	vessel	trips	pounds	vessel	trips	pounds	vessel	trips
2007	100,063	185	1,854	482,927	99	1,502	40,415	428	2,416
2008	82,846	160	1,459	685,546	93	1,508	63,793	445	2,510
2009	84,303	163	1,450	591,534	102	1,746	62,329	438	2,510
2010	128,081	248	2,283	571,151	95	1,610	32,054	349	1,384
2011	113,261	228	2,073	463,542	71	1,349	16,680	255	963

*All other fishing gears

Table 7. Commercial landings of southern flounder regardless of gear and percent change from 2007 harvest levels.

	Commercial Landings	
Year	Pounds	% Change from 2007
2007	2,082,996	-
2008	2,602,020	25
2009	2,395,384	15
2010	1,689,493	-19
2011	1,247,170	-40

Overall, landings decreased by 40% for 2011 compared to 2007. Compared to 2009 (the last year prior to Proclamation M-8-2010), 2011 landings decreased by 48% (Table 7).

Other more qualitative factors may be playing a role in decreasing fishing effort as a result of the settlement agreement. The settlement agreement limits soak times for unattended large mesh gill nets from one hour before sunset to one hour after sunrise. This further decreases effort and likely results in a lower discard mortality. Fishermen must stay closer to home because of the night time set requirements and the need to remove nets no later than one hour after sunrise. These overnight sets also require twice the travel with one run setting the net and the other run fishing the net. This increases the time and cost needed for the fishermen to participate in this fishery. In areas with higher tidal amplitudes, low tides at sunset and sunrise can prevent gill netters from setting and retrieving their gear within the specified time frame. The 15-mesh height restriction for large mesh gill nets further limits those fishermen who fish in areas not conducive to this gear configuration.

This analysis of effort does not account for fish availability. It only looked at effort that has occurred under the current regulations and compared them to what happened in 2007. Any reduction in effort is assumed to be due to regulations. Southern flounder landings in the estuary are typically dominated by only a few age classes. Natural fluctuations in recruitment can have a direct impact on effort and landings in any given year. Based on the 2009 stock assessment, fishing mortality has decreased and spawning stock biomass has increased since the early 2000s (Takade-Heumacher and Batsavage 2009). For 2011, landings in all major

commercial gears were similar to those that occurred in 2007 with the exception of estuarine gill nets. Of these gears, only estuarine gill nets had extensive regulations implemented and this gear experienced a drastic reduction in landings. Fishery independent gill net data from Pamlico Sound had relative abundance indices from 2007 and 2011 that were nearly identical, indicating similar fish availability between the two years. It will take an updated stock assessment to determine if regulatory changes in the southern flounder fishery for both the commercial and recreational sectors have had the desired impact of reducing fishing mortality and rebuilding biomass to the desired levels. It should also be noted that since the most recent regulatory changes have only been in place for two years, there is a need for additional years of consistent regulations before the full impacts can be assessed with any certainty.

The management measures that have been put in place to protect sea turtles have decreased fishing effort in the southern flounder gill net fishery and effort will probably remain low compared to pre-settlement agreement times. Additional measures will likely follow as a result of the endangered listing of Atlantic sturgeon and could very well have a more direct impact on the regions that were exempted from many of the sea turtle regulations. Managers need flexibility in the management of southern flounder to react to changes in fishing effort and stock abundance to ensure that the southern flounder stock will continue to recover. Changes that have occurred since May 2010 have most likely benefited the southern flounder stock but the full measure of those changes will not be certain until a new stock assessment is performed.

By default, the evolving management measures from the settlement agreement has been the strategy to deal with the dynamic situation of finding balance between interactions with protected species, the prosecution of the large mesh gill net fishery, and the sustainability of the southern flounder stock, until the stock can be assessed. Adaptive management, which is an approach that allows managers to take advantage of a variety of strategies and techniques that are adjusted, refined, and/or modified based on an improved understanding of system dynamics (NCDMF 2012), may be a tool to consider in the future management of southern flounder and further develop once a new assessment is performed.

Proposed Rules

None

Management Options

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

1) Accept management measures to reduce protected species interactions (adaptive management) as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery.

+ Projected to meet harvest reductions necessary to rebuild stock and end overfishing
+ Requires no additional regulatory changes
- Requires all reductions for commercial sector to come from one gear type
- Possibility for increased effort, particularly from pound nets and gigs

2) Implement other management measures outside of existing sea turtle restrictions to meet necessary reduction in harvest.

+ Regulations could be evenly distributed among gear users.
+ Higher likelihood of stock recovery
+ Less likelihood of regulations changing due to protected species management
- Will require additional reduction in landings beyond what is necessary
- Unnecessary economic impact on fishery
- No updated stock assessment available from which to develop or evaluate different management measures

Recommendations

MFC Preferred Management Strategy -

AC - Same as DMF recommendation

DMF- Accept management measures to reduce protected species interactions as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery. Specifically these minimum measures for the flounder gill net fishery are:

1. Maintain the following gill net restrictions (excluding run-around, strike or drop net that is used to surround a school of fish and then is immediately retrieved):

A. For all internal coastal waters year round other than waters of Albemarle, Croatan and Roanoke sounds north and west of Highway 64/264 bridges, Pamlico, Pungo, Bay and Neuse rivers, and only during shad season (Jan-Apr) for the upper New River and upper Cape Fear River,, limit the use of large mesh gill nets (4-6½-inch stretched mesh) to four nights per week, Monday through Thursday, except allow an extra day (Sunday/Monday) for setting large mesh gill nets south of Beaufort Inlet.

B. For all internal coastal waters other than waters of Albemarle, Croatan and Roanoke sounds north and west of Highway 64/264 bridges as well as Pamlico, Bay and Neuse rivers limit the use of large mesh gill nets (4-6½-inch stretched mesh):

- to **use or possess no more than 2,000 yards** of large mesh gill net per fishing operation regardless of the number of vessels involved in coastal fishing waters north and east of a line at longitude 76° 36.9972' W, which runs northerly from a point on Shackleford Banks to Lennoxville Point, then to the head of Turner Creek, and northerly up the western side of North River.

- to **use or possess no more than 1,000 yards** of large mesh gill net per fishing operation regardless of the number of vessels involved in coastal fishing waters north and west of a line at longitude 76° 36.9972' W, which runs northerly from a point on Shackleford Banks to Lennoxville Point, then to the head of Turner Creek, and northerly up the western side of North River and bound in the south by the North Carolina-South Carolina border.

C. Unless otherwise specified the maximum large mesh gill net yardage allowed is 3,000 yards.

2. Conduct a stock assessment with data through 2013.

Literature Cited

NCDMF 2012. Draft amendment 2 to the North Carolina blue crab fishery management plan. North Carolina Department of Natural Resources, Division of Marine Fisheries. Morehead City, NC. 517 p.

Takade-Heumacher, H. and C. Batsavage. 2009. Stock status of North Carolina southern flounder (*Paralichthys lethostigma*). North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC. 93 p.

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