# SHELLFISH/ CRUSTACEAN ADVISORY COMMITTEE

North Carolina Marine Fisheries Commission

# APRIL 11, 2024

*Briefing Materials*

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# N.C. MFC Shellfish/Crustacean Standing Advisory Committee
# Central District Office, Morehead City, N.C.
# April 11, 2024
# 6 p.m.

6:00 p.m. Call to Order*

**Vote on the Approval of the Agenda****

**Vote on the Approval of the Minutes from January 11, 2024 ****

6:05 p.m. Presentation of the Protection of Critical Sea Grass Habitat Through Shrimp Trawl Area Closures – Chris Stewart

*This is part of adaptive management adopted in February of 2022 by the MFC in the Shrimp FMP Amendment 2 to further protect SAV habitat in North Carolina, which identifies unprotected SAV habitat using updated imagery (SAV mosaic) and proposes additional protection through shrimp trawl area closures.*

6:20 p.m. Public Comment

6:50 p.m. Shrimp FMP Amendment 2 – Adaptive Management – Protection of Critical Sea Grass Habitat Through Shrimp Trawl Area Closures

*Discussion by AC on SAV protection through shrimp trawl area closures*
**Vote to Recommend Management Options for MFC Consideration ****

7:50 p.m. Issues from AC Members

8:00 p.m. Adjourn

**** Times indicated are merely for guidance. The committee will proceed through the agenda until completed.***
*****Action Items***
******Applies only to Marine Fisheries Commission members***

***N.C.G.S. 138A-15(e) mandates at the beginning of any meeting of a board, the chair shall remind all members of their duty to avoid conflicts of interest under Chapter 138. The chair also shall inquire as to whether there is any known conflict of interest with respect to any matters coming before the board at that time.******

***N.C.G.S. 143B-289.54(g)(2) states a member of the Marine Fisheries Commission shall not vote on any issue before the Commission that would have a "significant and predictable effect" on the member's financial interest. For purposes of this subdivision, "significant and predictable effect" means there is or may be a close causal link between the decision of the Commission and an expected disproportionate financial benefit to the member that is shared only by a minority of persons within the same industry sector or gear group. A member of the Commission shall also abstain from voting on any petition submitted by an advocacy group of which the member is an officer or sits as a member of the advocacy group's board of directors. A member of the Commission shall not use the member's official position as a member of the Commission to secure any special privilege or exemption of substantial value for any person. No member of the Commission shall, by the member's conduct, create an appearance that any person could improperly influence the member in the performance of the member's official duties. ******

***Commissioners having questions about a conflict of interest or appearance of conflict should consult with counsel to the Marine Fisheries Commission or the secretary's ethics liaison. Upon discovering a conflict, the commissioner should inform the chair of the commission in accordance with N.C.G.S. 138A-15(e). ******

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

January 30, 2024

**MEMORANDUM**

**TO:** Marine Fisheries Commission
Shellfish/Crustacean Advisory Committee

**FROM:** Anne Deaton, Habitat Program Manager, Habitat and Enhancement Section
Tina Moore, Southern District Manager, Fisheries Management Section

**SUBJECT:** Meeting of the Marine Fisheries Commission's Shellfish Crustacean Advisory Committee, January 11, 2024. For discussion on items to develop in the Eastern Oyster FMP Amendment 5 and Hard Clam FMP Amendment 3.

The Marine Fisheries Commission's Shellfish/Crustacean Advisory Committee (AC) held an in-person meeting on January 11, 2024, at the Division of Marine Fisheries, Central District Office, Morehead City, NC. There was also a virtual option for those that could not attend in person.

The following AC members were in attendance: Lauren Burch, Jim Hardin, Tim Willis, Michael Hardison, Mike Marshall, and Ted Wilgis. Online: Ryan Bethea, Mike Blanton, Mary Sue Hamann, and Brian Shepard. Absent: Bruce Morris

Division of Marine Fisheries (DMF) Staff: Hope Wade, Debbie Manley, Jeff Dobbs, Joe Facendola, Corrin Flora, Tina Moore, Anne Deaton, Carter Witten, Lorena de la Garza, Casey Knight, Charlie Deaton, Steve Poland, Alan Bianchi

Public: There were 13 viewers on YouTube.

Shellfish/Crustacean AC Chair Mike Blanton called the meeting to order at 6:05 p.m.

Chair Blanton provided some introductory remarks and let AC members introduce themselves. The Shellfish/Crustacean AC had a quorum.

## APPROVAL OF AGENDA AND APPROVAL OF THE MINUTES

**A motion was made by Tim Willis to approve the agenda. Second by Lauren Burch. The motion passed without objection.**

**A motion was made by Mike Marshall to approve the minutes from the Shellfish Crustacean AC meeting held on April 18, 2023. Second by Tim Willis. The motion passed without objection.**

The AC members introduced themselves. This was the first AC meeting for Michael Hardison and Ryan Bethea.

**EASTERN OYSTER FMP AMENDMENT 5 AND HARD CLAM FMP AMENDMENT 3**

Jeff Dobbs began by informing the AC the goal and objectives for both plans were approved during the November MFC business meeting. Both plans are looking only at the wild harvest through their development. Staff are beginning to develop issue papers to address potential management and would like early input from the committee. One joint issue for the oyster and clam FMP is the need for a recreational shellfish harvest permit. Because there is currently not a requirement for any type of license or permit for recreational shellfish harvest, data is not available to estimate the number of recreational shellfishers. Staff would like to consider requiring a low cost or free permit. This would provide a means to gain understanding of the total number of people participating.

Tim Willis asked if DMF could sample somehow to get an idea of effort, rather than a permit or license. Dobbs explained that the nature of the fishery with people walking in from shore and private docks year-round makes it difficult for creel clerks to encounter fishers to get an estimate. Lauren Burch noted this is probably the last fishery that does not need a permit or license. Joe Facendola explained that it would require legislative action if the change was incorporated into the CRFL license requirements. Facendola noted that initially shellfish was included in CRFL license rules but was taken out at some point. Mike Marshall explained it was partially because it was considered a subsistence fishery - critical food resource for low-income residents. Steve Poland said the staff is considering incorporating the benefits of having a permit in the plan. If the MFC decides it is worth doing and approve including this as a recommendation in the FMP, it will provide more justification for implementation. Mary Sue Hamann questioned if it would require significant reporting on part of the holder. To address this and other committee comments, Dobbs explained that DMF uses surveys to get information on catch from recreational license holders, but since a license is not required, there is no pool of contacts to reach out to. If they did have a license or permit, DMF could survey and subsample to get an estimate on recreational effort and catch. This information is the first step to determine if recreational landings are significant relevant to commercial landings. Brian Shepard noted that there are no strictly recreational clammers. Rather, they tend to casually collect some shellfish while doing other activities on the water. Michael Hardison said that people must get permits for all types of hunting and we need to have a gauge on recreational effort. Marshall agreed and said it is a big missing piece of information and a permit would be the least obtrusive and no cost. Tina Moore said that these comments are for scoping and it seems there is enough interest from the AC to explore. They would also like to know if AC members would support a permit, and if it should be free or with a nominal cost. Blanton reiterated to the AC that their responsibility tonight is to help the division frame the FMP document. Because of the considerable size of our coast and tourism it might be good idea to have permit. Hamann asked staff to report back about how other states handle this. Ted Wilgis added that NCCF gets lots of calls in the summer about clamming. Any outreach should be provided in Spanish as well as English.

Joe Facendola explained that the Oyster Amendment 5, unlike previous plans, would only include wild harvest - shellfish leasing will be addressed separately through the lease program. There are three major issues that will be addressed. Subtidal oyster management using mechanical harvest, mostly in the north; intertidal hand harvest, mostly in south; and recreational harvest which Dobbs just went over and will be in both amendments. For mechanical harvest Facendola explained we currently use trigger sampling, with a 26% legal threshold. Staff is looking at a different way to manage, with rotational harvest of subtidal cultch planting sites. Subtidal oysters in the Pamlico system need to grow higher in the water column to have adequate oxygen at certain times. Mechanical harvest is not good for that because it lowers the reef profile. Staff is considering large cultch planting sites with a fixed season. Lauren Burch asked how mechanical harvest season is managed now. Facendola explained about trigger sampling, and different seasons in bays versus deeper water. The new method would allow mechanical harvest only on a subset of existing large cultch sites that are about 10 acres in deep water. Harvest would be a fixed season and

fishermen could continue harvesting on a cultch site until it was depleted of legal oysters. Then those sites would close for approximately three years until legal-sized oysters had reestablished.

Blanton asked about the number of participants. Facendola said it has been declining, ranging from 30 to 50 participants. The peak was in 2010. Moore said the high effort was due to shellfish license holders at that time being able to mechanical harvest which can no longer occur due to legislative changes no longer allowing this license for mechanical methods. Marshall added that in the 1990s it was a boom-and-bust fishery, and Dermo was a contributing factor. Late 1990s hardly any mechanical harvest and then in oysters started expanding again in the deep water and like said everyone pulled their gear out to harvest. Blanton thought oyster harvesters in the northern waters was declining in deep water due to the uncertainty of the season openings and closings. He would like that changed for mechanical harvesters. Other states manage through rotational harvesting and it is pretty successful and think it's possible for NC. Brian Shepard noted that some of the shellfish decline is due to increasing wastewater treatment plant discharges into rivers. This creates a dead layer. Maryland buys spat on shell and putting a huge amount out. NC doesn't do that – put rock out and sometimes it works well, sometimes not. Marshall Mentioned that the 26% trigger was an attempt to get more data, before we used number of violations and when trips came into the dealer. He supports trying different things. We need to protect the habitat and other factors. Tim Willis mentioned that in Chesapeake Bay and Louisiana they were dredging in dead zones to mix it up. Facendola added there are two issues – sediment and oxygen. Trying to lift shell up out of sediment for spat. Probably more sediment issue in bays since closer to runoff. He said that current management in the bays is working, but not in the deeper sound. Storm events reduce oxygen in the deeper areas and they die off on the bottom but stay alive higher up in the water column. With this strategy, oyster sanctuaries would continue to grow taller to allow survival and increase reproductive potential, and increased cultch around the sanctuaries would provide more recruitment area. Provide more spat to resettle on the sites to re-populate the deep water areas,

We'll need to do this in baby steps over the next few decades. Facendola said ultimately, we would want a stock assessment to identify what is available for harvest. In 10-20 years, a stock assessment might be feasible. Burch asked if you just want to go to season. For this paper the strategy would start with a subset of managed areas. Staff is looking at the trigger data to determine some correlations, such as when a certain percentage of oysters are legal-size, the season can open a specific number of weeks. Some certainty for fishermen on the duration of the season. A lot of effort to gear up for this fishery and they know how long to fish. Then harvest at rotational sites could occur after the set season for example, 8 weeks. The larger cultch planting sites will have 16 sites built this year and could potentially have 4 cultch areas open a year. Ted Wilgis supports looking at different strategies. He suggested that in the plan try to provide estimates on how much material you need to maintain adequate cultch planting areas, where they could be located, and enforcement. If you have records on monetary effort in management, the state can qualify for hurricane assistance funds for oyster planting. Hamann asked if runoff can be addressed. Anne Deaton replied that this is addressed in the Coastal Habitat Protection Plan (CHPP). A large focus of the most recent amendment (DEQ 2021) was addressing water quality.

Shepard thought a set season is a good idea for this fishery. Wilgis asked what tools can be used to adjust the season? Facendola said that changes could be made if necessary, through adaptive management and proclamations. Blanton asked how we can do this successfully if the 26% trigger now is not working for the the number of participants now if we don't know what is sustainable. Facendola said you can look at current bushel limits, how long it takes based on effort now, they are capped in rule at 25 bushels. Can look at changing the bushel limit. Corrin Flora noted that this plan takes effort off the natural reefs, which will enhance natural reefs with no pressure on them. Marshall mentioned for clarification that the 26% trigger was designed by a UNC study as habitat protection measure, to retain enough cultch in the water. The trigger was not a fishery management measure it was a habitat protection measure.

Discussion moved on to intertidal oysters. The fishery is by hand harvest, primarily in the southern coast, and accounts for the majority of landings. The landings have been stable. There currently is no sampling in this area. The only indicator used to gauge the fishery was whether a trip landed less than 5 bushels. The previous FMP reduced the commercial shellfish license holder limits from 5 to 2 bushels. We have seen the number of participants drop since that change in bushel limits. And we'll look into any changes in the participants and trips further in this plan. The previous plan also called for development of an intertidal sampling plan. Facendola explained it is under development by staff in Habitat and Enhancement and Fisheries Management sections. Wilgis asked if the sampling is tied to shellfish mapping and includes open and closed harvest areas and could provide information to aid cultch planting. Anne Deaton said yes, sampling would occur in mapped sentinel sites in closed and open areas. We also are trying a pilot study using drones to look at oyster reef height. Wilgis asked is you could use for cultch planting sites to identify areas needing more material? Facendola, yes that could be used just trying to build the infrastructure with material holding sites as well as people and equipment. Brian Shepard asked if the FMP could look at whether too many shellfish leases could negatively impact wild populations. Too many triploid oysters taking the resources from the wild stock. Wilgis said there are studies that show carrying capacity showing impacts to wild stocks, more of a research question. Willis noted there are studies ongoing in the South Atlantic or possibly the Gulf States. Staff said it could be included as a research question or passed on to the leasing program. Willis asked if there was any understanding between the natural bottom leases versus caged ones. Facendola said that is not my area of expertise. Flora said we could send those questions to the shellfish lease program.

Jeff Dobbs reviewed the major issues to be discussed in the clam FMP - mechanical clam harvest. There has been a decline in effort over the years, with only 4 participants in 2021. That, in addition to habitat concerns, have resulted in closing of some areas to mechanical clamming. Due to encroachment from oysters and seagrass in these mechanical areas. We close the area in Bogue Sound completely due to seagrass and modified other areas. He asked for input on: 1) ending the mechanical clam fishery; and 2) ending the opening of channels prior to navigational dredging. The latter has not been done since 2007. The dredging is problematic due to timing with working with the ACOE and timing when fishermen notifies DMF to open the area before the maintenance dredging activity occurs.

If the mechanical harvest season is removed, they would likely end the other as well. Dobbs noted that the negatives of the fishery are the effort to mark and enforce for low participation, and potential habitat impacts from turbidity and SAV. Willis asked why would we limit fishing activity of the gear when it is only four people now. If so few people why the issue? Dobbs said it was of historically important and of value to more fishers. Dobbs said DMF is responsible for marking the areas, it takes a lot of staff time and resources to mark, and enforce. Also, habitat concerns with dredging up the bottom and turbidity and uprooting seagrass. Willis reiterated it is not many people and so why consider. Flora noted the paper will address the fishery and number of participants. Willis said let the fishermen put out the signs then.

Hardison asked if the four remaining fishermen are increasing landings. Dobbs explained that the active participants are in New River and there is variability in landings as it is opened every other year. Because DMF rotates open areas, numbers are higher when New River is open, and lower when its closed. Shepard said although it is only a few participants it is important to them. He also mentioned that New River has had several clam die offs in deep water. He said stirring up the bottom and removing sediment is helpful, and since we've reduced trawling and clam dredging up there, conditions are worse. He added that for the participants that rely on this fishery, it is important. If we don't have activity up there the bottom will die and Hurricane Florence caused some die off as well.

**PUBLIC COMMENT**

No public comment.

**ISSUES FROM AC MEMBERS**

A Flounder Symposium will be held at the New Bern Convention Center on March 20, 2024. Details will be on the DMF website soon. No issues were brought forward by other members.

**PLAN AGENDA ITEMS FOR THE NEXT MEETING**

Moore said they don't have ideas from staff yet due to MFC upcoming in February and the MFC Liaison position is vacant. She noted the MFC Habitat and Water Quality AC is meeting next week to discuss as issue through the Shrimp FMP Amendment 2 to look at the open/closed areas to shrimp trawling and overlaps with seagrass presence. This paper will go to the MFC in February and may come back to other MFC ACs, dependent on the discussion with the MFC. No additional items were requested.

Tim Willis made a motion to adjourn. Seconded by Lauren Burch. The meeting adjourned at 7:46 p.m.

N.C. Marine Fisheries Commission
Update for Advisory Committees
April 2024

## Meeting Schedules

MFC Advisory Committee (AC) Upcoming Meeting Schedules

| Northern Regional AC | Southern Regional AC | Shellfish/Crustacean Standing AC | Finfish Standing AC | Habitat and Water Quality Standing AC |
|---|---|---|---|---|
| April 9 | April 10 | April 11 | ~~April 16~~ | ~~April 17~~ |
| July 9 | July 10 | July 11 | July 16 | July 17 |
| October 8 | October 9 | October 10 | October 15 | October 16 |

MFC 2024 Meeting Schedule

| Date | Location |
|---|---|
| February 21 – 23 | Doubletree Hotel, New Bern |
| May 22 – 24 | Beaufort Hotel, Beaufort |
| August 21 – 23 | Raleigh (location TBD) |
| November 20 – 22 | Islander Hotel and Resort, Emerald Isle |

## At its February 2024 Meeting, the Marine Fisheries Commission (MFC):

- Approved a recommendation by the MFC Conservation Funding Committee to support the request by the DMF for a disbursement of funding equaling $40,000 from the Conservation Fund to provide support for the U.S. Fish and Wildlife Service Edenton National Fish Hatchery to produce Phase II striped bass for stocking in the Albemarle Sound. This is part of a three-year stocking effort by the Wildlife Resources Commission and the Division of Marine Fisheries (DMF) to restore striped bass populations in the Roanoke River and Albemarle Sound.
- Received a presentation on the completion report for field validation of Strategic Habitat Areas (SHA's) from Core Sound in Carteret County through Brunswick County. The presentation reviewed the results of that validation effort and discussed how SHAs could be applied to future protection, restoration, and enhancement efforts for critical habitats such as SAV. This was an informational presentation that required no action by the MFC.
- Selected its preferred management options for Striped Mullet FMP Amendment 2. The draft amendment was sent for review by the Department of Environmental Quality Secretary and required legislative entities. The draft amendment is expected to come back before the MFC at its May 2024 business meeting for final adoption. The preferred management options were:
    - ***Sustainable Harvest****:*
        - *Option 5: Combination of Measures: 5.n (day of week closure Jan-Sept Sat-Sun; Oct-Dec Sat-Mon).*
        - *Option 6: Stop Net Fishery Management: 6.a (Status quo).*
        - *Option 10: Adaptive Management Framework.*
    - ***Recreational Fishery:***

        - *Option 1: Recreational Vessel and Bag Limit: 1.c (100-fish bag, 400-fish vessel)*
        - *Option 2: For Hire Vessel and Bag Limit: 2.c (exception for bag limit for number of anglers fishing up to 400-fish maximum including in advance of a trip).*
- Was presented with an information paper that examines the resources needed to establish a long-term shrimp trawl observer program and a logbook program for North Carolina's shrimp trawl fishery. This was a specific recommendation from the 2022 Shrimp FMP Amendment 2 with the goal of gaining a better understanding of the current magnitude and composition of discards in the shrimp trawl fishery across all strata (e.g., season, area, and gear). *The MFC voted to look for multiple sources of funding and methods of monitoring that may be less expensive for a shrimp trawl observer program, in addition to the Commercial Fishing Resource Fund*.
- Received a presentation on the issue paper "Protection of Critical Sea Grass Habitat through Shrimp Trawl Area Closures", consistent with the 2022 Shrimp FMP Amendment 2. Amendment 2 included adaptive management for future action to address issues related to submerged aquatic vegetation (SAV) identified through DEQ collaboration with the Coastal Habitat Protection Plan (CHPP) support staff, the Habitat and Water Quality AC, and stakeholder groups. The DMF developed an issue paper that provides an adaptive management strategy to further protect SAV habitat in North Carolina, by identifying unprotected SAV habitat using updated imagery (SAV mosaic) and providing additional protection through proposed shrimp trawl area closures. *The MFC voted to refer the issue paper to the Northern and Southern regional and Shellfish/Crustacean advisory committees for their input.*
- Was presented an issue paper originally requested by the MFC about false albacore management. *The MFC selected Option 3 as its preferred management option and associated proposed language for rulemaking*. Rulemaking is scheduled to begin in August 2024. Option 3 is as follows:
    - *Formally monitor false albacore landings and provide a landings summary to the MFC at its annual August business meeting. Adopt rule for precautionary management of false albacore to cap harvest via recreational bag limits, recreational vessel limits, and commercial trip limits when the false albacore fishery landings exceed a threshold of 200% of average landings from both sectors combined from 2018 to 2022. Harvest reductions would be implemented if the threshold is exceeded as a means to prevent further expansion of the false albacore fisheries beyond the threshold, contingent on MFC concurrence*.
- Was presented an issue paper on simplifying pot marking requirements. *The MFC selected Option 2 as its preferred management option and associated proposed language for rulemaking*. Rulemaking is scheduled to begin in August 2024. Option 2 is as follows:
    - Amend rule to simplify pot buoy marking requirements by requiring only one of three ways to mark pot buoys, not two ways.
- *Requested that the Rules Review Commission waive the 210-day requirement for the Marine Fisheries Commission to submit a temporary rule to the Rules Review Commission based on the effective date of Session Law 2023-137, Section 6, per N.C.G.S. 150B-21.1(a2).* See the "Session Law 2023-137, Section 6" segment of this document for more information.

**Preview of May 2024 Quarterly Business Meeting**

Fishery Management Plans (FMPs)

- Striped Mullet FMP Amendment 2
    - The MFC is scheduled to vote on final approval of Amendment 2. If adopted, the MFC and DMF would begin implementing the management measures contained in the amendment.
- Estuarine Striped Bass FMP Amendment 2 Adaptive Management
    - DMF staff will present the Revision to Amendment 2 documenting no harvest in the Albemarle Sound and Roanoke River Management areas previously implemented through adaptive management, consistent with the 2022 update to the striped bass stock assessment. There is no MFC action that needs to take place on this item.
- Shrimp FMP Amendment 2 Implementation
    - The MFC will receive recommendations from the Northern, Southern, and Shellfish/Crustacean advisory committees about implementing adaptive management regarding "Protection of Critical Sea Grass Habitat through Shrimp Trawl Area Closures" with a potential vote on the proposed management measures.
- Spotted Seatrout FMP Amendment 1
    - The DMF is developing the draft amendment for the FMP advisory committee workshop scheduled to be held in April 2024. The MFC will hear a short update on the development of this FMP at its May 2024 business meeting, but no action is scheduled to take place.
- Eastern Oyster FMP Amendment 5 and Hard Clam FMP Amendment 3
    - The DMF is developing the draft amendments for the FMP advisory committee workshop to tentatively be held in late 2024. The MFC will hear a short update on the development of these FMPs at its May 2024 business meeting, but no action is scheduled to take place.
- Stock Assessment Updates*:* The DMF is working on stock assessment updates with data through 2022 for blue crab and southern flounder. The current stock assessments indicate both stocks are overfished and overfishing is occurring. Adaptive management in the Blue Crab FMP and the Southern Flounder FMP allows for management changes to address the results of each stock assessment update.
    - The MFC will receive a presentation on the Blue Crab Stock Assessment Update at its May 2024 business meeting. This could potentially result in additional management action for blue crab through the Adaptive Management framework in the Blue Crab FMP Amendment 3.

Rulemaking

- The MFC will vote on final approval of a package of rules covering:
    - Data collection and harassment prevention for the conservation of marine and estuarine resources;
    - Oyster sanctuary rule changes; and
    - Conforming rule changes for shellfish relay program and shellfish leases and franchises.

- The MFC will also be presented with language for rulemaking regarding the Interstate Wildlife Violator Compact, for rulemaking to potentially begin in August 2024.

Other Items

- The MFC will also receive a presentation on the Shellfish Lease and Aquaculture Program that covers the statutes and rules governing the approval process for new leases.

**Session Law 2023-137, Section 6**

This is the legislation that was passed in the fall of 2023 that requires any person who recreationally harvests red drum, flounder, spotted seatrout, striped bass, and weakfish to report that harvest to the DMF. The requirement applies in the coastal and joint fishing waters under the authority of the MFC and any connecting inland fishing waters that are under the authority of the Wildlife Resources Commission.
Additionally, it requires any person holding a commercial fishing license, who is engaged in a commercial fishing operation, to report all fish harvested to the DMF, regardless of sale. For the purposes of this law, "all fish" includes finfish, shellfish, and crustaceans.

The legislation phases in the requirements over a period of three years. The first phase is effective December 1, 2024, and includes a verbal warning for failure to report harvest. Warning tickets will be issued starting December 1, 2025, followed by an infraction with a $35 fine starting December 1, 2026 for failure to report harvest. These infractions count towards suspension of fishing licenses and permits.

The DMF is currently drafting temporary rules to implement this legislation. In order to meet the required deadlines for implementation, MFC will likely need to hold two special-called meetings, one in late spring and another in early summer. The exact dates of these meetings have not yet been finalized. The DMF is working with the Wildlife Resources Commission, who is also drafting temporary rules to implement this legislation.

# PROTECTION OF CRITICAL SEA GRASS HABITAT THROUGH SHRIMP TRAWL AREA CLOSURES

March 25, 2024

## ISSUE

Providing additional protection for critical sea grass habitat through shrimp trawl area closures.

## II. ORIGINATION

The North Carolina Shrimp Fishery Management Plan (FMP) Amendment 2 and the North Carolina Marine Fisheries Commission (NCMFC).

## III. BACKGROUND

In February 2022, the NCMFC adopted the Shrimp Fishery Management Plan Amendment 2. With the adoption of Amendment 2 several management strategies were implemented to further reduce bycatch of non-target species and minimize ecosystem impacts (NCDMF 2022). The commission's management strategy included adaptive management for future action to address issues related to submerged aquatic vegetation (SAV) identified through Department collaboration with the Coastal Habitat Protection Plan (CHPP) support staff, the Habitat and Water Quality Advisory Committee (AC), and stakeholder groups. Adaptive management combines management and monitoring, with the aim of improving decision-making over time as more information becomes available. Adaptive management uses an iterative learning process to improve management outcomes, allows flexibility in decision making, and incorporates new information to accommodate alternative and/or additional actions (Holling 1978; Allan and Stankey 2009; Smith et al. 2013). In the context of North Carolina FMPs, adaptive management is an optional management framework that allows for specific management changes to be implemented between FMP reviews under specified conditions to accomplish the goal and objectives of the plan.

This issue paper uses the adaptive management strategy adopted in Amendment 2 to further protect SAV habitat in North Carolina, by identifying unprotected SAV habitat using updated imagery and providing additional protection through shrimp trawl area closures. As new imagery becomes available, shrimp trawl lines may be created or adjusted to encompass additional SAV habitat via revision of existing proclamations (NCMFC Rule 15A NCAC 03L .0101) or suspending of rules via proclamation (NCMFC Rule 15A NCAC 03I .0102). The Atlantic State Marine Fisheries Commission (ASMFC) SAV policy encourages state agencies to implement regular statewide SAV monitoring programs every five years to identify changes in SAV health and abundance (Havel and ASMFC 2018). Additionally, the South Atlantic Fishery Management Council (SAFMC) strongly recommends that a comprehensive adaptive management strategy be developed as a long-term protection strategy (SAMFC 2014). The 2021 Amendment to the CHPP recommends coast-wide monitoring occur every five years to evaluate the success of management actions and determine contributing relationships between changes in SAV species extent, distribution, and composition (Field et al 2020; NCDEQ 2021). The Albemarle-Pamlico National Estuary Partnership coordinates annual aerial and ground-based monitoring statewide on a rotating schedule during the spring and fall each year.

North Carolina is home to the largest documented polyhaline and mesohaline (brackish) SAV ecosystem on the Atlantic seaboard of North America (Bartenfelder et al. 2022). NCMFC Rule 15A NCAC 03I .0101 (4)(i) defines SAV as fish habitat dominated by one or more species of underwater vascular plants and occurs in subtidal and intertidal zones. SAV habitat provides refuge, forage, corridor, spawning, and nursery areas for many organisms including flounder (*Paralichthys* spp.), red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), snapper, grouper, bay scallops (*Argopecten irradians*), blue crab (*Callinectes sapidus*), and penaeid shrimp (NCDMF 2021). Fish and invertebrate use of SAV differs spatially and temporally due to distribution ranges, time of recruitment, and life histories as well as seasonal abundance patterns of SAV (Micheli and Peterson 1999; Minello 1999; NOAA 2001; NCDEQ 2016). The SAFMC designated SAV as Essential Fish Habitat (EFH) for shrimp, snapper and grouper species, and spiny lobster (*Panulirus argus*), and Essential Fish Habitat Areas of Particular Concern for shrimp and snapper and grouper species (SAFMC 2021). The Mid-Atlantic Fishery Management Council designated SAV as Habitat Areas of Particular Concerns for summer flounder (*P. dentatus*; MAFMC 2016).

Field sampling of Strategic Habitat Areas (SHAs) in regions 3 and 4 (Core Sound through Brunswick County) found that SHAs had a greater abundance of SAV dependent species [Penaeid shrimp, southern flounder (*P. lethostigma*), red drum, silver perch (*Bidyanus bidyanus*), blue crab, etc.], as well as SAV (NCDMF 2023), supporting the critical importance of SAV for fishery species (Deaton et al. 2023). SAV also provides other important ecosystem functions such as increasing structural complexity, sediment and shoreline stabilization, improving water quality, primary productivity, nutrient cycling, and carbon sequestration. Beyond its ecological value, SAV provides significant market and nonmarket value to the state of North Carolina (Sutherland et al. 2021). In the Albemarle-Pamlico estuary alone, a five percent decadal loss in SAV is estimated to account for $8.6 million in losses a year in commercial fishing, recreational fishing, property value, and carbon sequestration. For a complete review of habitat requirements, species composition, ecological and biological functions, fish use, and status of SAV habitat see the North Carolina CHPP source document (NCDEQ 2016) and the 2021 Amendment (NCDEQ 2021).

In North Carolina, beds of SAV occur in subtidal and intertidal areas of sheltered estuarine and riverine waters where there is suitable sediment, adequate light reaching the bottom, and moderate to negligible current disturbance (Ferguson and Wood 1990, 1994; Thayer et al. 1984). SAV habitat is primarily located in shallow subtidal water (<6 feet) and individual species vary in their occurrence as salinity, depth, and water clarity change (NCDEQ 2016, 2021). The distribution, abundance, and density of SAV varies seasonally and annually (Dawes et al. 1995; Fonseca et al. 1998; SAFMC 1998; Thayer et al. 1984). Therefore, historical as well as current occurrences need to be considered to determine locations of viable seagrass habitat (SAFMC 1998).

Since the 1980s various mapping and monitoring projects have been conducted by several universities and state and federal agencies to document the extent of SAV in North Carolina (NCDMF 2021). More recently, aerial survey and ground-based monitoring data were collected in the high salinity waters from Manteo to Wrightsville Beach from 2020 to 2021. These maps were merged with previous data to comprise the historical or maximum known extent of SAV along North Carolina's coast (commonly referred to as the SAV mosaic). The 2021 Amendment to the CHPP divides the mosaic into nine SAV regions to best represent regional variability of

waterbodies (Figure 1). For a complete review of coastal habitat mapping and SAV monitoring, see Amendment 1 to the CHPP (NCDEQ 2021).

While there are several major threats to SAV (i.e., eutrophication, sedimentation, pollution, coastal development, climate change, etc.), impacts from mobile bottom disturbing fishing gears is of particular concern. It has been well documented that bottom disturbing gears such as trawls can significantly reduce habitat complexity and community composition from the physical disruption of the habitat to the removal of species (Dorsey and Pederson 1998; Auster 1998; NCDMF 1999; SAFMC 2014; Hiddink et al. 2017; Sciberras et al. 2018; Barnette 2001; NRC 2002; NCDEQ 2016, 2021). Otter trawls, the primary fishing gear used to harvest shrimp in NC, are conical nets pulled behind vessels along the benthos (Stewart and Dietz 2021; NCDMF 2022). Shearing or cutting of SAV leaves, flowers, or seeds, and uprooting of the plant may occur from the sweep of the net or the digging of the trawl doors into the sediment (ASMFC 2000). Skimmer trawls, another common gear used to harvest shrimp in North Carolina, uses metal skids to keep frames with attached nets off the bottom as they are fished. However, damage to the bottom can still occur if the gear is improperly tuned or designed (Hein and Meier 1995). Additionally, skimmer trawls are effectively fished in shallow waters, raising concerns with propeller scarring. Both gears increase turbidity, which can slow the growth of primary (algae and plants) and secondary producers (organisms that consume other organisms), limit nutrient regeneration, and disrupt the feeding relationships of all organisms within the ecosystem (the food web). For a comprehensive review of the impact of trawling in North Carolina waters, see NCDMF (1999, 2014, 2022), and NCDEQ (2016, 2021).

## IV. AUTHORITY

North Carolina General Statutes
§ 113134 RULES
§ 113-173 RECREATIONAL COMMERCIAL GEAR LICENSE
§ 113182 REGULATION OF FISHING AND FISHERIES
§ 113-182.1 FISHERY MANAGEMENT PLANS
§ 113-221.1 PROCLAMATIONS; EMERGENCY REVIEW
§ 143B-289.52 MARINE FISHERIES COMMISSION – POWERS AND DUTIES

North Carolina Marine Fisheries Commission Rules
15A NCAC 03H .0103 PROCLAMATIONS, GENERAL
15A NCAC 03J .0104 TRAWL NETS
15A NCAC 03L .0101 SHRIMP HARVEST RESTRICTIONS
15A NCAC 03L .0103 PROHIBITED NETS, MESH LENGTHS AND AREAS

## V. DISCUSSION

Specific habitat protections for SAV have been implemented as part of FMPs for shrimp (NCDMF 2006, 2015, 2022), bay scallop (NCDMF 2007, 2015), hard clam (NCDMF 2008, 2017), and blue crab (NCDMF 1998; 2020). In addition, the 2006 Shrimp FMP included consideration of a strategy to expand areas where dredging and trawling is prohibited to allow some recovery of SAV and shell bottom where those habitats historically occurred (NCDMF 2006). Trawling was prohibited

in the Albemarle and Currituck sounds due to user conflicts, but the prohibition also provided ancillary protections for SAV habitat (NCMFC Rule 15A NCAC 03J .0104). Trawling and dredging is prohibited in SAV beds on the eastern side of Pamlico, Core, and Back sounds through a trawl net prohibited area designation (NCMFC Rule 15A NCAC 03R .0106). SAV beds north of the Intracoastal Waterway (IWW) and on the western end of Bogue Sound are protected via proclamation (NCDMF 2007). With the adoption of Amendment 2 to the Shrimp FMP, trawling in Bogue Sound was further restricted to the IWW only to protect SAV habitat while continuing to allow shrimp trawling. SAV in the New River is also protected within no trawl areas below the Highway 172 Bridge. Crab Spawning Sanctuaries (NCMFC Rule 15A NCAC 03L .0205) and inlet trawling restrictions (NCMFC Rule 15A NCAC 03J .0401) provide a "no trawl corridor" around inlets that protect crabs and allows migration of sub-adult fish to the ocean. All trawling was permanently prohibited in Crab Spawning Sanctuaries with the adoption of Amendment 2 to the Shrimp FMP; prior to its adoption, trawling was limited to November through February. See Shrimp Fishery Management FMP Amendment 2 (NCDMF 2022) for additional area restrictions that prohibit trawls in North Carolina's coastal and estuarine waters.

Because the current understanding of SAV distribution is based on historic mapping efforts (1981-2021), maps may not represent the actual, real-time extent of SAV for a given year but represent potential SAV habitat. Unsworth et al. (2018) notes seagrass conservation targets should incorporate future potential distribution of seagrasses and account for physiological responses to shifting environmental conditions that may result in species range-changes, localized invasions and extinctions, and shifts in structure and function of SAV habitat. Therefore, any shrimp trawl closures implemented to protect SAV must be broad enough to capture potential SAV habitat distribution.

One method to promote protection and recovery of SAV habitat is the creation of management buffers around important habitats. The overall goal of a buffer is to achieve sustainable use of natural resources that benefit both local communities and resources, while limiting the impact of destructive activities that take place outside of a protected area (Sanderson and Bird 1998; Martino 2011; Ebregt and Greve 2000). Terrestrial buffers are used by the North Carolina Environmental Management and Coastal Resources commissions to protect wetlands and water quality (NCDEQ 2016). In the marine environment, buffers have been used in conjunction with Marine Protected Areas (MPA) to protect important marine and coastal ecosystems as well as create migration corridors. Increasing connectivity between SAV habitats and other essential fish habitats can further reduce habitat fragmentation (edge effect) which can negatively impact community structure and nursery value (Benitez-Malvido and Arroyo-Rodriguez 2008). As a part of the Hard Clam FMP, adaptive management is used to modify mechanical clam harvest areas (MCHAs) to allow a buffer between dredged areas and SAV and oyster beds (NCDMF 2008, 2017). Similar buffers between open shrimp trawl areas and the maximum known extent of SAV habitat should be established as a means of protecting SAV habitat. More expansive closures are needed to reduce the impact of turbidity and sedimentation associated with bottom disturbing gear. Excessive sedimentation from bottom disturbing fishing gear and propeller wash can bury SAV. Increased turbidity further reduces water clarity, SAV growth, productivity, and survival (NCDEQ 2016). Furthermore, buffers that are expanded to make use of existing navigation aids, landmarks, or management boundaries accomplish the goal of increased buffers while also helping to promote compliance and simplify enforcement.

The 2021 Amendment to the CHPP cites the need to further protect and restore SAV as new mapping data become available (NCDEQ 2021). At the time of the amendment, the maximum extent of SAV along North Carolina's coast was 191,155 acres (1981-2015). With the additional mapping data from 2020 to 2021, the maximum known extent of SAV habitat is approximately 196,190 acres (Table 2; Figure 1). While closing areas of critical SAV habitat allows for calculation of how much additional habitat will be protected from direct physical disturbance from shrimp trawls, overall and additional benefits to SAV are difficult to quantify. In the absence of shrimp trawls, SAV growth may continue to be impaired by poor water quality, climate change, disease, or other natural disturbances. It's important to note that while broad scale closures are often better for conservation and biodiversity (Ebregt and Greve 2000), their creation may prevent trawling in productive areas with no SAV and disproportionately impact some user groups (i.e., small vessels, Recreational Commercial Gear License holders). The division does not have shrimp trawl effort data specific for each SAV region; thus, the precise economic impacts to the shrimp trawl fishery cannot be estimated but effort was made to balance SAV habitat protection and impacts to fishermen when determining closure boundaries.

## VI. MANAGEMENT OPTIONS AND IMPACTS

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

SAV Region 1 – Currituck Sound and Back Bay

Region 1 extends from Back Bay south to Point Harbor and encompasses all of Currituck Sound. Based on the most recent SAV mosaic (1981-2021), there are 21,613 acres of known SAV habitat in this region (Table 2; Figure 1). Shrimp trawling is prohibited throughout Currituck Sound [NCMFC Rule 15A NCAC 03J .0104(b)(3)]; no additional shrimp trawl closures are needed to protect SAV habitat in this region.

SAV Region 2 – Albemarle / Roanoke Sound

Region 2 extends from the Albemarle Sound to the Melvin R. Daniels Bridge (HWY 64) in the Roanoke Sound and includes the Alligator River and portions of the Croatan Sound (Figure 1). There are 12,872 acres of known SAV habitat in this region of which 42.1% is unprotected (Table 2). Shrimp trawling is prohibited in the Albemarle Sound, and throughout much of Roanoke Sound [NCMFC Rule 15A NCAC 03J .0104(b)(3)]. Special secondary nursery areas (SSNA) are designated in Kitty Hawk/ Buzzards, and Shallowbag bays. While these SSNAs have not opened since 2017, establishing shrimp trawl prohibited areas will provide permanent protection to known SAV habitat within these SSNAs.

Shallow water and other impediments limit trawling in this region; however, there is a considerable amount of unprotected SAV habitat in waters surrounding Colington and Roanoke islands. Creating a new no shrimp trawl line from Weir Point to the Manns Harbor Bridge will protect SAV habitat along the western shoreline of Roanoke Island and increase connectivity (Figure 2). Further restricting trawling to the Roanoke Sound Channel will increase connectivity between SAV habitats and create clear boundaries for enforcement (Figure 2). Allowing trawling within 100 feet on either side of the channel will allow trawlers space to safely maneuver their vessels and reduce user group conflict. While broad shrimp trawl closures may further limit small

commercial and recreational vessels, they provide the greatest protection to SAV habitat. Complementary closures in Region 5 (Roanoke Sound to Ocracoke Inlet) should be considered in conjunction with closures in Region 2 to create a continuous closed area of SAV habitats across these regions (Figure 5).

1. Prohibit shrimp trawling along the western shoreline of Roanoke Island from Weir Point to the Manns Harbor Bridge.
   + Decrease damage to SAV from shrimp trawls and allow potential for SAV recovery in formerly occupied areas
   + Creates continuous closed areas between SAV habitats among regions
   - Decreases some traditional shrimp trawling areas
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

2. Limit shrimp trawling to main channel only (100 ft either side) of the Roanoke Sound Channel.
   + Decrease damage to SAV from shrimp trawls and allow potential for SAV recovery in formerly occupied areas
   + Creates continuous closed areas between SAV habitats among regions
   + Provides access to fishermen and has minimal impact to soft bottom habitats that are dredged for navigation
   - Decreases some traditional shrimp trawling areas
   - Modification of existing closure lines could cause confusion
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

SAV Region 3 – Tar-Pamlico and Neuse rivers

Region 3 stretches across three counties (Beaufort, Pamlico, and Carteret) and encompasses the Pungo, Tar-Pamlico, Neuse, and Bay rivers and their tributaries (Figures 1 and 3). There are 4,581 acres of known SAV habitat within this region, of which 11.6% is unprotected (Table 2). In the Pungo River, shrimp trawling is prohibited upstream of a line from Currituck Point running southwesterly to Wades Point [NCMFC Rule 15A NCAC 03R .0114(A)]. All waters upstream of a line running from the entrance of Goose Creek northeasterly to Wades Point are closed to trawling in the Tar-Pamlico River [NCMFC Rule 15A NCAC 03R .0114(B)]. In the Neuse River, shrimp trawling is prohibited upstream of a line running northerly from Cherry Point to Wilkinson Point [NCMFC Rule 15A NCAC 03R .0114(C)]. Most of the tributaries and bays in this region are designated as primary and secondary nursery areas; however, trawling is allowed in Bay River as well as parts of Goose Creek, Clubfoot Creek, Adams Creek, South River, and Turnagain Bay.

Shrimp trawling is prohibited in designated pot areas in the Pamlico, Bay, and Neuse rivers from June 1 to November 30 in less than six feet of water [NCMFC Rules 15A NCAC 03J .0104(b)(6), 03J .0301(a)(2), and 03R .0107(a)(5)(6)(7)(8)]. Establishing permanent shrimp trawl closures in select designated pot areas where SAV is known to occur will provide permanent protection to SAV habitat and further reduce conflict between shrimp trawls and crab pots. Permanent shrimp trawl closures are recommended for designated pot areas in Vandemere Creek, Shell Bay, White Perch Bay, Bonner Bay, Fisherman's Bay, Turnagain Bay, and South River (Figure 3).

3. Prohibit shrimp trawling year-round in designated pot areas in Vandemere Creek, Shell Bay, White Perch Bay, Bonner Bay, Fisherman's Bay, Turnagain Bay, and South River.
   + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
   + Provides additional protection to critical shell bottom habitat
   + Minimal impact to fishermen since areas are not used extensively
   + Reduce gear conflicts between trawls and crab pots
   - Decreases some traditional shrimp trawling areas
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

<u>SAV Region 4 – Pamlico Sound</u>

Region 4 encompasses most of Pamlico Sound, spanning from the Manns Harbor Bridge (HWY 64) to the mouth of Neuse River and Cedar Island (Figures 1 and 4). The eastern side of Pamlico Sound (Outer Banks) is in SAV Region 5 and connected to SAV Regions 2, 3, and 6. There are 712 acres of known SAV habitat in Region 4, of which 68.8% is unprotected (Table 2). Stumpy Point Bay is closed to trawling from Drain Point to a line running westerly to Kazer Point [NCMFC Rule 15A NCAC 03R .0106(2)]. Most of the feeder creeks and bays along the Hyde County shoreline are classified as Primary Nursey Areas (PNA) and Secondary Nursery Areas (SNA). It is unlawful to use trawl nets in PNAs and SNAs (NCMFC Rule 15A NCAC 03N .0104 and .0105). Trawling is also prohibited in three military danger zones and restricted areas located near the mouths of Long Shoal and Bay rivers as well as Piney Island.

SAV habitat has been documented along the northwestern shoreline of Dare County from Manns Harbor to Callaghan Creek and from Long Wretch Creek to Stumpy Point (Figure 4). Establishing straight-line closures along the shoreline would protect known SAV habitat, simplify enforcement, and have minimal impact to fishermen in the Croatan Sound (Figure 4). Expanding the Stumpy Point shrimp trawl closure to include the area from Drain Point to Sandy Point will further protect SAV habitat south of Wild Boar Point. Additional closures in Sandy, Parched Corn, Berrys, East Bluff, and West Bluff bays as well as the mouths of Burrus, Middletown, Back, Brooks, and Middle creeks should also be considered (Figure 4). Establishing prescribed area closures along the western Hyde County shoreline will further protect SAV habitat and simplify enforcement (Figure 4).

4. Create and expand existing closures along the western shoreline of Dare and Hyde counties to include the bays and tributaries from Manns Harbor to West Bluff Bay.
   + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
   + Minimal impact to fishermen since areas are not used extensively
   + Reduce gear conflicts between trawls and crab pots
   - Decreases some traditional shrimp trawling areas
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

SAV Region 5 – Roanoke Sound to Ocracoke Inlet

Region 5 extends from the Manns Harbor Bridge (HWY 64) south to Ocracoke Inlet and includes portions of the Roanoke and Pamlico sounds (Figures 1 and 5). There are 103,856 acres of known SAV habitat within this region; the largest acreage of SAV habitat in North Carolina (Table 2). Much of the eastern side of the Pamlico Sound is closed to trawling to protect SAV habitat (15A NCAC 03R .0106 (1)). Shrimp trawling is prohibited in the Wanchese Marshes Seed Oyster Management Area [NCMFC Rule 15A NCAC 03R .0116(2)]. Oregon, Hatteras, and Ocracoke inlets are designated as crab spawning sanctuaries. Amendment 2 to the Shrimp FMP permanently closed all crab spawning sanctuaries to trawling (NCDMF 2022; Proclamation SH-1-2023).

Because of their proximity and connection, shrimp trawl closures in SAV regions 2 and 5 should complement each other to increase connectivity as well as simplify enforcement and compliance. Therefore, shrimp trawling should be further restricted to within 100 feet on either side of the channel running from the southeastern shore of Wanchese to the Bodie Island marshes (Figure 5). Along the western shore of Roanoke Island, shrimp trawl closures should extend south of the Manns Harbor Bridge to the Wanchese Seed Oyster Management Area at Cedar Bush Bay to align with proposed closures in Region 2 (Figure 5). To protect the remaining SAV habitat along the western shoreline of the Outer Banks, the existing trawl net prohibited area should be extended to the west behind Salvo and Buxton Harbor (Figure 5).

5. Limit shrimp trawling to main channel only (100 ft either side) of the southeastern shore of Wanchese to the Bodie Island marshes.
   + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
   + Creates continuous closed areas between SAV habitats among regions
   + Provides access to fishermen and has minimal impact to soft bottom habitats that are dredged for navigation
   - Decreases some traditional shrimp trawling areas
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

6. Prohibit trawling along the western shore of Roanoke Island from the Manns Harbor Bridge to northern most tip of the Wanchese Seed Oyster Management Area.
   + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
   + Creates continuous closed areas between SAV habitats among regions
   + Provides access to fishermen and has minimal impact to soft bottom habitats that are dredged for navigation
   - Decreases some traditional shrimp trawling areas
   - Modification of existing closure lines could cause confusion
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

7. Modify the existing trawl net prohibited area along the Outer Banks to include portions of the western shoreline behind Salvo and Buxton Harbor.

+ Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
+ Creates continuous closed areas between SAV habitats among regions
+ Minimal impact to fishermen since areas are not used extensively
- Modification of existing closure lines could cause confusion
- SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

SAV Region 6 – Core Sound

Region 6 contains the second largest known SAV habitat within the state; however, the vast majority of SAV in this region is unprotected (Figures 1 and 6). There are 37,645 acres of known SAV and SAV habitat, of which 35.5% is unprotected (Table 2). The area on the eastern side of Core Sound is designated as a no trawl area by NCMFC Rule 15A NCAC 03R .0106 (1) and is in place to protect SAV but can be opened to peeler crab trawling by proclamation [NCMFC Rule 15A NCAC 03J .0104 (4)]. On the mainland side of Core Sound, Jarrett Bay, Brett Bay, Nelson Bay, Thorofare-Barry Bay, and Cedar Island Bay are designated as SSNAs; however, they have not opened since 2018 (Proclamation SH-6-2018). Prior to the adoption of Amendment 2 to the Shrimp FMP, West Bay was managed in conjunction with SSNAs, last opening in 2017 (NCDMF 2022). SSNA openings based on division sampling were eliminated as a part of Amendment 2; thus, openings in West Bay no longer occur. All other tributaries and bays in Core Sound are designated as PNAs. Ophelia and Drum inlets are designated as crab spawning sanctuaries and are closed to trawling.

Limiting shrimp trawling to the MCHA in Core Sound (Figure 6) will increase connectivity between SAV habitats among regions as well as simplify enforcement and compliance.

8. Prohibit trawling in Core Sound, and its tributaries except for the MCHA.
    + Decrease damage to SAV habitat from shrimp trawls
    + Creates continuous closed areas between SAV habitats among regions
    + Provides access to resource and has minimal impact to soft bottom habitats that are impacted by other fisheries and or dredged for navigation
    - Decreases some traditional shrimp trawling areas
    - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV
    - Modification of existing closure lines could cause confusion

SAV Region 7 – Back Sound to Sanders Island

Region 7 stretches across Carteret and Onslow counites and comprises 12,265 acres of known SAV habitat, of which 45.4% is unprotected (Table 2; Figures 1 and 7). Amendment 2 to the Shrimp FMP prohibited trawling in Bogue Sound except for the IWW and permanently closed crab spawning sanctuaries located at Barden, Beaufort, and Bogue inlets to trawling. The North River SSNA may be open to trawling at the Director's discretion; however, it has not opened since 2000 (Proclamation SH-14-2000). The bays and tributaries that surround the North River, Newport River, White Oak River, Bear Creek, and Queens Creek are designated as either PNAs or SNAs, and are closed to trawling.

Due to the patchy distribution of SAV in this region, it is difficult to designate areas where trawling could occur without overlapping SAV habitat. Broader shrimp trawl closures providing a buffer between open areas and SAV habitat should be considered, particularly along the shoreline of the Straits and Back Sound (Figure 7). Further limiting trawling to the North River MCHA will protect SAV along the shoreline and continue to allow shrimp trawling and have minimal impact to soft bottom habitats that are impacted by other fisheries or dredged for navigation (Figure 7). Additional shrimp trawl closures are recommended along the eastern shoreline of Newport River off Russells and Wading creeks. While SAV is less extensive in the White Oak River, additional shrimp trawl closures below the Highway 24 Bridge should be considered (Figure 7). Further limiting trawling to the IWW from Cedar Point to Sanders Island will provide additional protection to SAV habitat and increase connectivity among regions (Figure 7).

9. Prohibit shrimp trawling in the Straits, Back Sound, and their tributaries.
   + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
   + Creates continuous closed areas between regions and SAV habitats
   + Provides additional protection to critical shell bottom habitat
   + Minimal impact to fishermen since areas are not used extensively
   - Decreases some traditional shrimp trawling areas
   - Modification of existing closure lines could cause confusion
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

10. Modify existing or create new shrimp trawl closure lines in the North and Newport rivers.
   + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
   + Creates continuous closed areas between regions and SAV habitats
   + Provides access to resource and has minimal impact to soft bottom habitats that are impacted by other fisheries and or dredged for navigation
   - Decreases some traditional shrimp trawling areas
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV
   - Modification of existing closure lines could cause confusion

11. Limit shrimp trawling to IWW from Cedar Point to Sanders Island.
   + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
   + Creates continuous closed areas between regions and SAV habitats
   + Provides access to resource and has minimal impact to soft bottom habitats that are dredged for navigation
   - Decreases some traditional shrimp trawling areas
   - Modification of existing closure lines could cause confusion
   - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

SAV Region 8 – Brown's Inlet to Snow's Cut

Region 8 extends from Brown's Inlet to Carolina Beach (Snow's Cut) and encompasses the New River and Topsail, Stump, and Middle Sounds (Figures 1 and 8). Within this region there are 2,646 acres of known SAV habitat, of which 17.9% is unprotected (Table 2). The majority of SAV habitat in the region is in the New River and along the IWW (Stump and Topsail sounds) and is largely protected under existing rules and proclamations. In the New River, trawling is prohibited in all tributary creeks downstream of the closure line at Grey and Wards Point and in the military restricted zone that extends from the western shoreline of the river below Grey Point to the northeastern shoreline of Stones Bay. The waters upstream of the Highway 172 bridge are designated as SSNA and can be opened to the use of skimmer trawls only from September 1 to November 30. Below the Highway 172 Bridge, trawling is prohibited in all bays and tributary creeks and additional areas were closed to match the MCHA in 2017 to protect SAV (Proclamation SH-2-2017).

Trawling is restricted to the main channel throughout the IWW (Figure 8). The area from Marker #105 to the Wrightsville Beach drawbridge was closed to trawling following the adoption of the 2006 Shrimp FMP. Within the waters from Rich Inlet to Carolina Beach, the division maintains six shellfish management areas (SMA) as well as an oyster sanctuary at the mouth of Hewlett's Creek, all of which are closed to trawling. The remainder of the feeder creeks and bays along the IWW are classified as PNAs or SNAs and are closed to trawling. Trawling is further prohibited in the crab spawning sanctuaries located at Browns, New, Topsail, Rich, Masonboro, and Carolina Beach inlets.

The current no shrimp trawl lines in the New River MCHA could be modified to fully encompass documented SAV habitat at Hall Point (Figure 8). While depth limits effort in these areas, the existing lines could be refined via revision of existing proclamations. Above the Highway 172 Bridge, the creation of new shrimp trawl closure lines would be needed to protect SAV habitat at the mouths of Stones and Everett creeks as well as Pollocks Point. Establishing straight-line closures using channel markers and landmarks would simplify enforcement and compliance. Additional closures could be implemented to protect SAV Habitat between Wards and Lowes points (Figure 8). Additional closures are recommended in Chadwick Bay to protect SAV along the shoreline from Fullard Creek to Swan Point. There would be minimal to no impact to fishermen, as Chadwick Bay is a SSNA and last opened in 2012. The proposed closures would also protect several clutch planting sites off of Roses Point. Outside of the New River, no additional shrimp trawl closures are needed along the IWW.

12. Modify existing or create new shrimp trawl closure lines in the New River.
    + Decrease damage to SAV from shrimp trawls and allow for SAV recovery in formerly occupied areas
    + Minimal impact to fishermen since areas are not used extensively
    + Identifying clear boundaries could prevent damage gear and habitat
    - Decreases some traditional shrimp trawling areas
    - Modification of existing closure lines could cause confusion
    - SAV mapping reflects maximum known extent, so creation of broad no shrimp trawl areas may prevent shrimp trawling in areas that currently do not have SAV

SAV Region 9 – Cape Fear River to NC-SC Stateline

Region 9 spans across New Hanover and Brunswick counties and encompasses the Cape Fear River and the IWW to the NC-SC Stateline (Figure 1). Below Snow's Cut, trawling is allowed in the main river channel and behind many of the spoil islands. The areas known as the "Dow Chemical Bay" and "Radar Bay" are closed to trawling. Trawling, and all other boating activity, is prohibited in the military restricted area at the Sunny Point Military Ocean Terminal. Trawling in the SSNA behind Kure Beach was prohibited following rule changes implemented in the May 2021 Revision to Amendment 1 that re-designated it as a permanent SNA (NCDMF 2021). The bays south of the Fort Fisher Ferry Terminal (First Bay or "the Basin", Second Bay, Buzzard's Bay) and behind Bald Head Island (Cape and Bay creeks) were designated as Trawl Net Prohibited areas with the implementation of the 2006 Shrimp FMP (NCDMF 2006). Trawling is further prohibited in the crab spawning sanctuary at the Cape Fear River Inlet.

Trawling in Brunswick County is primarily limited to the main channel of the IWW. Most of the shoreline bordering the IWW is designated as nursery areas and are closed to trawling. With the adoption of Amendment 1, shrimp trawling was prohibited in the IWW from the Sunset Beach Bridge to the South Carolina line, including the Shallotte River, Eastern Channel, and lower Calabash River to protect small shrimp and reduce bycatch. Following rule changes implemented in the May 2021 Revision to Amendment 1, the Lockwood Folly River and Saucepan Creek SSNAs were re-designated as permanent SNAs (NCDMF 2021). With the adoption of Amendment 2, the Carolina Boat Basin was closed to trawling (NCDMF 2022). The remainder of the feeder creeks and bays along the IWW are classified as PNAs or SNAs and are closed to trawling. Trawling is prohibited in crab spawning sanctuaries located at Shallotte River Inlet, Lockwood Folly Inlet, and Tubbs Inlet.

Elevated tidal heights in the southern portion of the state increase turbidity and light attenuation, limiting SAV growth in the region. No additional shrimp trawl closures are recommended in Region 9 due to the absence of documented SAV habitat.

## VII. RECOMMENDATIONS

NCDMF: Implement shrimp trawl closures specified in this paper to further protect SAV and SAV habitat from physical damage, turbidity, and sedimentation.

The 2021 Amendment to the CHPP cites the need to further protect and restore SAV as new mapping data become available (NCDEQ 2021). The 2022 Shrimp FMP Amendment 2 adopted a strategy to provide recommendations for future action through adaptive management to address SAV issues identified through collaboration of the Division, CHPP support staff, Habitat and Water Quality AC, and stakeholder groups. In support of the CHPP, NCDMF recommends creating management buffers to protect SAV habitat from physical disturbance, turbidity, and sedimentation by implementing broad, region specific shrimp trawl closures. Specifically, the NCDMF recommends management options 1-12. The division also recommends that issue paper be referred to the regional and Shellfish/Crustation ACs for further input before making final recommendations to the MFC.

Habitat and Water Quality AC: Endorse the division's recommendations to protect existing and prospective SAV habitat. In portions of proposed closure areas where SAV cannot be supported, the division should work with stakeholders to maximize SAV protection while reducing impact on stakeholder to maximize SAV protection while reducing impact on stakeholder use. A commitment should be made to quantify the status of SAV habitat in NC and a monitoring program to measure progress of these programs.

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August 1, 2023
November 8, 2023
November 28, 2023
December 20, 2023
January 31, 2024
March 25, 2024

## Tables

Table 1. Data sources, mapping years, methodology, and extent of each individual submerged aquatic vegetation (SAV) mapping event used to create the North Carolina SAV Mosaic, 1981 to 2021.

| Data Source | Mapping Year(s) | Methodology | Mapping Extent |
|---|---|---|---|
| Carraway & Priddy (1983) | 1981 | Maps of SAV were created from aerial natural color photography accompanied by ground truth data for verification including location and density. | 1981 (May): Bogue, Back and Core sounds |
| Ferguson & Wood (1994) | 1983, 1985, 1990, 1992 | SAV was delineated and mapped from natural color aerial photography with a minimum mapping unit of 20m. Accompanying field inventories were conducted within study regions to verify SAV signatures and species distribution and composition. | 1983 (Spring): Outer Banks from Ocracoke Inlet to Oregon Inlet<br>1985 (Spring): Core Sound<br>1988 (Spring): Core Sound, and behind Cape Hatteras from Hatteras to Avon<br>1990 (Fall): Currituck, Albemarle, Roanoke, and Croatan sounds, and Oregon Inlet to south of Pea Island<br>1991 (Fall): Pamlico River Estuary, Neuse River Estuary, western Pamlico Sound and Albemarle<br>1992 (Fall): Pamlico River, parts of eastern and western Pamlico Sound, and Albemarle Sound (Perquimans River) |
| Division Water Quality (now Water Resources) | 1998 | Maps from aerial photography. | Neuse River and tributaries |
| Elizabeth City State University | 2002-2003, 2006 | Maps from color aerial photography, accompanied by field survey point data to aid in photo interpretation were produced by the ECSU Remote Sensing Program. SAV polygons were generated using “heads up” digitizing on the computer monitor. | 2002 (October): Northern shoreline of Albemarle Sound and tributaries from Big Flatty Creek to Edenton Bay<br>2003 (October): Back Bay, Currituck Sound, and Kitty Hawk Bay<br>2006: Western Albemarle Sound |
| North Carolina State University | 2005 | Aerial photography from July 2005 accompanied by ground truth data. | 2005 (July): Southern shore of Albemarle Sound including Bull Bay to northern Croatan Sound |
| Division Water Quality Rapid Response Team (NCDEQ 2005, 2007) | 2005-2007 | Maps from interpolated transect data SAV was observed and collected using a garden rake from boat, traveling along the shoreline. | 2005 and 2006 (June-September): field surveys were conducted for the major tributaries of Neuse and Pamlico rivers<br>2007 (May-August): field surveys were conducted in the Neuse and Pamlico rivers and tributaries |
| Marine Corps Air Station Cherry Point (MCAS Cherry Point 2007) | 2007 | Field survey’s consisting of visual observations and underwater cameras in ≤ 6 ft depth of water. Aerial survey using hyperspectral imagery, collected on May 14, 2007, was analyzed in ENVI software using the Spectral Angle Mapper Classification method to identify SAV. | May 14, 2007: imagery data of Piney Island was collected<br>2007 (June-July): field surveys for Piney Island and Brant Island Shoal |

Table 1 (continued).

| Data Source | Mapping Year(s) | Methodology | Mapping Extent |
|---|---|---|---|
| Albemarle Pamlico National Estuarine Partnership & SAV Partners (APNEP 2019, 2019b) | 2006-2008 | SAV was mapped along the coast of NC and northward into Back Bay, VA by manually digitizing visible SAV from remotely sensed imagery. Digitizing scale was typically set at 1:1,500 with a minimum mapping unit set at 15 m. | This extent encompasses the coastal zone that lies within the APNEP regional boundary (Bogue Inlet north to Back Bay), as well as that which is outside of that boundary (Bogue Inlet south to Masonboro Inlet).<br>2006 (May-June): Bogue, Back, and Core sounds<br>2007 (September): Pamlico and Pungo rivers<br>2007 (October): coast wide except Bogue, Back and Core sounds<br>2008 (May-June): Bogue, Back, and Core sounds |
| | 2012-2014 | SAV was mapped along the coast of NC by manually digitizing visible SAV from remotely sensed imagery. Digitizing scale was typically set between 1:2,000 and 1:3,000 with a minimum mapping unit set at 15m. | This extent encompasses the high-salinity coastal zone that lies within the APNEP regional boundary (Hwy. 64 Bridge of Roanoke Sound south to Bogue Inlet).<br>2013 (May): Bogue, Back, and North Pamlico sounds |
| NCDMF & APNEP (NCDEQ 2015) | 2015 | SAV was mapped along the Southern coast of NC by manually digitizing visible SAV from remotely sensed imagery. | This extent encompasses the high-salinity coastal zone of Onslow Bay that lies south of the APNEP regional boundary. Imagery collected May 24, 2015 |
| APNEP SAV Partners (APNEP 2022) | 2019-2020 | SAV was mapped along the coast of NC by manually digitizing visible SAV from remotely sensed imagery. Digitizing scale was typically set between 1:1,500 and 1:3,000 with a minimum mapping unit set at 15 m. | This extent encompasses the high-salinity coastal zone that lies within the APNEP regional boundary (Hwy. 64 Bridge of Roanoke Sound south to Bogue Inlet), except for mainland Core Sound and multiple areas in Pamlico and Roanoke Sounds (see source metadata for detailed description).<br><br>All SAV was digitized from 2020 (May-June) imagery – 2019 imagery was uninterpretable for SAV. |
| NCDMF & APNEP (APNEP 2022b) | 2021 | SAV was mapped along the Southern coast of NC by manually digitizing visible SAV from remotely sensed imagery. Digitizing scale was typically between 1:1,500 and 1:2,000 with a minimum mapping unit set at 15 m. | This extent encompasses the high-salinity coastal zone of Onslow Bay that lies south of Bogue Sound and terminating near Mason's Inlet (Onslow, Pender, and New Hanover counties).<br><br>2021 (May): Bear Inlet south to Mason's Inlet |

Table 2. The known historic extent of mapped submerged aquatic vegetation (SAV) in North Carolina, 1981-2021.

| | | | Historic Extent SAV Habitat 1981-2015 | | Historic Extent SAV Habitat 1981-2021 | | Unprotected SAV Habitat 1981-2021 | |
|---|---|---|---|---|---|---|---|---|
| SAV Region | Salinity Zone | SAV Region Name | Acres | Percent (%) | Acres | Percent (%) | Acres | Percent (%) |
| 1 | Low | Currituck Sound & Back Bay | 21,613 | 11.3 | 21,613 | 11.3 | 81 | 0.4 |
| 2 | Low | Albemarle Sound | 12,872 | 6.7 | 12,872 | 6.7 | 5,422 | 42.1 |
| 3 | Low | Tar-Pamlico & Neuse rivers | 4,581 | 2.4 | 4,581 | 2.4 | 530 | 11.6 |
| 4 | High | Pamlico Sound | 712 | 0.4 | 712 | 0.4 | 490 | 68.8 |
| 5 | High | Roanoke Sound to Ocracoke Inlet | 101,739 | 53.2 | 103,856 | 53.2 | 19,693 | 19.0 |
| 6 | High | Core Sound | 36,862 | 19.3 | 37,645 | 19.3 | 13,095 | 34.8 |
| 7 | High | Back Sound to Sanders Island | 10,826 | 5.7 | 12,265 | 5.7 | 4,916 | 40.1 |
| 8 | High | Brown’s Inlet to Snow's Cut | 1,950 | 1.0 | 2,646 | 1 | 348 | 13.2 |
| 9 | High/Low | Cape Fear River to SC line | 0 | 0.0 | 0 | 0 | 0 | 0.0 |
| Total | | | 191, 155 | | 196,190 | | 44,576 | |

## Figures


Figure 1. Historic extent of submerged aquatic vegetation (SAV) habitat mapped in North Carolina, 1981 to 2021.

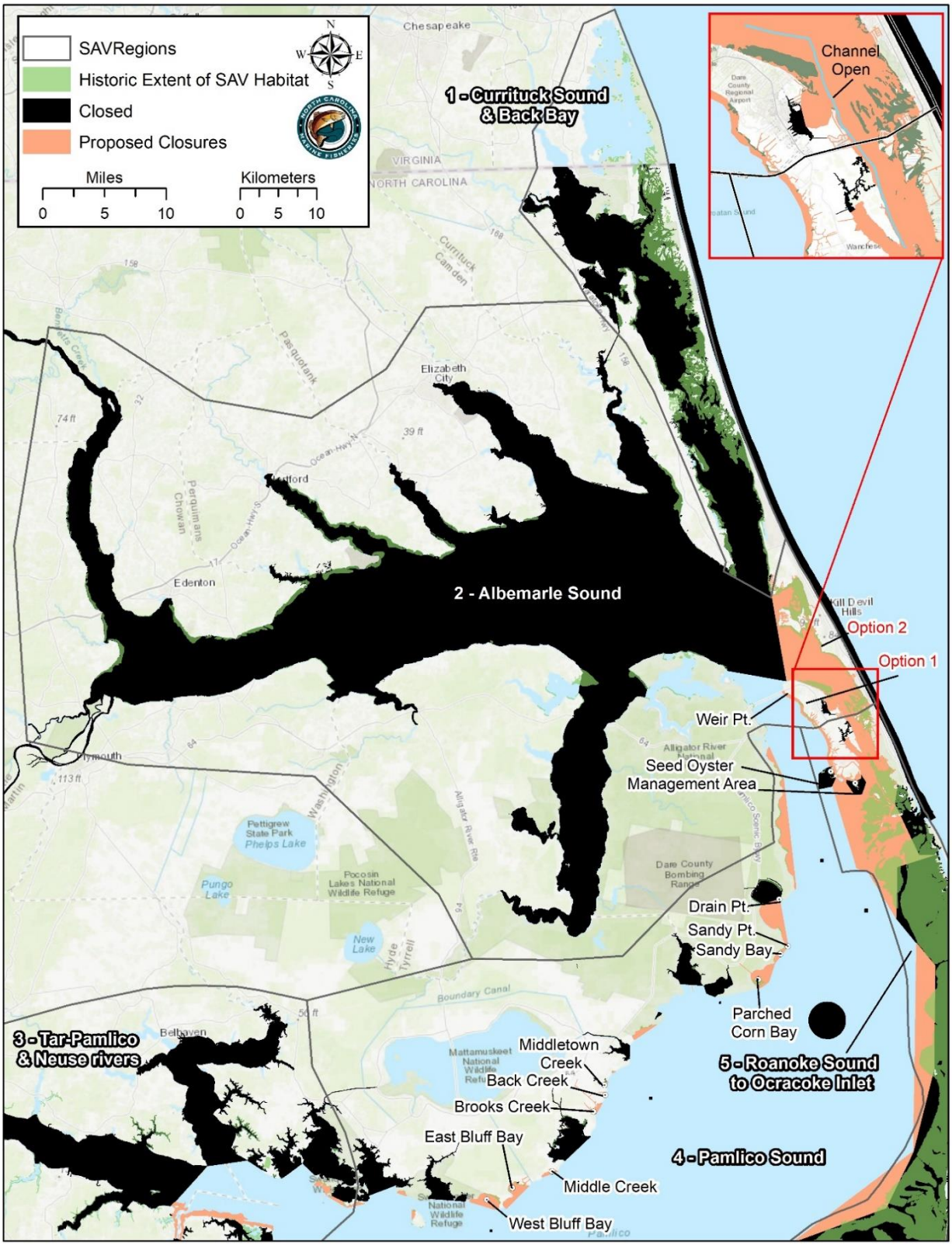


Figure 2. Proposed shrimp trawl closures in the Roanoke Sound (SAV Region 2) to protect submerged aquatic vegetation (SAV).

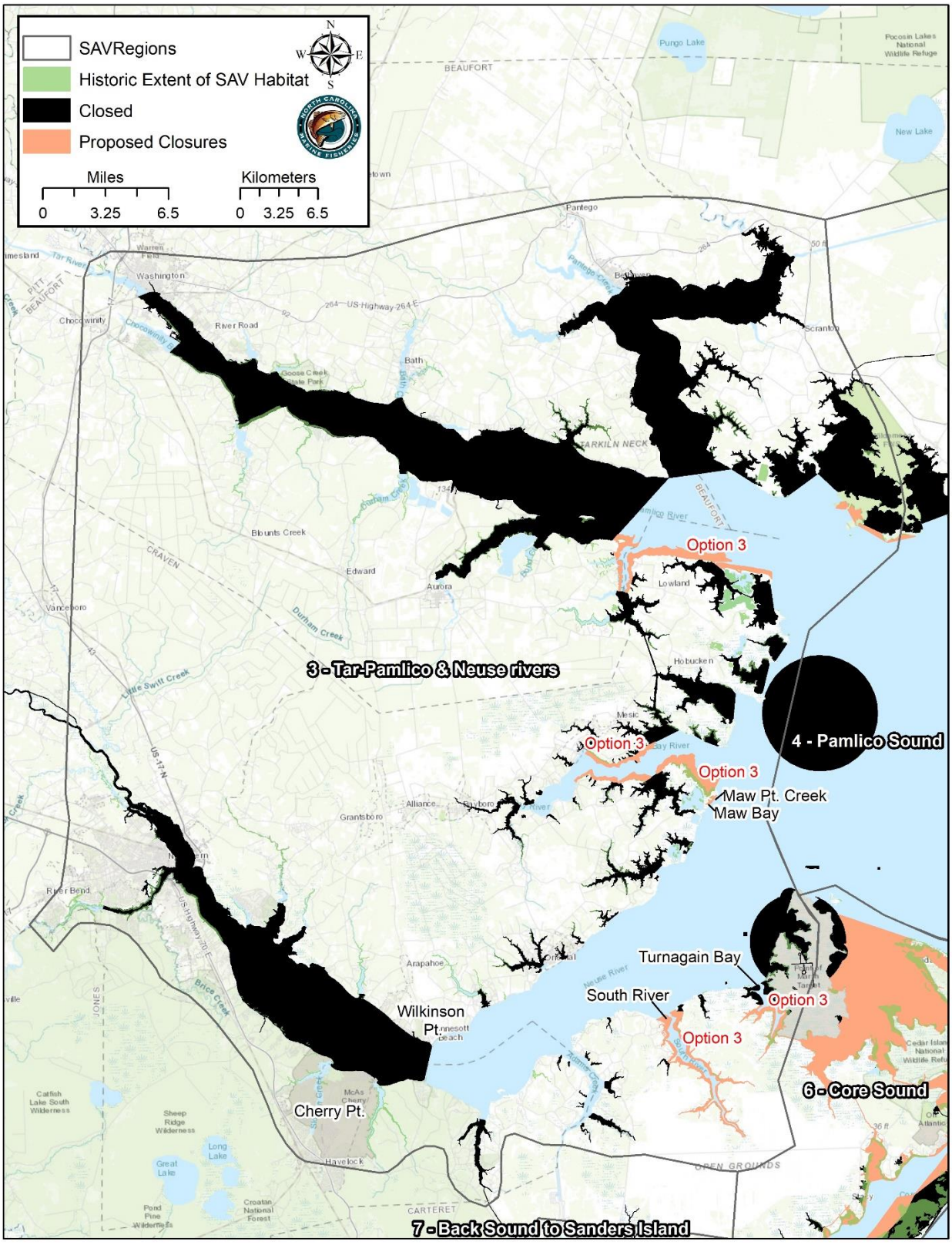


Figure 3. Proposed shrimp trawl closures in the Tar-Pamlico and Neuse rivers (SAV Region 3) to protect submerged aquatic vegetation (SAV).

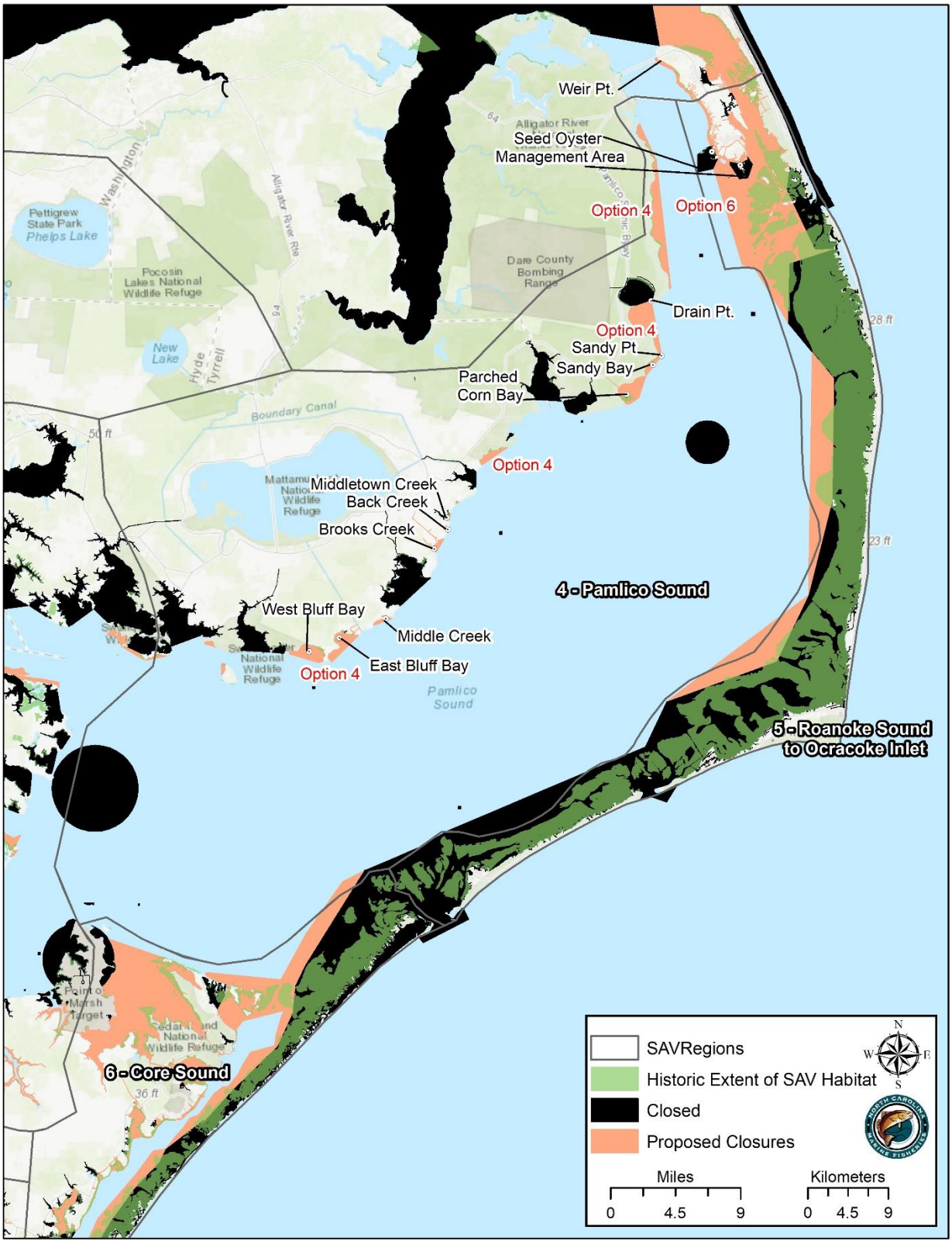


Figure 4. Proposed shrimp trawl closures in the Pamlico Sound (SAV Region 4) to protect submerged aquatic vegetation (SAV).

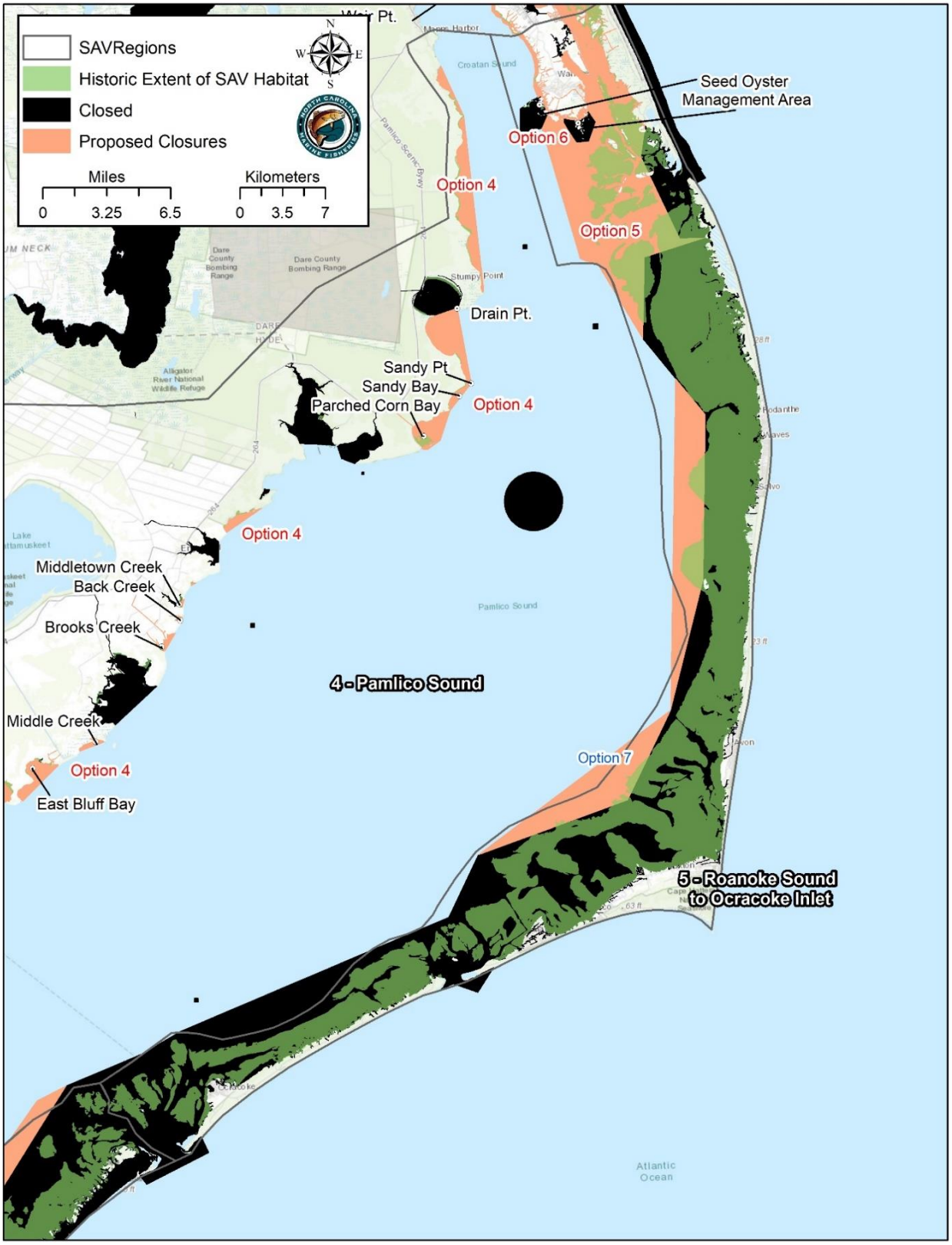


Figure 5. Proposed shrimp trawl closures from Roanoke Sound to Ocracoke Inlet (SAV Region 5) to protect submerged aquatic vegetation (SAV).

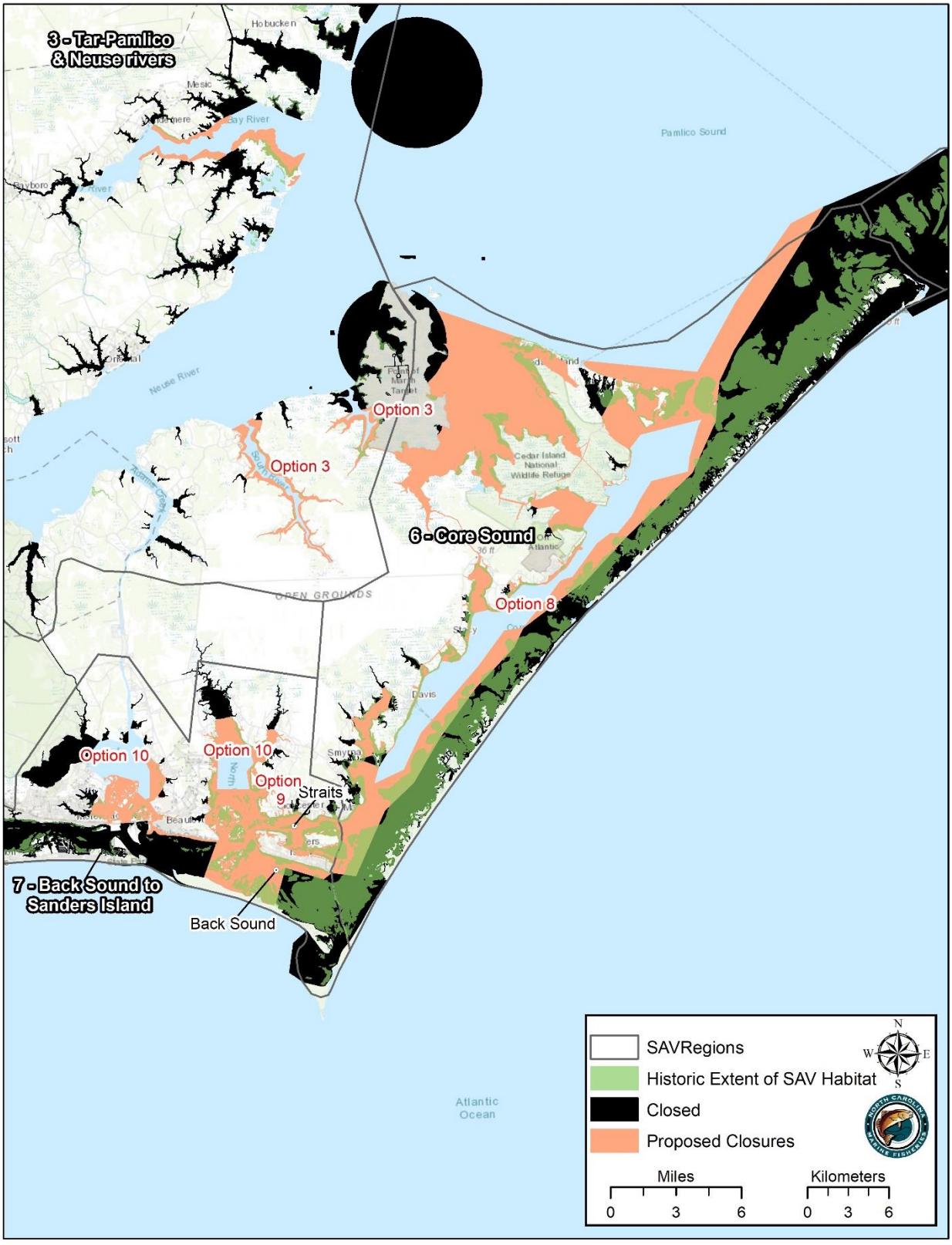


Figure 6. Proposed shrimp trawl closures in the Core Sound (SAV Region 6) to protect submerged aquatic vegetation (SAV).

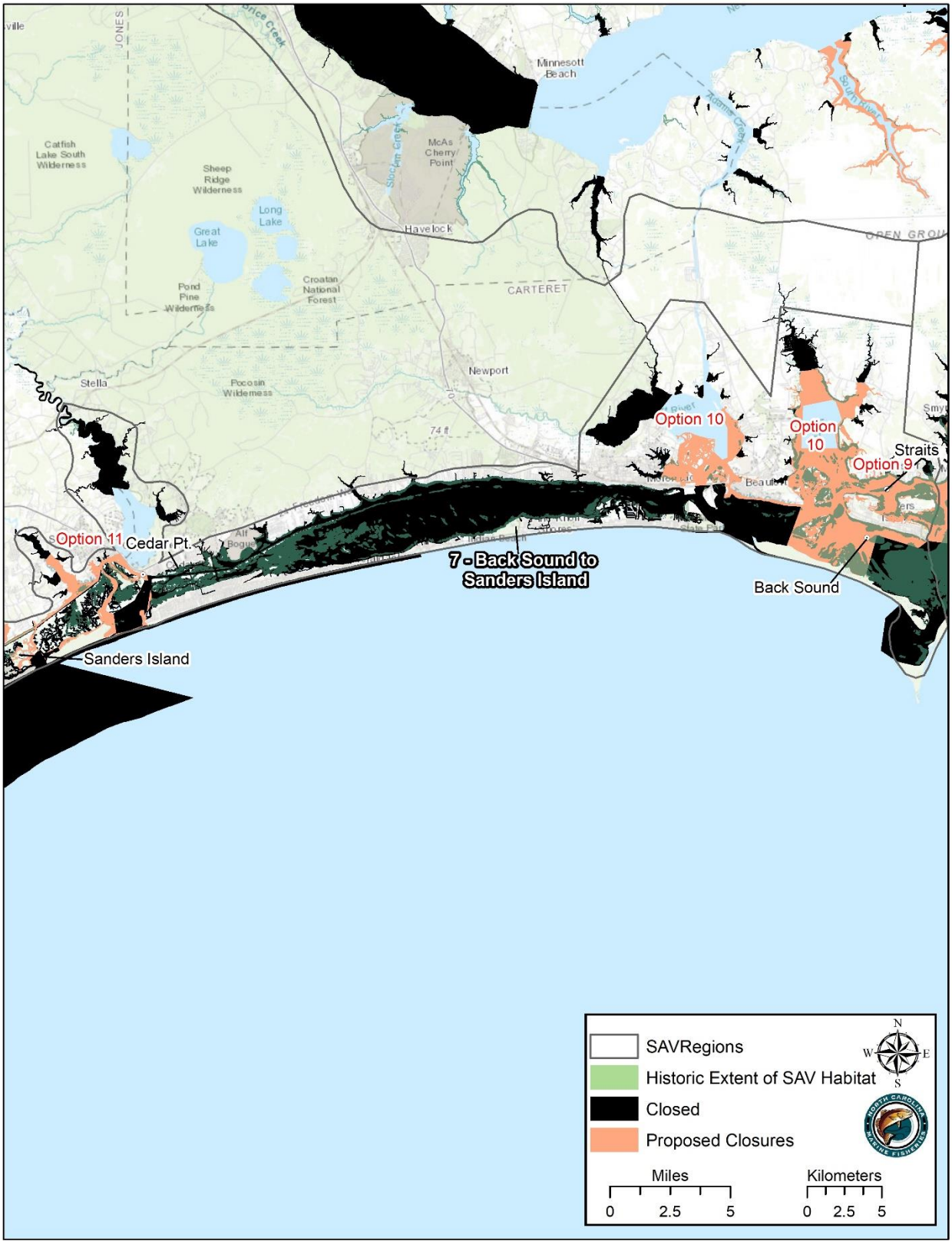


Figure 7. Proposed shrimp trawl closures from Back Sound to Sanders Island (SAV Region 7) to protect submerged aquatic vegetation (SAV).

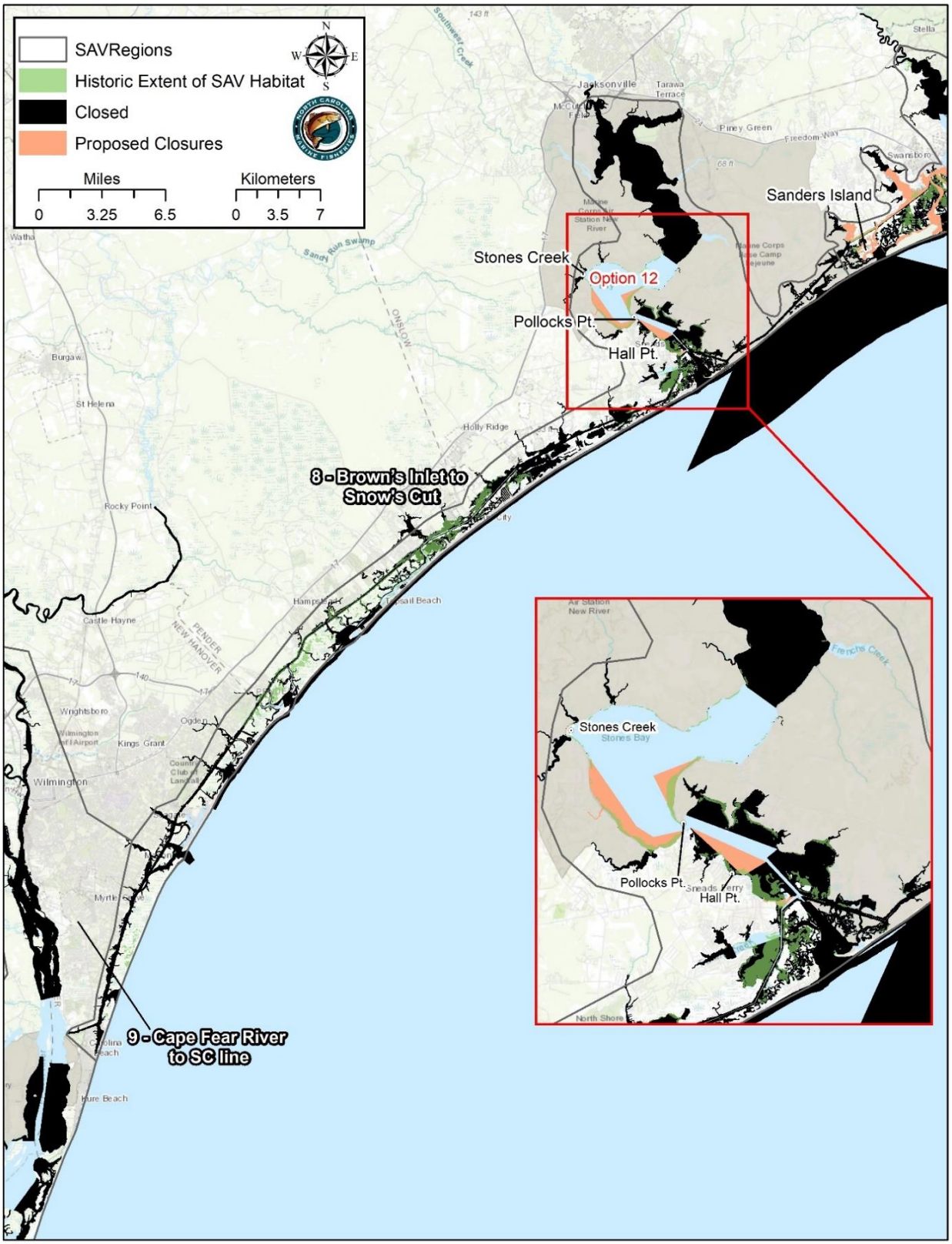


Figure 8. Proposed shrimp trawl closures from Brown's Inlet to Snow's Cut (SAV Region 8) to protect submerged aquatic vegetation (SAV).

To view the AGOL interactive map viewer for the *Protection of Critical Sea Grass Habitat Through Shrimp Trawl Area Closures* issue paper please click on the web address below or copy and paste it in your web browser.

https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=61f2b88f26f7416caba3000163231ce1

The app will automatically open with the proposed closures as well as the SAV mosaic. If you would like to view additional layers, click on the icon (three stacked squares) at the bottom of the screen. Within the layer list, you can click on the three dots to left of the title to adjust the transparency or hide the labels of any of the selected layers to better see the SAV mosaic. Both the layer list and the legend can be moved or closed by re-clicking the icons at the bottom of the screen. The measurement tool may be useful and can be found in the lower right corner (circle with ruler); to disengage the tool re-click on the circle.