Shellfish/Crustacean Standing Advisory Committee
Meeting via Webinar
January 17, 2023
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 October 25, 2022 **
6:10 p.m.	2023 Annual AC Orientation Presentation– Lara Klibansky
	- Discussion of Stock Assessment 101 Presentation
6:40 p.m.	Marine Fisheries Commission Update – Lara Klibansky
	- Striped Mullet FMP Supplement Update – Dan Zapf, Jeff Dobbs
7:20 p.m.	Blue Crab FMP Amendment 3 Revision: Consultation for Diamondback Terrapin Excluder Device Changes
7:45 p.m.	Public Comment
7:55 p.m.	Plan Agenda Items for Next Meeting
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

Oct. 26, 2022

MEMORANDUM

TO: Marine Fisheries Commission
Shellfish/Crustacean Advisory Committee

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

SUBJECT: Meeting of the Marine Fisheries Commission's Shellfish Crustacean Advisory Committee, October 25, 2022. 2023 Meetings Planning and Updates**.**

The Marine Fisheries Commission's Shellfish/Crustacean advisory committee (AC) held a meeting on Oct. 25, 2022, via webinar and in-person at the Division of Marine Fisheries, Central District Office, Morehead City, NC. Advisory Committee members could attend in either setting and communicate with other committee members whereas public comment could only occur via the in-person setting.

The following AC members were in attendance: Mike Blanton, Ana Shellem, Mary Sue Hamann, Doug Cross, Mike Marshall, Bruce Morris, Brian Shepard, Ted Wilgis, Tim Willis (Absent: Adam Tyler, Jim Hardin)

Division of Marine Fisheries (DMF) Staff: Lara Klibansky, Hope Wade, Debbie Manley, Corrin Flora, Tina Moore, Anne Deaton, Chris Stewart, Daniel Ipock, Steve Poland, Carter Witten, Jeff Dobbs

Public: None in attendance, six viewers watched on You Tube.

Shellfish/Crustacean Chair Mike Blanton called the meeting to order at 6:03 p.m.

Chair Blanton provided some general guidance for order of the meeting and noted the conflict of interest statement for Commissioners serving on the AC. Blanton asked the AC members to give an brief introduction.

A call for attendance was performed. The Shellfish/Crustacean AC had nine members present and quorum was met.

APPROVAL OF AGENDA AND APPROVAL OF THE MINUTES

A motion was made to approve the agenda by Mike Marshall. Second by Bruce Morris. The motion passed without objection.

A motion was made to approve the minutes from the Shellfish/Crustacean AC meeting held on October 19, 2021 by Ana Shellem. Second by Mike Marshall. The motion passed without objection.

MARINE FISHERIES COMMISSION UPDATE

Lara Klibansky gave an update on the newly appointed MFC commissioners and who they replaced. Pete Kornegay (science seat) left due to personal reasons and Dr. Doug Rader will continue his term until 2023. Ana Shellem is replacing Sam Romano (commercial seat) and Donald Huggins is replacing Tom Hendrickson (at-large seat). At the Finfish AC meeting on Oct. 20, 2022, Sarah Gardner was sworn in and will fill an at-large seat at the November business meeting.

Klibansky reminded everyone the AC solicitation period is open through Nov. 1. The DMF is looking for applicants for all five ACs and encouraged current AC members to reapply. The MFC chair will select AC members and staff will notify applicants by Dec. 1.

The Coastal Habitat Protection Plan (CHPP) was the last item this committee reviewed and approved. It was approved by all three commissions, and all recommended the development of a public/private partnership to help with research and outreach to implement CHPP actions. Several meetings since adoption of the CHPP have occurred and implementation of this plan is underway.

Next the committee was provided an overview of the May and August 2022 MFC business meetings. At the May meeting, the review of the N.C. River Herring Fishery Management Plan (FMP) was approved as an information update (not an amendment) because the Atlantic States Marine Fisheries Commission is currently conducting a stock assessment and it will be prudent to wait until the results of the assessment are finalized before making management changes. Amendment 3 to the Southern Flounder FMP was approved at the May meeting, completing the cycle for this plan. Results of the 2022 Striped Mullet Benchmark Stock Assessment were presented to the MFC at its May business meeting. The peer reviewed stock assessment indicates the N.C. striped mullet stock is overfished, and overfishing is occurring in the terminal year of the assessment (2019). At its November meeting, the MFC will be given the results of the scoping period for the review of the Striped Mullet FMP and vote to approve the goal and objectives of draft Amendment 2.

At the August meeting, the MFC tabled the final vote on the selected management measures for estuarine striped bass was tabled to give the new commissioners time to fully review the draft Amendment 2 to the FMP; the preferred management measures were approved at the May meeting. The DMF held two meetings in October to review the amendment with the newly appointed commissioners. The MFC is scheduled to select management measures for and give final approval of the Estuarine Striped Bass FMP Amendment 2 at its November business meeting.

The results of the 2022 stock assessment for spotted sea trout and outcome of the peer review will be presented as an informational update at the November meeting.

In May, the MFC was given a presentation on blue catfish. This is an issue several commissioners have brought up as a major concern due to their impact to other species, particularly in the Albemarle Sound. The DMF continues to actively collect data (diet, etc.) to determine their impact.

Dolphin (mahi mahi) was also discussed at the August meeting and the MFC asked the DMF to draft a letter opposing any new regulations (bag limits). At the August business meeting, the MFC asked that a white paper be developed for false albacore; concerns were raised because it is a highly migratory species with no regulations.

The November MFC meeting will be held at the Islander Hotel & Resort in Emerald Isle from Nov. 16th to the 18th.

Tim Willis asked for an update on the Coastal Conservation Association (CCA) lawsuit vs. the state of NC. Klibansky indicated that she could not comment ongoing legal cases at this time. Willis said the outcome would impact several of the issues that were just discussed.

2023 ANNUAL MFC ADVISORY COMMITTEE MEETINGS PLANNING

Klibansky reviewed the 2023 calendar and noted that in past years the AC did not meet unless there was something the MFC needed input on; however, moving forward we would like to meet on a regular basis to give updates and talk about less contentious topics. The next meeting with an action item will be October 2023 for the management of striped mullet. In January, there will be new AC members and the ACs will receive a presentation from one of the DMF stock assessment biologists to orient the new members. In the future we will alternate between Webex and in-person meetings; the schedule will be finalized once we received input from the ACs. Marshall indicated that he like the idea of meeting more regularly and thought it was important to interact with the members more frequently. Sue Hamann asked if AC members were required to attend commission meetings. Staff indicated that it is not required but AC members can always attend online. MFC updates will be given at each of the four planned AC meetings. Additional AC meeting may be held if requested by the AC.

FISHERY MANAGEMENT PLANS UPDATE

Corrin Flora gave an update on Amendment 3 to the Southern Flounder FMP, noting the 2022 season was based on management from the amendment and it may be a few months before the data is finalized. She noted that the division will not have the Marine Recreational Information Program (MRIP) data until the end of November. Staff noted that the recreational season ended in September and the commercial season is wrapping up and there have been some positive signs. There has also been positive sign in the fishery-independent data as well. Willis asked for more information on MRIP. Flora explained that MRIP is a federal program that produces catch and effort estimates for recreational fisheries. NC is one of the largest contributors to this program. Outreach materials and data is available online. Hamann asked about how the recent management measures have impacted the for-hire fleet. Staff indicated that there is legislation in place that limits our ability to use logbooks to collect data; thus, the landings and discard data are lumped in with all recreational harvest. MRIP does have a charter headboat survey that allows us to look at some of this data. Recently the division received a grant to conduct an economic study on the charter headboat fleet. The last survey was done 10 years ago; Klibansky will send this out to the AC.

For the 2022-2023 FMP Review Schedule, hard clam, oyster, striped mullet, estuarine striped bass, and spotted seatrout are under review; the review of river herring has concluded. The 2018 benchmark blue crab stock assessment will also be updated as part of adaptive management and will include data through 2022. The terminal year of the last assessment was 2016 and indicated that the stock was overfished and overfishing was occurring. The assessment update will add six years of data through 2022 with two to three years of management having occurred under the current FMP amendment. The DMF is also working with UNCW to evaluate new bycatch reduction devices (BRD) to reduce diamondback terrapin interactions in crab pots. The Shellfish/Crustacean AC will review this in early in 2023. Blanton noted the Commercial Fisheries Resource Fund Committee approved giving money to support additional testing of the devices. Flora noted that there were positive results from the current study with hope to expand the study statewide. The new BRD design, narrows the funnel of the pot down and doesn't require the addition of new gear. Cross indicated the need for this came about because the Monterey Bay Aquarium Seafood Watch added blue crab to their red list which restricts sales to high end markets and has crippled the crab meat picking market. Willis asked for an update on the terrapin abundance numbers. Flora indicated that the NC Wildlife Resource Commission conducts a survey and was recently expanded to 12 areas. Colonel Carter Witten with Marine Patrol noted there are two areas where BRDs are required from

Mar. 1 to Oct. 31st with great compliance. Staff further noted that many pot builders are incorporating the new funnel design in pots and BRDs are more readily available. If you need any additional details on this work contact Joe Facendola, DMF. Blanton asked when the data for the stock assessment update would be available. Flora commented that it will likely be ready by April 2023; a summary could be available as early as the July or August. Willis asked if the blue crab landings were down, noting that he had heard from some crabbers up north landings were low. Flora indicated that we review the indices and landings annually with our FMP reviews which can be found online. Klibansky will send a copy out as well. Willis also asked if shrimp landings were down and when the data would be available. Flora commented that shrimp are an annual crop so no stock assessment is done, but landings data can be found in the FMP update.

No management changes were deemed necessary for river herring; the information update is summarized in the 2022 FMP review and will serve as the five-year review of the plan. Staff are reviewing data and existing management for the Hard Clam and Oyster FMPs. Staff will bring information to the ACs in late 2023; a scoping period will likely begin around that same time. The MFC will review the preferred management measures for estuarine striped bass in November. Due to low juvenile abundance in the Albemarle-Roanoke stock the DMF conducted a stock assessment update. DMF and Wildlife Resources Commission staff are continuing to work on this update and based on the initial review of the results, the Director did not open the fishery in Albemarle Sound and continues to assess the subject.

For spotted seatrout, the peer review panel agreed the stock assessment was the best available data to manage the fishery. The assessment contains data up to 2019 and showed biomass was high and therefore not overfished, but overfishing is occurring. Hamann asked staff to define for overfished and overfishing. In early 2023 DMF will have scoping meetings for this plan.

Ted Wilgis asked when the AC would receive an update on the oyster FMP. Flora indicated staff are currently reviewing data and current management. We would like to further develop potential management strategies before bringing them out for scoping in October 2023. Hamann asked if there has been research investigating bird interactions and shellfish aquaculture, specifically fecal contamination from birds roosting. Witten indicated that this has been an issue in NJ. Staff indicated the Interstate Shellfish Sanitation Conference (ISSC) and Federal Drug Administration (FDA) have not established guidelines for this yet; however, the ISSC is now requiring growers to have a bird mitigation plan in their Aquaculture Operation Plan (AOP). Growers must comply or will not be able to transport product out of state. Marine Patrol and the Habitat Enhancement Lease Program enforce and oversee AOPs in NC. In March 2023, the ISSC will discuss this further. Cross noted that this is more of an issue for surface cages and is not an issue for bottom leases. Flora further noted that the amendment would only focus on wild oysters.

Next, Flora discussed striped mullet and said the stock is overfished, and overfishing is occurring in 2019. Because of stock concern the DEQ Secretary asked the MFC to work with DMF to implement a supplement. This will be in place until the next amendment is adopted. At the November meeting the MFC will review the scoping input and vote to approve the goal and objectives. The proposed management strategies for Amendment 2 include: Sustainable Harvest, Recreational Fishery Management, Small Mesh Gill net Management, Stop Net Fishery Management, and Migration Corridors. The DMF had three scoping meetings and an online questionnaire. Management actions in Amendment 2 will focus on ending overfishing and rebuilding the spawning stock biomass to provide sustainable harvest. The MFC will review the supplement in November and vote to approve it to go out for public comment. The supplement could be implemented as early as 2023. If all goes as planned the Amendment 2 could be in place as early as 2024 or 2025. Flora indicated the division is looking for Striped Mullet AC members and the AC will come up with recommendations in a workshop setting. Hamann asked what the publics' concerns were. Staff indicated concerns with the terminal year of the

assessment, lack of electrofishing data, inclusion of the gill net survey, and how the landings data is used. Dobbs noted inclusion of the new data made the model more stable; however, it did change the overall stock status. Flora noted that all assessments are taken out for peer review. Overall, all the concerns of the peer review panel were addressed and the assessment was deemed appropriate for management. We issue press releases for these workshops and the public is welcome to attend. Cross also expressed concerns that the electrofishing data was not included. Dobbs spoke on how data from the independent gill net survey was included which had better spatial coverage and statistical power than the electrofishing data, therefore including data from the electrofishing survey was redundant.

Dobbs gave an overview of the striped mullet scoping meetings. He noted people wanted adaptive management based on abundance indices, not landings as they are influenced by environmental conditions and market demands. Stakeholder expressed need for regional management, noting differences in migration patterns, gears, and markets across the state. Gill net minimum and maximum mesh size restriction as well as migration corridors have been suggested as potential management options. The MFC has not implemented any overarching gill net restrictions; however, will address these in species-specific plans. Dobbs asked the AC if they had any management ideas for Amendment 2 to the Striped Mullet FMP. Cross expressed the need to evaluate how other economic factors influence landings across all plans; further noting that fuel costs and other operating costs have recently reduced effort in the shrimp, scallop, and summer flounder trawl fisheries. Staff noted the division assesses landings and effort annually and the data can be found in the License and Statistic Big Book; commissioners will receive a copy at their November meeting. Klibansky noted she would provide the Big Book as well as the FMP updates to the AC at the January meeting. Blanton asked what options were included in the supplement. Staff noted the options are still being evaluated by the Director and we looking at an end of season closure in the supplement, but other options could be explored in the amendment. Blanton also asked if any tagging studies have been conducted recently. Dobbs gave a summary of study that was conducted in NC from 1998-2001 with returns into 2004; noting that over 14,000 were tagged with roughly 400 returns. There was high site fidelity and many of the fish tagged returned to where they were originally tagged after spawning in the ocean. While there were a few fish that migrated out of state, there is little evidence of long distance migration. Blanton expressed the need to conduct another tagging study to investigate escapement and improve the rate of recapture.

PUBLIC COMMENT

There was no public in attendance.

PLAN AGENDA ITEMS FOR THE NEXT MEETING

No items are planned at this time. Klibansky said the MFC ACs will not likely need to meet again until January 2023 when she will give an update on the outcome of the November MFC business meeting and the ACs will receive a presentation on stock assessments.

Blanton asked if at the January meeting, they could receive a presentation on adaptive management measures and how they have been incorporated into other plans, specifically how they may be applied to Amendment 3 to the Blue Crab FMP. Wilgis asked if the traffic light approach was still being used for the blue crab assessment. Flora indicated that it was a benchmark assessment. Additionally, Blanton asked for more information on Monterey Bay Aquarium Seafood Watch program, specifically how to be delisted. Klibansky said she would pull together some information for the January meeting. Cross indicated that what gets put on the list is highly influenced donor contributions.

Blanton asked Cross if he had any updates on the shellfish lease program. Cross indicated that AOPs have been streamlined and he would like to put off any updates until the January meeting. Klibansky noted

there will be a shellfish lease program update under the Director's report at November MFC meeting and will be included as a part of the January commission update. Wilgis asked for more information from DMF and NCSU on the oyster assessment methodology and timeline. Staff noted the NCSU research was not an assessment, but is providing survey methodology to capture estimates of oyster abundance and the data could be used to inform an assessment after a data stream of at least 10-years is completed.

Mike Blanton motioned to adjourn; it was seconded by Ana Shellem. The meeting adjourned at 7:53 p.m.

Memo

To: Shellfish/Crustacean Advisory Committee

From: Joe Facendola

Date: Nov. 30, 2022

Re: Amending the DMF approved terrapin excluder devices and gear modifications list for use in crab pots in Diamondback Terrapin Management Areas

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Amendment 3 to the Blue Crab Fishery Management Plan (FMP) included a framework for Diamondback Terrapin Management Areas (DTMA) management. Step one of the framework set approved biological reduction devices allowed in a DTMA. This step also allowed for additional or alternative devices and modified pot designs to be approved by the DMF in consultation with the Shellfish/Crustacean Advisory Committee, provided the device or design has been shown to reduce impacts to blue crab catch or cost to fishers and maintain the level of diamondback terrapin protection offered by the previously approved excluder devices (see Appendix for DTMA framework step 1).

Adding an Excluder Device Option

As an alternative to plastic or wire inserts which reduce the dimensions of crab pot funnels to limit terrapin bycatch, North Carolina crabbers proposed reducing the overall dimensions of crab pot funnels. This gear modification, referred to as "Narrow Funnel Design" (NFD), has an inner funnel opening with a circumference of 9 meshes (1.5 in. hexagon mesh) compared to a standard commercial crab pot funnel with an inner opening circumference of 12 meshes (Figure 1)

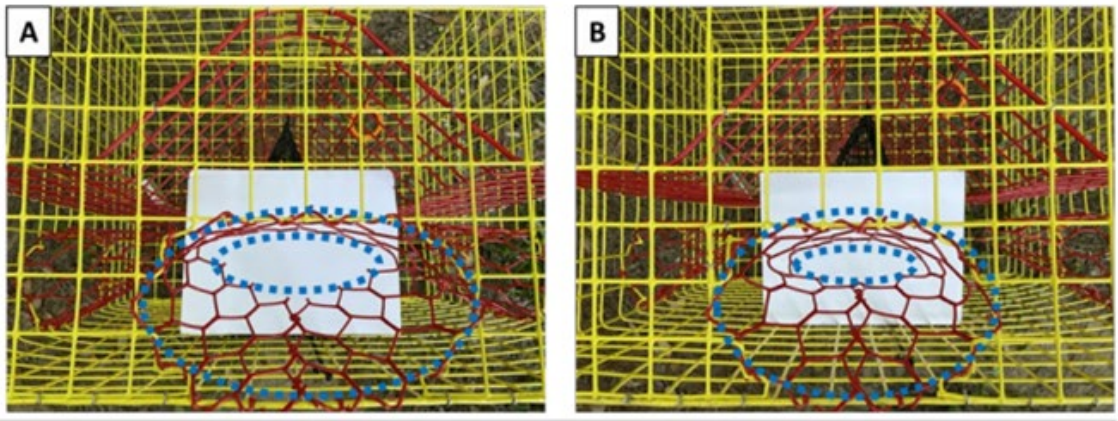

Figure 1. Crab pot funnels constructed out of 1.5 in. hexagon mesh. (A) "Standard Funnel" with an inner circumference of 12 meshes and an outer circumference of 14 meshes. (B) "Narrow Funnel Design" (NFD) with an inner circumference of 9 meshes and an outer circumference of 11 meshes.

In collaboration with the Division of Marine Fisheries (DMF) and a workgroup of commercial crabbing partners, researchers at the University of North Carolina Wilmington (Funded via a North Carolina Commercial Fishing Resource Fund Grant) developed and extensively tested the NFD approach in captive

tank trials, controlled field experiments, and fisheries-dependent observations to assess the effectiveness in reducing diamondback terrapin bycatch and determine any impacts to blue crab catch.

Initial tank experiments showed the NFD pot to be effective at reducing diamondback terrapin bycatch, with 12 of 17 diamondback terrapins used in captive trials entering crab pots with standard funnels and none entering NFD crab pots. (Published in: Wilson et al. 2022 Herpetological Conservation and Biology 17(1):76–84).

The fisheries-independent controlled experiment showed a significant reduction in the bycatch rate of diamondback terrapins per unit effort in NFD pots compared to standard crab pots, resulting in an overall 74% reduction in diamondback terrapin bycatch for NFD pots and a 49% reduction in bycatch from reinforced pots (pots which use 10-gauge wire to reduce and reinforce the funnel to 4x16 cm, meeting the currently approved criteria).

Results from both the experimental field trials and fishery-dependent observer trips showed no significant difference in blue crab catch per unit effort between NFD and standard crab pots (Figure 2). While not significantly different statistically, results from the observer commercial crabber trips show a slight trend towards higher blue crab catch rates in NFD pots.

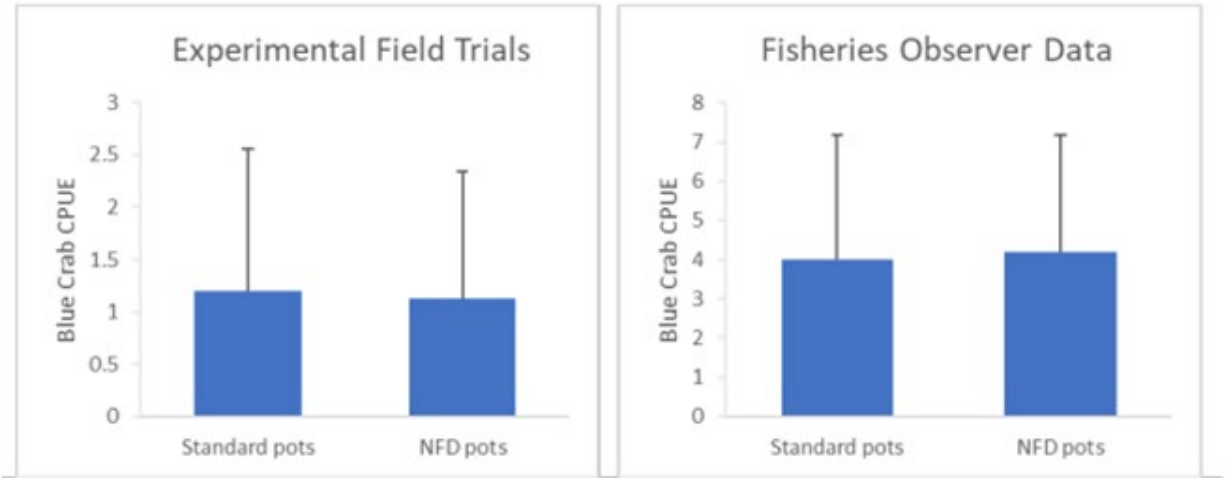

Figure 2. Blue crab CPUE for standard crab pots vs. NFD pots for both fisheries-independent field trials, and fisheries-dependent observer trips. There was no significant difference in CPUE between standard and NFD pots in either data set.

Results of the experimental trials also showed no significant difference in the size range of blue crab captured (Figure 3). The largest blue crabs captured during the field trials were from NFD pots. This gear modification can be done at the manufacturing stage of the crab pot and should not incur any additional cost or require increased gear handling time and maintenance.

Given the protection offered to diamondback terrapins by NFD, the minimal (none) negative impacts to blue crab catch, and the potential savings in cost to crabbers, the NFD meets all criteria in Amendment 3 for DMF approval for use in DTMAs.

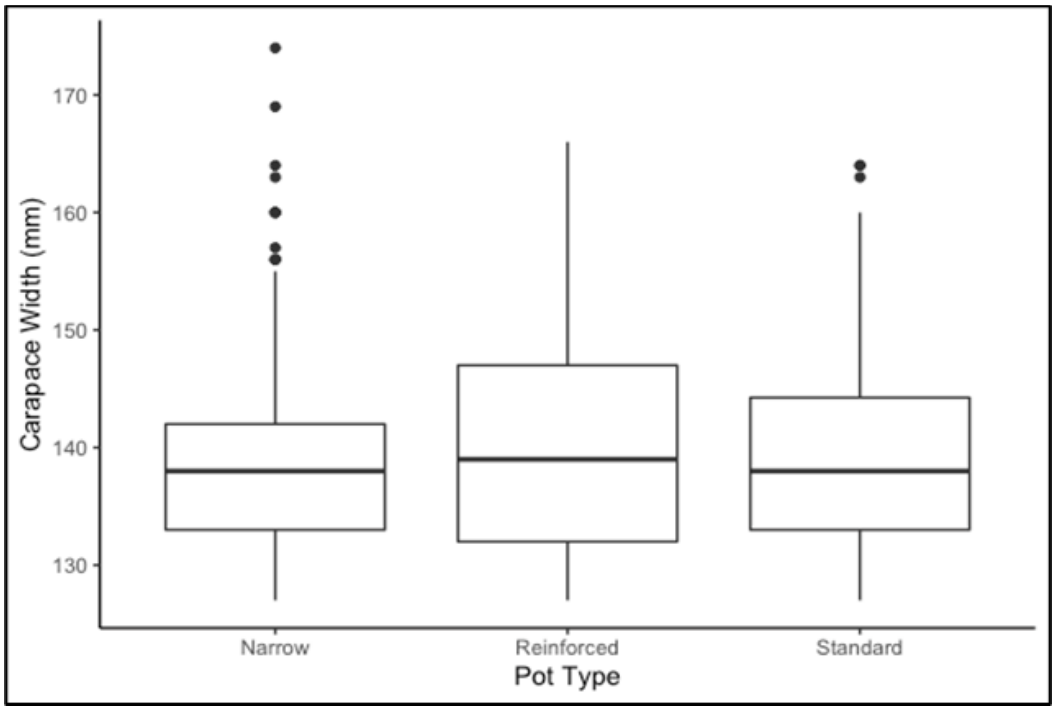

Figure 3. Carapace width of blue crabs caught in NFD, reinforced, and standard crab pots. There was no significant difference in carapace width between any of the pot types.

Removing an Excluder Device Option

The 4 x 16 cm (1.6 x 6.3 in.) pre-made plastic terrapin excluder device, while effective at reducing diamondback terrapin bycatch, has been shown to both reduce crab catch rate and size in many of the studies in which it was evaluated. This dimension excluder made with 10-gauge wire was shown to be relatively ineffective at reducing terrapin bycatch (only 49% reduction) during UNCW field trials. Removing the option to use a 4 x 16 cm (1.6 x 6.3 in.) plastic or 10-gage wire terrapin excluder as well as the above language which allows excluders devices to not be used, would address the enforcement concerns of Marine Patrol, and eliminate an option which may be both ineffective at bycatch reduction and have greater negative impact to blue crab catch.

Appendix

Step 1 DTMA framework summary:

Criteria defines the approved terrapin excluder device types and sizes required in crab pots fished within designated DTMAs. The following terrapin excluder devices shall be considered approved for use in DTMAs: any shell height limiting excluders made from at least 10-gauge galvanized wire and hog rings with an internal opening no larger than 4 x 16 cm (1.6 x 6.3 in.) height by width; any pre-made plastic shell height limiting excluder devices with an internal opening no larger than 4 x 16 cm (1.6 x 6.3 in.) height by width; or the pre-made plastic shell width limiting "SC design" measuring 5.1-6.4 x 7.5 cm (2-2.5 x 3.1 in.; Figure 4.5.1). Terrapin excluders will be securely affixed by at least each of the four corners of the device in each funnel opening of the crab pot, in a manner that restricts the maximum dimensions of any opening in the funnel. A separate terrapin excluder device would not be required in a crab pot fished within a DTMA

if all funnel openings in that pot were modified to measure no larger than the maximum internal opening of an approved excluder device, and the funnel openings are made rigid in a manner to maintain these dimensions. A diamondback terrapin bycatch reduction workgroup of fishers, academic researchers, and managers will be created. Additional or alternative terrapin excluder devices or modified pot designs recommended through the workgroup may be approved by the DMF, in consultation with the Shellfish/Crustacean Advisory Committee, provided they have been shown to reduce impacts to blue crab catch or cost to fishers and maintain the level of diamondback terrapin protection offered by the terrapin excluder devices initially approved and listed above. A revision to the current FMP Amendment will be developed as additional devices are approved.

APPENDIX 4.5: ESTABLISH A FRAMEWORK TO IMPLEMENT THE USE OF TERRAPIN EXCLUDER DEVICES IN CRAB POTS – *2023 Revision updates Step 1*

I. ISSUE

Establish a framework for developing proclamation use criteria and terrapin excluder specifications to reduce interactions of diamondback terrapins (*Malaclemys terrapin*) with crab pots. The 2023 revision modifies the approved device list set forth in Step 1 of the framework adopted in Amendment 3, to reflect results of the latest collaborative research on crabber sourced bycatch reduction solutions.

II. ORIGINATION

North Carolina Marine Fisheries Commission (NCMFC) selected management strategy in Amendment 2 of the Blue Crab Fishery Management Plan.

III. BACKGROUND

The NCMFC adopted Amendment 2 of the North Carolina Blue Crab Fishery Management Plan (FMP) in November 2013 (1). In this plan, the NCMFC recognized diamondback terrapins as a wildlife resource in need of protection from crab pot fishing activities under its jurisdiction and sought to proactively implement conservation measures to prevent localized diamondback terrapin depletions or extirpations through incidental bycatch from current or future activity in the blue crab fishery. To implement this selected management strategy, the NCMFC granted proclamation authority for the director of the North Carolina Division of Marine Fisheries (NCDMF) to require terrapin excluder devices to be used in crab pots. This proclamation authority was placed in NCMFC Rule 15A NCAC 03L .0204(b), which became effective April 1, 2014. This rule states the Fisheries Director may, by proclamation, require the use of terrapin excluder devices in each funnel entrance in crab pots and impose the following restrictions concerning terrapin excluder devices: specify areas; specify time periods; and specify means and methods.

This issue paper develops proclamation issuance criteria necessary to implement the NCMFC management strategy and proposes a framework by which the NCDMF would determine discrete "diamondback terrapin management areas" (DTMAs) where all crab pots fished within would be required to use NCDMF approved terrapin excluder devices or modified pot designs. Once accepted by the NCMFC, this framework would be used to determine appropriate locations of DTMAs across coastal North Carolina. The issue of incidental capture of diamondback terrapins and use of excluders to prevent terrapin bycatch in crab pots in the North Carolina blue crab fishery is thoroughly reviewed in the issue paper "Diamondback Terrapin Interactions with the Blue Crab Pot Fishery" in sections 11.12 and 12.1.5.2 of the 2013 Blue Crab FMP Amendment 2

Diamondback terrapins were moved from "Near Threatened" to the greater risk category "Vulnerable" on the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN) after their most recent assessment in 2018. Ongoing range-wide population

declines due to accidental mortality as bycatch in commercial Blue Crab fisheries, and coastal habitat impacts due to development were cited as primary justifications for moving this species into the increased risk category. The North Carolina Wildlife Resources Commission (NCWRC) lists diamondback terrapin as a North Carolina species of "Special Concern" statewide and as a Federal "Species of Concern" in Dare, Pamlico and Carteret counties in NC. The status of "Special Concern" or "Species of Concern" does not specifically provide any special protection under the federal Endangered Species Act, however the federal status may be upgraded to "Threatened" or "Endangered" if natural or human-made factors are affecting its continued existence, or there is an inadequacy of existing regulatory mechanisms in place (e.g. unmitigated mortality from bycatch in crab pots). In February 2011, the NCWRC Nongame Wildlife Advisory Committee received a report from the Scientific Council on Amphibians and Reptiles which recommended the diamondback terrapin be listed as "Threatened" (2). This report, citing a large body of evidence from numerous studies, concluded incidental bycatch in crab pots is the most serious threat to diamondback terrapins in North Carolina (3; 4; 5; 6). Seafood Watch, one of the best-known seafood consumer awareness programs, gives the North Carolina blue crab fishery their lowest rating of "Avoid", stating that serious concerns about the lack of implementation of any regulations to protect diamondback terrapins from bycatch in crab pots are the primary reason for this poor rating (7).

Diamondback terrapins are found throughout North Carolina's high salinity coastal marshes; however, all coastal areas do not contain suitable terrapin habitat (8). Diamondback terrapins are long-lived, late to mature, and display relatively low fecundity (9). Delayed sexual maturity and low reproductive rates, coupled with long life spans and strong site fidelity, make this species susceptible to substantial population declines or even localized extirpations through the incidental bycatch and removal of a relatively low number of individuals from the population annually (3; 6).

Genetic analysis (10) of diamondback terrapins sampled from Massachusetts to Texas suggests at least four major regional population groupings across this range, with North Carolina diamondback terrapins belonging to the Coastal Mid-Atlantic grouping. Although diamondback terrapins display high site fidelity, there is enough movement of individuals to maintain long term gene flow within these larger regional scales (10).

Several factors have been identified in determining the likelihood of diamondback terrapin bycatch in crab pots where crab fishing activities and diamondback terrapin occurrence overlap, such as: water depth and distance from shore (11; 12; 13; 14; 15), presence or dimensions of the excluder device (16; 17; 12; 15; 18; 19; 20; 21; 22), and the season which fishing occurs (11; 12; 13; 15; 23). Taking these factors into consideration, diamondback terrapin mortality from incidental bycatch in crab pots can be mitigated, reducing population impacts from localized and regional extinctions within North Carolina, and maintaining genetic connectivity across the Coastal Mid-Atlantic population.

Using the known factors affecting diamondback terrapin bycatch in crab pots, a highly targeted approach to reducing bycatch mortality with the least potential impact to the statewide blue crab fishery can be developed through the establishment of discrete regional DTMAs. This approach would be employed in lieu of either a statewide requirement for terrapin excluder devices to be

used on all crab pots, or the prohibition of crab pots from specific areas. This issue is being addressed as part of Amendment 3 instead of being implemented in between FMP amendments due to the scheduled review of the blue crab FMP moved to 2016/2017 on the schedule by the NCMFC in August 2016.

IV. AUTHORITY

North Carolina General Statute
113-134 RULES
113-182 REGULATIONS 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 Rules
15A NCAC 03H .0103 PROCLAMATIONS, GENERAL
15A NCAC 03J .0301 POTS
15A NCAC 03L .0201 CRAB HARVEST RESTRICTIONS
15A NCAC 03L .0204 CRAB POTS

V. DISCUSSION

Step 1 Determine NCDMF approved terrapin excluder device types and sizes or gear modifications to be required

Multiple researchers across the range of diamondback terrapins have examined the effectiveness of terrapin excluder devices, also known as a bycatch reduction device, and their impact on the catch of blue crabs in the pot fishery. Table 4.5.1 provides a summary of these field studies by state. Across all studies the largest reduction in diamondback terrapin bycatch or the largest percent of potential diamondback terrapin exclusion typically occurred using terrapin excluder devices with the smallest vertical opening dimensions (Table 4.5.1). Impacts of terrapin excluder devices to crab catch ranged from 25.7% increased catch rates (24) to a 29% reduction in crab catch rates (25), as well as reduction in the average carapace width of crabs captured (20; 21). Numerous studies have also concluded that specific dimensions of terrapin excluder devices result in no significant reduction in size or catch rate of blue crabs when compared to control pots without terrapin excluder devices. However, some studies that did not find statistically significant differences in crab catch or sizes between control pots and pots with terrapin excluders did acknowledge a trend towards a reduced blue crab catch when terrapin excluders are in place (18; 19). Longer blue crab retention times in pots which employed excluder devices has been shown to mitigate catch rate impacts from lower numbers of crabs entering pots with excluders, resulting in no net loss in overall catch (20). However, from a theoretical modeling approach, which analyzed over 8,000 possible terrapin excluder dimensions (between 3.2 x 5.1 cm and 16 x 16 cm) compared to field collected morphometric dimension of terrapins, the overall excluder opening area followed by the diagonal excluder opening dimension were found to have the greatest predictive relationship with the exclusion of terrapins (22).

Shell height has often been concluded to be the determining dimension in the exclusion of diamondback terrapins from crab pots (16), and across multiple studies rectangular excluders with a vertical opening of 4 cm (1.6 in) or less have been the most effective (Table 4.5.1). In one Virginia study, excluders which prevent terrapins from entering based on shell height were shown to allow the same number of terrapins to be captured in pots when compared to those which prevent entry based on shell width, however based on terrapin measurements simultaneously captured in pots without excluders, the devices which limited by shell width had greater potential exclusion (21). Requiring the use of a terrapin excluder device which restricts entry based on shell height, with a horizontal width less than 16 cm (6.3 in.), the typical width of a crab pot throat, may not result in any additional reduction in diamondback terrapin bycatch if the horizontal opening of the device is no larger than 4 cm (1.6 in.). In North Carolina a 4 x 16 cm (1.6 x 6.3 in.) excluder was shown to offer 100% reduction in potential terrapin capture (15). In South Carolina a relatively square shaped "SC design" excluder with a slightly curved top and bottom 5.1-6.4 x 7.3 cm (2-2.5 x 2.9 in.) which restricts entry based on shell width, would exclude 33% more terrapins than two other commonly tested excluder devices, 5 x 10 cm (2 x 3.9 in.) and 4.5 x 12 cm (1.8 x 4.7 in.), and by increasing the width of this device of 0.4 cm (0.5 in.) 99% of legal-size blue crab would be captured (22).

Excluder devices made of 11-gague wire have been tested and have been recommended as an option in Virginia. However, crab pots with 11-gauge wire excluders do allow in large terrapins and wire excluders must be constructed of a gauge heavy enough to maintain rigidity (20). In controlled field experiments in North Carolina, crab pots which used 10-gauge wire inserts to create a rigid funnel entrance to no more than 4 x 16 cm (1.6 x 6.3 in.) had a 49% reduction in terrapin catch when compared to control pots with standard dimension unmodified funnels (26).

The effect of excluder orientation has also been examined. In a controlled aquarium setting, McKee et al. (27) tested the effect of a 5 x 15.2 cm (2 x 6 in.) excluder device mounted both horizontally and vertically on diamondback terrapin entry to crab pots. They found that although there was a 17.5% reduction in diamondback terrapin entries into pots with a horizontally mounted excluder when compared to control pots without an excluder, this difference was not statistically significant. However, the vertically mounted excluder did result in significantly lower amount of diamondback terrapin pot entries and significantly longer entry times when compared to both control and pots with horizontally mounted excluders.

Diamondback terrapins display sexual dimorphism in size, with males not growing as large in shell height and length as females. Small diamondback terrapins of either sex are vulnerable to capture. However, females grow to a shell height which prevents them from entering typical crab pots by the time they reach eight years of age, with mature males possibly remaining vulnerable to pot entrapment throughout their life (4). This difference in growth rate and ultimate size difference between the sexes leaves young individuals (both sexes) and males more vulnerable to capture in crab pots when using some terrapin excluder devices. The selective removal of juveniles and males can lead to localized alterations in both population age structure and sex ratios, which can threaten the survival of the population (6). Due to geographic variation in diamondback terrapin body size, local evaluation of effective terrapin excluder device size may be required (28).

Hart and Crowder (15) in Jarrett Bay, off Core Sound, North Carolina, found using a 4 x 16 cm (1.6 x 6.3 in.) terrapin excluder device would have excluded 100% of all diamondback terrapins encountered during their research, however this would result in a 26.6% reduction in all legal sized male blue crabs captured, a 4.5 x 16 cm (1.8 x 6.3 in.) terrapin excluder device would have potentially excluded 77% of the total diamondback terrapins (100% female, 70% male) while reducing the legal male blue crab catch by 21.2%, and a 5 x 16 cm (2 x 6.3 in.) terrapin excluder device would have potentially excluded 28% of the total diamondback terrapins (50% female, 10% male). Based on pooled shell height data from diamondback terrapins captured by Southwood et al. (29) in Masonboro and Middle Sounds, North Carolina, a terrapin excluder device with a height of 4 cm (1.6 in.) would have excluded 91% of all diamondback terrapins (100% female, 80% male), a terrapin excluder device with a height of 4.5 cm (1.8 in.) would have excluded 51% of all diamondback terrapins (93% female, 0% male), and a terrapin excluder device with a height of 5 cm (2 cm) would have excluded 40% of the all diamondback terrapins (73% female, 0% male). Hart and Crowder (15) recommend the statewide adoption of a 4.5 cm (1.8 in.) height terrapin excluder device, as it offered high diamondback terrapin protection at a lower loss of blue crab catches. This size terrapin excluder device would have prevented the bycatch of 93% of female diamondback terrapins, but 0% of male diamondback terrapins sampled by Southwood et al (29). Chavez and Southwood Williard (19) examined the effects of "large" 5 x 15 cm (2 x 6 in.) and "small" 3.8 x 15 cm (1.5 x 6 in.) terrapin excluder devices on the catch of blue crab and diamondback terrapins at multiple sites around Beaufort, NC. They concluded that neither size resulted in a significant reduction in the number nor carapace width of blue crabs caught when compared to pots without terrapin excluder devices and resulted in a potential 86% (100% female, 0% male) to 100% reduction in diamondback terrapins captured, respectively. Chavez and Southwood Williard (19) did comment that although there was no statistically significant reduction in blue crab catch numbers, there is a trend toward catch reduction in pots fitted with the smaller terrapin excluder device.

Most terrapin bycatch reduction research has focused on developing various inserts to reduce the inner entrance of crab pot funnels (Figure 4.5.1). Terrapin excluders must be securely affixed by at least each of the four corners of the device in each funnel opening of the crab pot to be effective (Figure 4.5.2). Pre-made plastic shell height limiting style terrapin excluder devices have been commercially available from manufacturers such as Top-Me Products. However, the price per excluder device has varied greatly between retail sources ($0.25 to $4.00) and the continued availability of the smaller opening, more effective excluder device is uncertain. The "SC design" is not yet widely available via retail, requiring a custom order through at least one manufacturer of plastic signs. An alternative to pre-made plastic excluders, inserts can be made relatively inexpensively by using 10-gauge (or thicker) wire and hog rings. Both pre-made plastic and wire and hog ring excluders result in additional per-pot cost to crabbers and require additional gear handling time to install.

As an alternative to inserts, North Carolina crabbers proposed reducing the overall dimensions of crab pot funnels. This gear modification, referred to as "Narrow Funnel Design" (NFD), has an inner funnel opening with a circumference of 9 meshes (1.5 in. hexagon mesh) compared to a standard commercial crab pot funnel with an inner opening circumference of 12 meshes (Figure 4.5.3). The University of North Carolina Wilmington in partnership with commercial crabbers and NCDMF evaluated NFD pots through, tank trials, fisheries-independent controlled field

experiments, and fisheries-dependent field trials observing commercial crabber trips in southeastern North Carolina.

Tank experiments showed the NFD to be effective at reducing terrapin bycatch, with 0 of the total 17 terrapins tested entering crab pots with NFD, while 12 entered pots with standard funnels during the captive trials (30). The fisheries-independent controlled experiment showed a significant reduction in the bycatch rate of terrapins per unit effort in NFD pots compared to standard crab pots, resulting in an overall 74% reduction in terrapin bycatch for NFD pots (109 captured in standard pots, 28 captures in NFD pots) (26). Results from both the experimental field trials and fishery-dependent observer trips showed no significant difference in blue crab catch per unit effort, or in mean carapace width of blue crabs caught in NFD and standard crab pots. Additionally, the largest sized blue crabs captured during the field trials were from NFD pots (26). While not statistically significantly different, the results from observing commercial crabbers do show a trend towards higher blue crab catch rates in NFD pots (26). This gear modification can be done at the manufacturing stage of the crab pot and should not incur any additional cost or require increased gear handling time and maintenance.

As some terrapin excluder devices have been demonstrated to reduce the efficiency of crab pots, crabbers may respond by increasing the total number of pots fished in an area to offset reductions in crab catch, resulting in an increase in the potential for diamondback terrapin interactions within the DTMAs. The possibility for increased localized crab pot effort as a response to the requirement to the use of terrapin excluder devices highlights the need to employ the most effective terrapin excluder devices which also have the least impact to blue crab catch.

2023 Revision – Updated List of Approved Devices

The best current available data from diamondback terrapin and blue crab research should be used when considering the dimensions and type of excluder devices to be approved by NCDMF, and to be required for use in DTMAs. Arendt et al. (22), when modelling diamondback terrapin exclusion probabilities for the range of device dimensions tested and published in the literature since 1994, determined the 4 x 8 cm (1.6 x 3 in.) shell height limiting excluder followed by the "SC design" 5.1-6.4 x 7.7 cm (2-2.5 x 3.1 in.) shell width limiting excluder to be the most effective at reducing the probability of diamondback terrapin entry into crab pots. These exclusion probabilities were calculated using dimensions from blue crabs and diamondback terrapins captured in South Carolina. As regional variation in morphometric length x width relationships as well as size distributions may exist for both blue crabs and diamondback terrapins, the exact reductions in diamondback terrapin capture and impacts to blue crab catch may likely be site specific for each excluder dimension. In North Carolina field studies, excluders which limit based on shell height, with an opening no more than 4 cm vertical height and no more than 16 cm horizontal width (1.6 x 6.3 in.) have been shown to offer the greatest protection to both male and female diamondback terrapins, however this size excluder device is shown to significantly impact blue crab catch rates and size in pots where they are employed (see Table 4.5.1). When examining the size distribution of diamondback terrapins captured in North Carolina by researchers at the University of North Carolina Wilmington, both a height limiting excluder with a vertical opening of no greater than 4 cm (1.6 in.) and the "SC design" 5.1-6.4 x

7.7 cm (2-2.5 x 3.1 in.) shell width limiting excluder would appear to prevent the bycatch of the majority and most frequent size ranges of terrapins captured in North Carolina (Figure 4.5.4). The excluder device selected for use in DTMAs should provide significant bycatch reduction to terrapins while minimizing impacts to blue crab catch if possible. As the 5.1-6.4 x 7.7 cm (2-2.5 x 3.1 in.) "SC design" excluder device offers the highest level of bycatch protection for terrapins with minimal impact to blue catch, this device should be approved for use as bycatch reduction method in any proposed DTMAs. The approved terrapin excluder will be securely affixed by at least each of the four corners of the device in each funnel opening of the crab pot, in a manner that restricts the maximum dimensions of any opening in the funnel to that of the internal opening dimensions of the approve excluder device. As an alternative to a mounted excluder device, modified NFD pots should also be approved for use as a bycatch reduction method in any proposed DTMA. This gear modification has been extensively tested in southeastern North Carolina and has been shown to significantly reduce terrapin bycatch while having no significant impact to blue crab catch rates or sizes. To be considered a NFD pot, all funnel entrances of the pot are constructed out of 1.5 in. hexagon mesh, with each funnel having an inner opening of a circumference of no more than 9 hexagon meshes and an outer opening of a circumference of 11 hexagon meshes.

To allow for collaboration between stakeholders, NCDMF a diamondback terrapin bycatch reduction workgroup consisting of North Carolina fishers, academic researchers, and fishery managers should be formed. This workgroup may review and test existing excluder devices or work in partnership to examine novel bycatch reduction designs to minimize the impact to blue crab catch while reducing terrapin bycatch. Recommendations on additional excluder devices or modified pot designs by the workgroup will be considered for approved use in DTMAs by the NCDMF in consultation with the Shellfish/Crustacean Advisory Committee. To be considered for approval by the NCDMF, the other devices or modified pot designs must be shown to reduce impacts to blue crab catch or cost to fishers and maintain a level of diamondback terrapin protection offered by existing approved excluder devices.

<u>This will be a paragraph explaining S/C AC outcomes in Jan 2023</u>

Step 1 Summary:(*2023 Revision Updated*)
Criteria defines the **approved terrapin excluder device types and sizes required or gear modifications in crab pots fished within designated DTMAs**. The following terrapin excluder device and shall be considered approved for use in DTMAs: the pre-made plastic shell width limiting "SC design" measuring 5.1-6.4 x 7.7 cm (2-2.5 x 3.1 in.; Figure 4.5.1, C). Terrapin excluders will be securely affixed by at least each of the four corners of the device in each funnel opening of the crab pot, in a manner that restricts the maximum dimensions of any opening in the funnel. The following gear modification shall be considered for approved use as an alternative to excluder devices in DTMAs: "Narrow Funnel Design" (NFD) pots, where all funnel entrances of the pot are constructed out of 1.5 in. hexagon mesh, with each funnel having an inner opening of a circumference of 9 hexagon meshes and an outer opening of a circumference of 11 hexagon meshes (Figure 4.5.3, B). A diamondback terrapin bycatch reduction workgroup of fishers, academic researchers, and managers will be created. Additional or alternative terrapin excluder devices or modified pot designs recommended through the workgroup may be approved by NCDMF, in consultation with the Shellfish/Crustacean Advisory Committee, provided they have

been shown to reduce impacts to blue crab catch or cost to fishers and maintain the level of diamondback terrapin protection offered by the terrapin excluder devices initially approved and listed above. A revision to the current FMP Amendment will be developed as additional devices are approved.

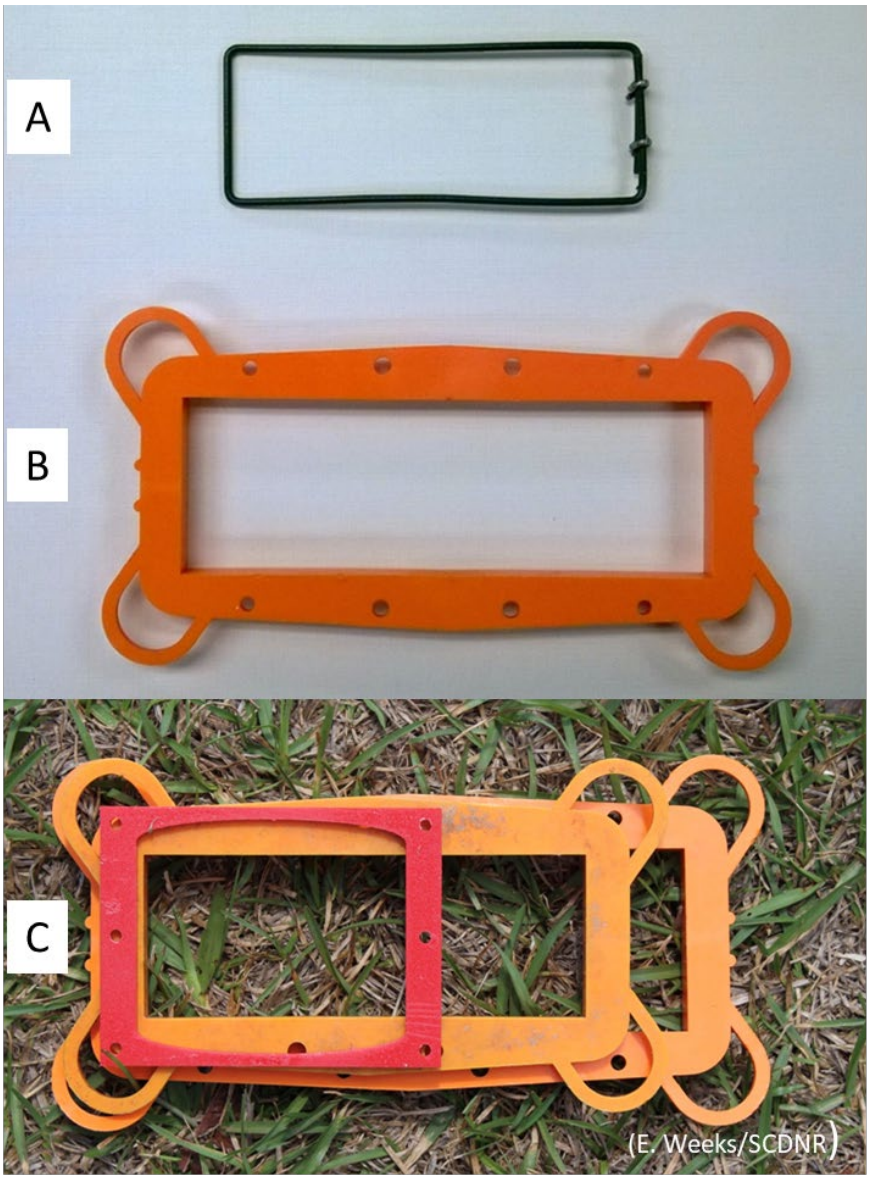

Figure 4.5.1. Examples of terrapin excluder devices for use in crab pots include: (A) wire and hog ring excluder made by a crab pot manufacturer, (B) premade plastic excluder made by Top-Me Products, (C) plastic "SC design" excluder, a shell width limiting device (red) shown on top of two premade plastic shell height limiting devices (photo credit: E. Weeks/SCDNR).

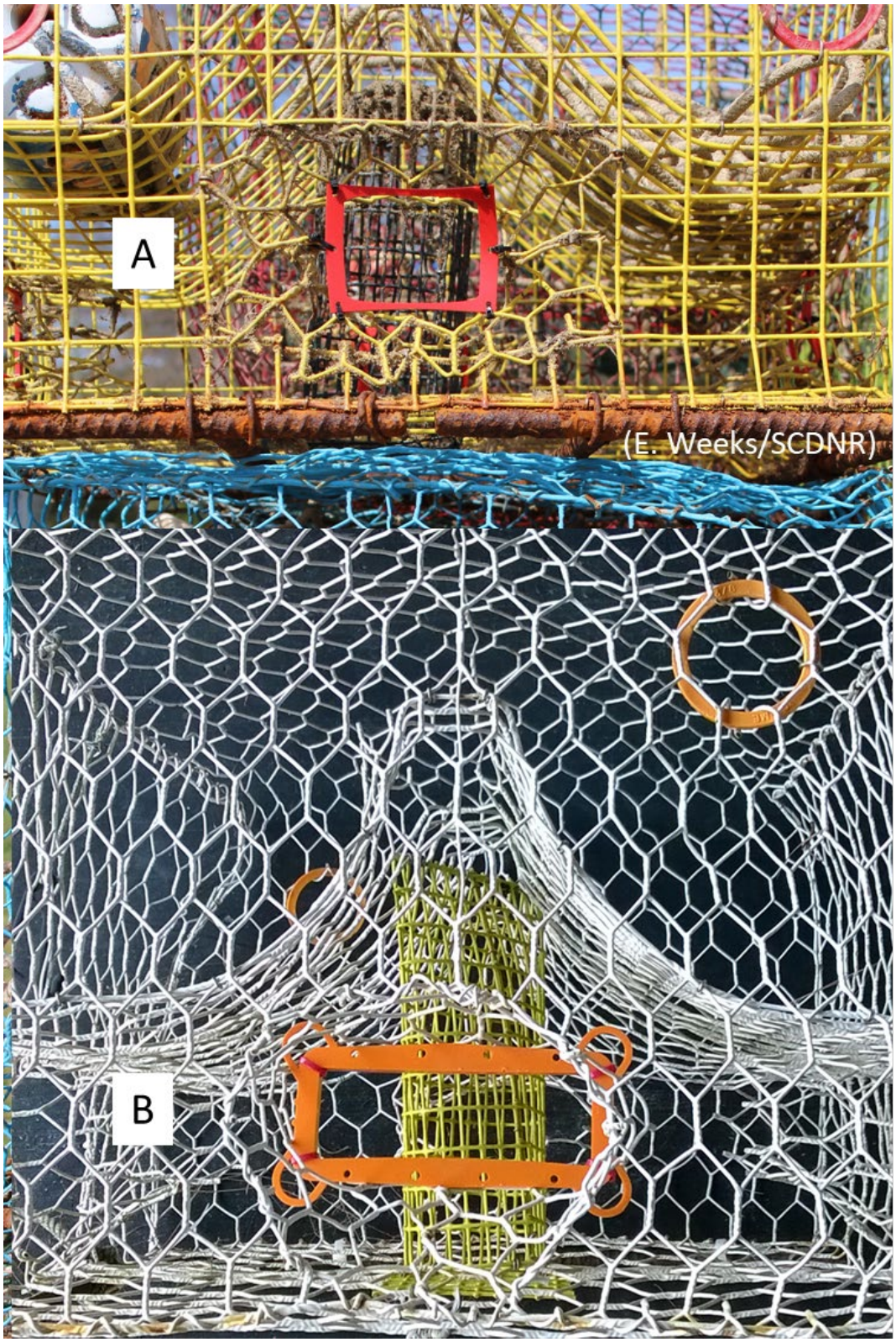

Figure 4.5.2. Premade plastic diamondback terrapin excluder devices shown inside one entrance funnel opening of crab pots. (A) The "SC design" shell width limiting excluder. (B) A shell height limiting excluder.

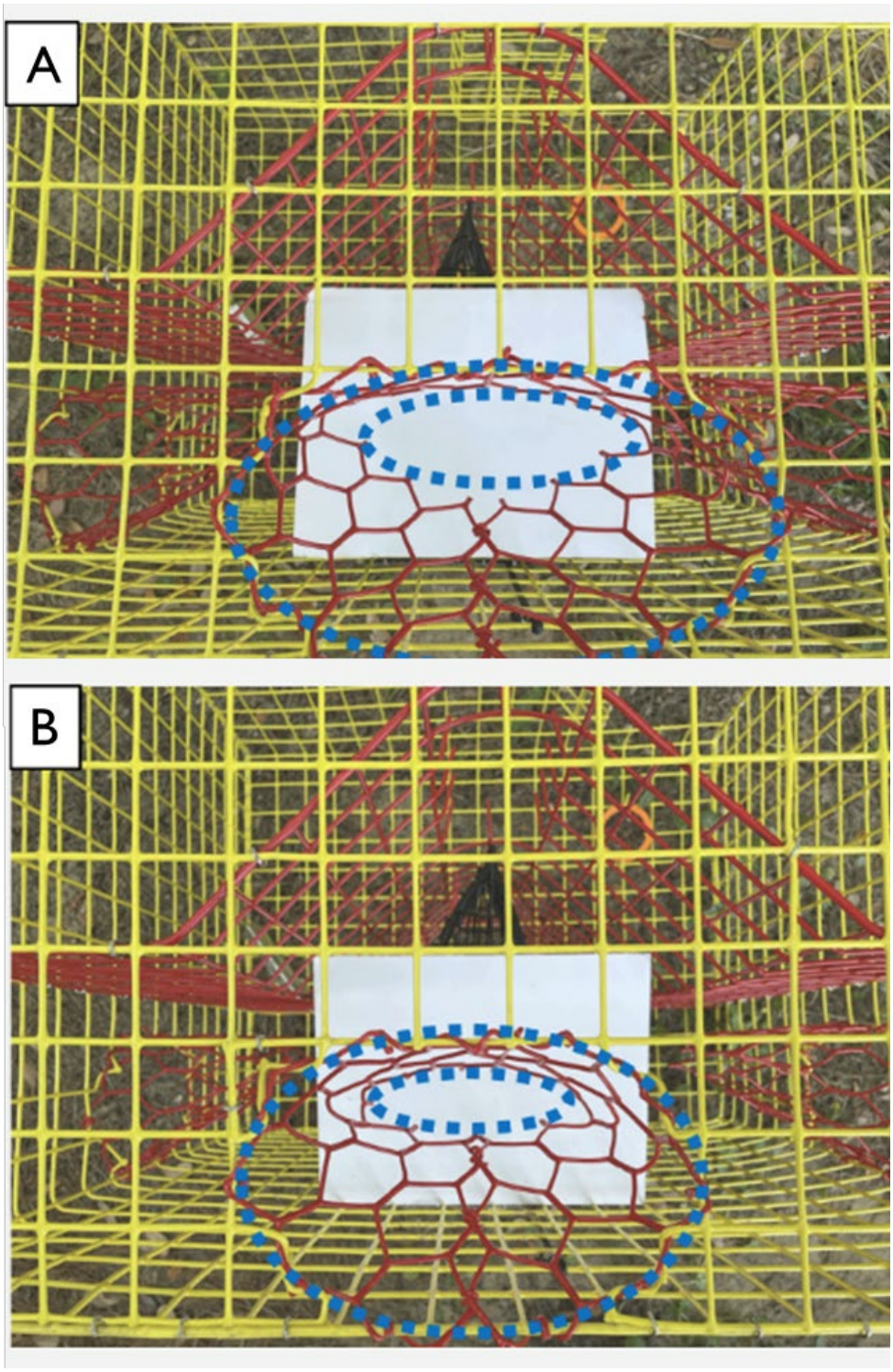

Figure 4.5.3. Crab pot funnels constructed out of 1.5 in. hexagon mesh. (A) “Standard Funnel” with an inner circumference of 12 meshes and an outer circumference of 14 meshes. (B) “Narrow Funnel Design” (NFD) with an inner circumference of 9 meshes and an outer circumference of 11 meshes.

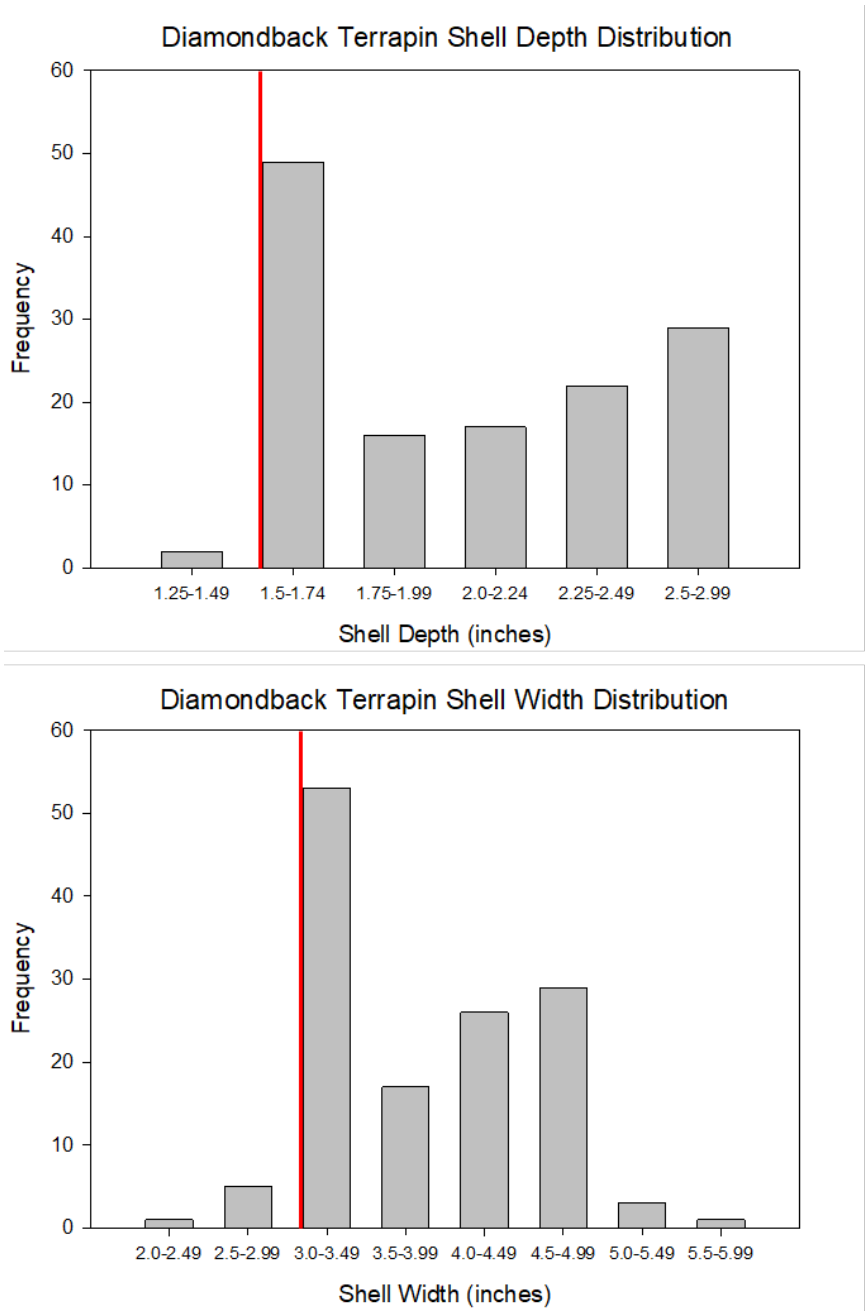

Figure 4.5.4. Distribution of shell depth and height for diamondback terrapins (n = 135) in coastal North Carolina. Data compiled by Dr. Amanda Williard (Department of Biology and Marine Biology, University of North Carolina Wilmington). These data represent field records for terrapins captured by seine at multiple sites (Figure 8 Island, Masonboro Island, Bald Head Island, and Beaufort) 2008 to 2018. Vertical red lines approximate potential exclusion of individuals in the size frequency bins to the right of the line; in the upper panel by a height limiting excluder design with a vertical opening of no greater than 4 cm (1.6 in.) and by a shell width limiting "SC design" 5.1-6.4 x 7.7 cm (2-2.5 x 3.1 in.) in the lower panel.

Table 4.5.1. Summary results of field studies examining effectiveness of different terrapin excluder device dimensions and impacts to blue crab catch. A "x" signifies no diamondback terrapins were caught in the study. A "*" signifies NFD and excluder dimensions are given in 1.5" hex mesh circumference of inner funnel entrance.

Location	Reference	Excluder Dimensions (cm; height x width)	Impact to Diamondback Terrapin Bycatch	Impact to Blue Crab Catch
NJ	Mazarella 1994 (31)	5 x 10	93% reduction	No significant difference
NJ	Wood 1997 (32)	5 x 10	90% reduction	11% increase in catch rates
		4.5 x 10	100% reduction	9% increase in catch rates
DE	Cole and Helser 2001 (17)	5 x 10	59% reduction	No significant change in number
		4.5 x 12	66% reduction	12% reduction in legal crabs
		3.8 x 12	100% reduction	26% reduction in legal crabs
MD	Roosenburg and Green 2000 (16)	5 x 10	47% reduction	No significant effect on size or number
		4.5 x 12	82% reduction	No significant effect on size or number
		4 x 10	100% reduction	Significant reduction in size and number
VA	Rook et al. 2010 (33)	4.5 x 12	96% reduction	No significant effect on size or number
VA	Upperman et al. 2014 (18)	5 x 15.2	75% potential exclusion	No significant effect on size or number
		4.5 x 12	96% potential exclusion	Significant reduction in size and number
VA	Corso et al. 2017 (20)	5.1 x 15.2	83% reduction	No significant effect on number Significant reduction in size (1mm)
VA	Grubbs et al. 2017 (21)	5.1 x 15.3	87% reduction	No significant reduction in catch rate Significant reduction in size (2mm)
		6.4 x 7.3	87% reduction	No significant reduction in catch rate Significant reduction in size (2mm)
NC	Grant 1997 (25)	5 x 10	75% reduction	19% reduction
		4 x 12	100% reduction	29% reduction
NC	Thorpe and Likos 2008 (34)	5 x 12	x	5.7% reduction
		5 x 10	x	18.2% reduction
NC	Hart and Crowder 2011 (15)	5 x 16	28% potential exclusion	5.7% reduction in legal male crabs
		4.5 x 16	77% potential exclusion	21.2% reduction in legal male crabs
		4 x 16	100% potential exclusion	26.6% reduction in legal male crabs

Location	Reference	Excluder Dimensions (cm; height x width)	Impact to Diamondback Terrapin Bycatch	Impact to Blue Crab Catch
NC	Chavez and Southwood Williard 2017 (19)	5 x 15	86% potential exclusion	No significant reduction in size or number
		3.8 x 15	100% potential exclusion	No significant reduction in size or number
NC	Wilson et al. 2022 (30)	* 9	no terrapin entry into NFD	Not tested
NC	Wilson et al. 2022 (26)	* 9	74% reduction	No significant reduction in catch rate or size
		4 x 16 (10 ga. wire)	49% reduction	No significant reduction in catch rate or size
SC	Grubbs et al. 2017 (21)	5.1 x 15.3	x	No significant reduction in catch rate
				Significant reduction in size (1mm)
		6.4 x 7.3	x	Significant reduction in catch rate
				Significant reduction in size (2mm)
GA	Belcher and Sheirling 2007 (35)	5 x 16	98% reduction	7% reduction in number
FL	Butler and Heinrich 2007 (36)	4.5 x 12	73.2% reduction	No significant effect on size or number
LA	Guillory and Prejean 1998 (24)	5 x 10	x	25.7% increase in overall catch rate

Step 2 Determine dates when terrapin excluder devices will be required

Diamondback terrapins display seasonal differences in habitat use and are known to enter a state of torpor during the winter months. Hardin and Southwood Williard (23) observed radio tagged diamondback terrapins begin exiting the water column and burrow into the marsh mud once water temperatures drop below 20 degrees Celsius (68 °F) during October in Masonboro Sound, North Carolina. They then observed diamondback terrapins resuming activity in April as water temperatures rose. The peak catch of diamondback terrapins in crab pots was seasonal in South Carolina, with the majority of captures occurring during April and May (11). These elevated catches were probably associated with post hibernation feeding and reproductive activity (11). In Jarrett Bay, North Carolina, Hart and Crowder (15) observed all diamondback terrapin interactions with blue crab pots during April and May. In Masonboro Sound, North Carolina, Alford and Southwood Williard (37) sampled modified "tall" crab pots from May to late October. These modified pots are greater in height than standard commercial crab pots, which allows entrapped diamondback terrapins access to air during all tidal phases to prevent drowning mortality. During those months, 27 diamondback terrapins were captured with May having the highest capture rate with 12 diamondback terrapins, followed by June and July with five and four, respectively. There were no captures in August, four in September, and two in October. In southeastern North Carolina, the diamondback terrapin "active season", was determined to be between April 1 and October 31 by observing the movement and activity patterns of radio tagged diamondback terrapins (23). NCDMF has recently encountered active diamondback terrapins in sampling programs in March, during higher than average spring temperatures. Allowing fishers to use crab pots without terrapin excluder devices during the dormant season (November 1 – February 28) in DTMAs should not result in significant bycatch of diamondback terrapins, however, this may result in crab pots without terrapin excluder devices being lost and becoming "ghost pots" within DTMAs. Though not baited, these "ghost pots" may continue to cause bycatch mortality (38).

Step 2 Summary:
As peak captures of diamondback terrapins in crab pots occur in early spring as individuals emerge and become active, it is important to account for annual variably in spring temperature and have terrapin excluder devices employed before diamondback terrapins become active. Based on NCDMF interactions and research conducted in North Carolina, **terrapin excluder devices shall be used in designated DTMAs from March 1 through October 31** to cover the entirety of the potential diamondback terrapin active season to limit diamondback terrapin bycatch. Both commercial and recreational crab pots would be required to use terrapin excluder devices when fishing in DTMA's during the diamondback terrapin active season.

Step 3 Identify the zone of potential diamondback terrapin interaction with crab pots

Crab pots are one of the most widely distributed fishing gears in the state, occurring throughout all coastal and joint fishing waters. Diamondback terrapins typically spend most of their lives in shallow water adjacent to tidal wetlands, resulting in only a small portion of the area used in the crab pot fishery spatially intersecting with diamondback terrapin habitat (27). The water depths in these nearshore diamondback terrapin habitat areas generally range from < 1 m to 3 m (< 3.3 to 9.8 ft.). In a cooperative research study between crab fishers and the management agency in

South Carolina, 1,913 crab pots set between 0 and 9 m (0 and 29.5 ft.) in depth were sampled. All captured diamondback terrapins were from pots set at depths < 5 m (16.4 ft.), and 97% were captured in pots at depths < 3 m (9.8 ft.; 14).

Thorpe et al. (13) notes that at a study site in Carteret County, North Carolina, all pots sampled were set greater than 91 m (298.6 ft.) from shore and no diamondback terrapins were caught. However, at sites in Brunswick County, North Carolina, all pots were set within 4.5 m to 91 m (14.8 to 298.6 ft.) from shore, resulting in nine diamondback terrapins being caught (all of which were captured < 13 m (42.7 ft.) from shore). Grant (25), at three estuarine sites in North Carolina, showed significant reductions in diamondback terrapin captures as distance from shore increased. The majority of diamondback terrapins (84.5%) were captured less than 25 m (82 ft.) from shore and 15.5% were taken between 26 and 50 m (85.3 and 164 ft.) offshore. None were captured in pots more than 50 m (164 ft.) from shore. In Jarrett Bay (Core Sound), North Carolina, all diamondback terrapin captures occurred within 321 m (1,053.1 ft.) of the shoreline, with 90% occurring 250 m (820.2 ft.) or less from the shore and 76% occurring 150 m (492.1 ft.) or less from the shore (15).

From these studies, it can be inferred the potential zone of most diamondback terrapin interactions with crab pots in North Carolina are areas that are both less than 250 m (820.2 ft.) from any shoreline and less than 3 m (9.8 ft.) deep at low tide. However, using a specific depth and distance from shore as a metric for requiring a terrapin excluder device may be problematic to effectively enforce, due to changing tides and currents. The designation of discrete DTMAs, which primarily contain habitats less than this depth and distance from shore, are easier to enforce as a way to implement a terrapin excluder device requirement in the crab pots.

Using these parameters (less than 250 m (820.2 ft.) from any shoreline, and less than 3 m (9.8 ft.) deep at low tide), a GIS layer was created for the state and mapped to identify regions that meet both criteria (Figure 4.5.5). A narrow band of potential interaction zone lies immediately behind nearly all of the outer banks and other barrier islands. The southern shoreline of Albemarle Sound, as well as locations in the Alligator and Pasquotank rivers also contain areas of potential interaction zone. Broader regions of potential interaction zones occur within Currituck Sound, as well as the lower Newport River and areas around Fort Macon and Beaufort. The widest and most continuous area identified as a potential interaction zone occurs primarily in New Hanover and Brunswick counties in the coastal areas spanning from Figure 8 Island to Bald Head Island.

Step 3 Summary:
Based on currently available data, **areas both less than 250 m from any shoreline and less than 3 m deep at low tide shall be generally identified as areas of potential overlap between diamondback terrapins and the crab pot fishery**. These criteria may be revised by the division as additional research becomes available.

<u>Step 4 Validate diamondback terrapin presence and overlap with zone of potential crab pot interaction</u>

Several sampling programs conducted by the NCDMF encounter diamondback terrapins. These programs include several fishery-independent trawl surveys, a commercial gill net observer

program, and fishery-independent gill net survey. These sampling programs are all conducted in brackish marsh areas across the state which contain possible suitable diamondback terrapin habitat. From 1970 to 2017, a total of 649 individual diamondback terrapin interactions were documented. Due to multiple captures at one site, or fixed station designs in sampling programs, these 649 individual diamondback terrapins have been recorded from 173 unique locations throughout coastal North Carolina.

The North Carolina Natural Heritage Program (NCNHP) maintains a database of natural resource information which also contains diamondback terrapin distribution information. This database is used by government agencies, industry, the military, and conservation groups to make economic development, infrastructure, and land conservation decisions. NCNHP diamondback terrapin distribution data comes from reported sightings as well as compiled data from published research, such as the Southwood Williard and Harden (29) postcard survey. Plotting both the NCDMF sampling program diamondback terrapin interactions and the NCNHP data over the potential interaction zone, visually illustrates the areas statewide where diamondback terrapin populations are likely to occur as bycatch in the crab pot fishery (Figure 4.5.6).

Diamondback terrapin distribution is observed primarily from Roanoke Island to the South Carolina line. There are two NCDMF interactions recorded in Albemarle Sound, however the rest of the region north of Roanoke Island does not have any diamondback terrapin occurrences documented in either the NCDMF or NCNHP datasets. The area in Currituck Sound which is highlighted as a potential interaction zone, also does not have documented diamondback terrapin occurrences. Some areas which have been identified as potential interaction zones with overlapping diamondback terrapin occurrences include: the areas immediately behind the Outer Banks from Roanoke Island to Portsmouth Island, portions of western Pamlico Sound, the lower Newport River, areas around Fort Macon and Beaufort, as well as the areas from Figure 8 Island to Bald Head Island. Detailed regional maps highlight the potential interaction zone and known terrapin occurrences for these areas (Figures 4.5.7 – 4.5.11). The region spanning from Wrightsville Beach to the lower Cape Fear River shows one of the relatively wide areas of potential interaction zone which also has numerous documented diamondback terrapin occurrences in the state (Figure 4.5.11).

Step 4 Summary:
Diamondback terrapin presence and overlap with the zone of potential crab pot interaction shall be verified by the division using any of the following: data from the NCDMF, NCNHP, other agencies, universities, and peer-reviewed published literature.

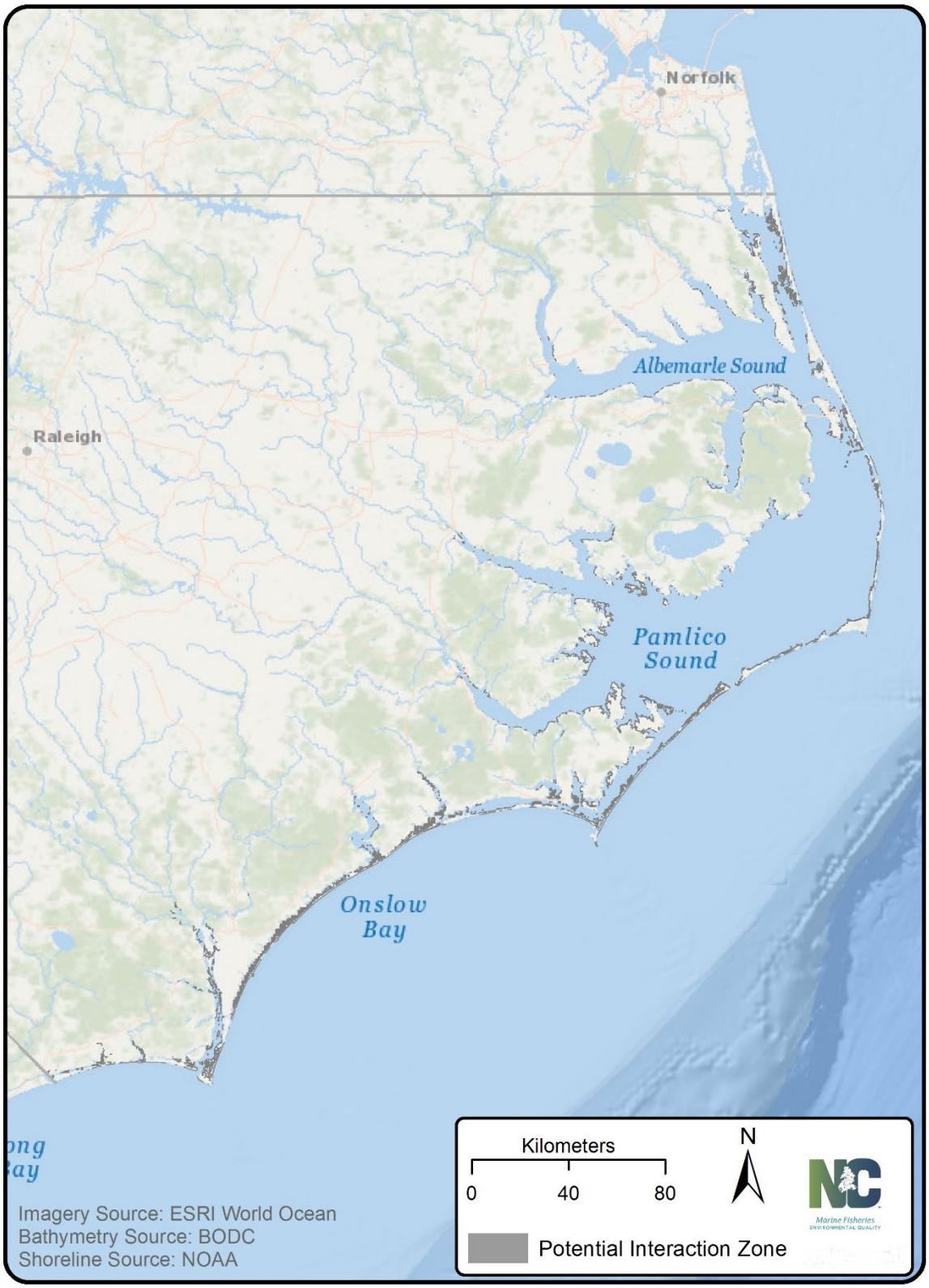

Figure 4.5.5 A map of coastal North Carolina showing the potential interaction zone (< 3 m (9.8 ft.) deep, < 250 m (820.2 ft.) from any shoreline) of diamondback terrapins and crab pots.

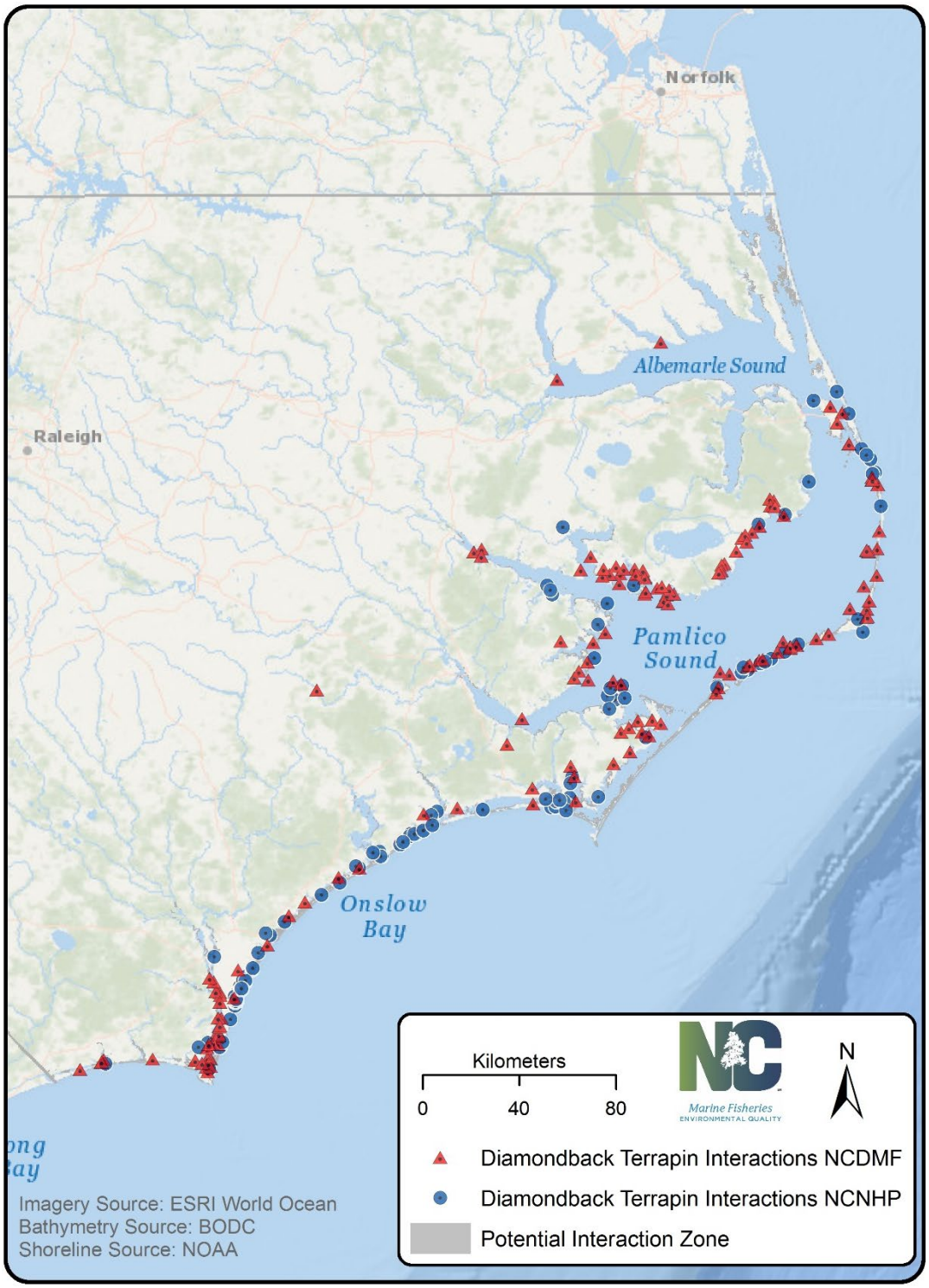

Figure 4.5.6. A map of coastal North Carolina showing the potential interaction zone (< 3 m (9.8 ft.) deep, < 250 m (820.2 ft.) from any shoreline) of diamondback terrapins and crab pots, overlaid with NCDMF (1971 – 2017) and NCNHP diamondback terrapin observations.

Step 5 Determine appropriate Diamondback Terrapin Management Area boundaries

The creation of DTMAs would focus the use of terrapin excluder devices or approved modified pot designs to essentially create sanctuary areas where diamondback terrapins would otherwise suffer mortality due to incidental catch in crab pots. Crab pots will not be banned in these areas, however, to successfully ensure the maintenance of diamondback terrapin populations within these areas and to have them possibly serve as long-term regional source populations, bycatch should be reduced to low levels within the DTMA's.

Diamondback terrapins have been observed to have relatively small home ranges in North Carolina. In Core Sound, average radio tagged terrapin home range size was calculated to be 3.05 km2 (1.18 mi.2), with a maximum observed home range of 7.41 km2 (2.86 mi.2) (39). In coastal New Hanover County, NC, the maximum straight-line travel distance of radio tagged terrapins observed was 1.20 km (0.75 mi.) for individuals captured in Masonboro Sound, and 1.05 km (0.65 mi.) for Figure 8 Island marshes (23). The size of a DTMA should at a minimum allow for the protection of the entire possible home range size of the target local terrapin population and may include adjacent unoccupied suitable terrapin habitat to allow for population recovery. The smallest size to likely be an effective DTMA should encompass the largest known home range of diamondback terrapin in NC, or cover 7.41 km2 (2.86 mi.2, 1830 acres) of suitable terrapin habitat.

For an area to be considered for designation as a DTMA, a diamondback terrapin population must be documented (e.g., NCDMF, NCNHP, or other agency or university data), as well as being identified as a potential area for diamondback terrapin interactions with crab pots (via the GIS depth and distance layer). The boundaries should incorporate a significant portion of the selected region identified as a potential interaction zone. Natural boundaries for ease of marking, compliance, and enforcement should be considered, however the design should minimize including any waterbody area not designated as potential interaction zone. Boundaries of other existing natural or conservation areas may also be used to identify DTMAs to aid in public compliance and simplify enforcement and marking, provided they are comprised primarily of the potential interaction zone.

Examples of possible types of natural or conservation areas in NC include State Natural Areas, National Estuarine Research Reserves, National Wildlife Refuges, and National Seashores. State Natural Areas have been designated by the North Carolina Division of Parks and Recreation to protect areas sensitive to human activities and preserve and protect areas of scientific, aesthetic, or ecological value. The National Estuarine Research Reserve System (NERR) is a network of protected areas across the United States which protects coastal and estuarine habitats for long-term research, education, and coastal conservation. The National Wildlife Refuge system (NWRS), and National Seashores are networks of federally managed lands and waters within the United States recognized and protected for their natural value. Considering these types of management areas when delineating DTMAs allows NCDMF to use boundaries that have been previously established and marked and serves as additional justification for requiring terrapin excluder devices in areas which have been independently determined as environmentally sensitive or important habitats for the protection of wildlife. An increase in crab pot density of one pot per creek is associated with a 74.6% decline in terrapin count, when estimating the

impact of unmodified crab pots on a refuge wide scale (40). The use of terrapin excluder devices or modified pot designs for the reduction of diamondback terrapin mortality in crab pots would align with the wildlife protection and conservation goals of the various managing agencies for these existing designated areas. Negative impacts from crab pot mortality and low potential rates of recolonization may prevent maintaining ongoing populations of diamondback terrapins in refuges or reserves unless diamondback terrapin loss through bycatch is minimized (40).

Step 5 Summary:
Boundaries of DTMAs shall be drawn to incorporate a significant portion of the potential interaction zone containing verified population(s) of diamondback terrapins and to minimize the inclusion of areas not identified in the potential interaction zone. Boundaries of preexisting natural or conservation areas may be used as DTMA boundaries to aid in public compliance, simplify enforcement, and to support the conservation goals of these areas.

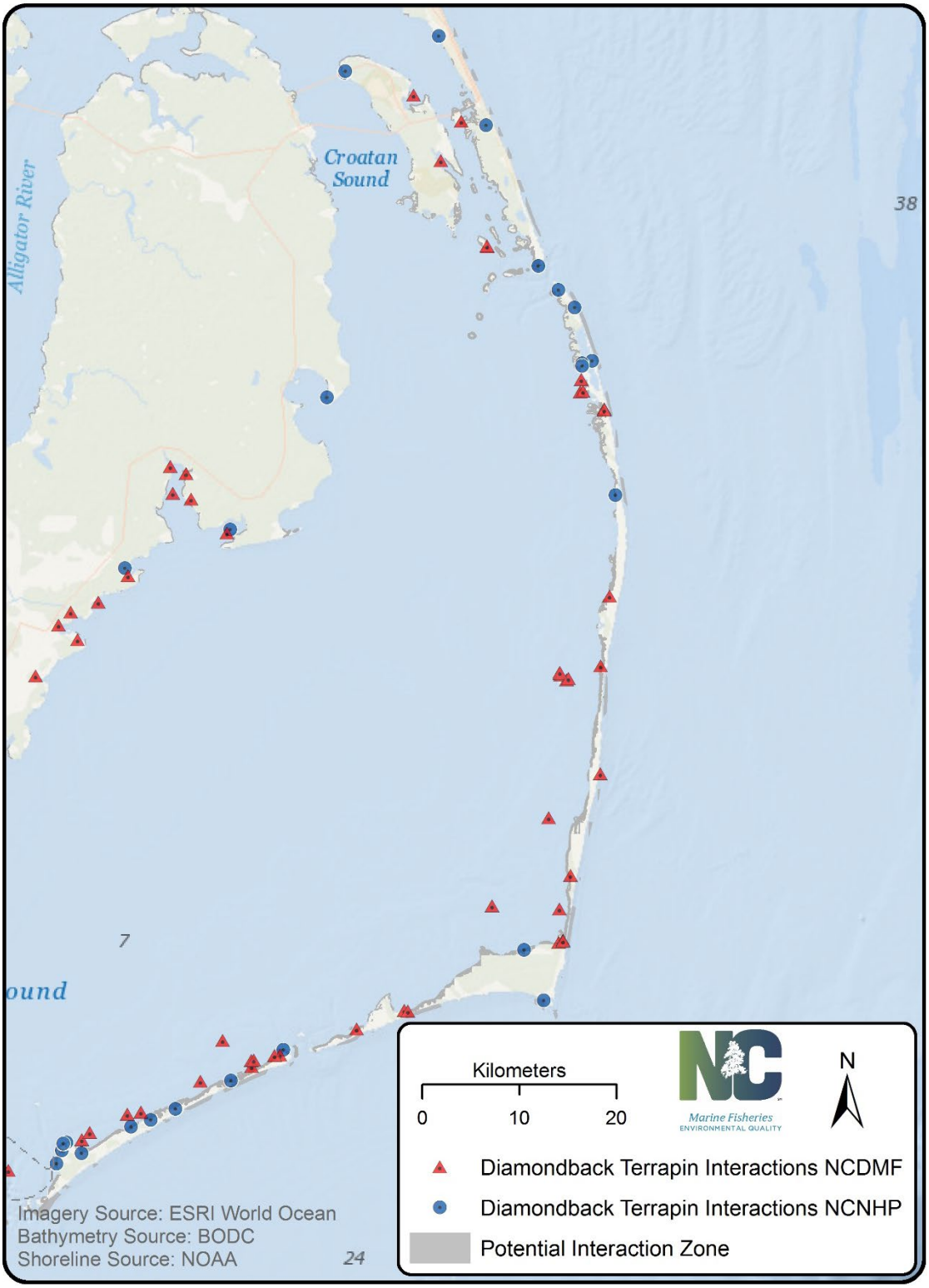

Figure 4.5.7. A map of eastern Pamlico Sound showing the potential interaction zone (< 3 m (9.8 ft.) deep, < 250 m (820.2 ft.) from any shoreline) of diamondback terrapins and crab pots, overlaid with NCDMF (1971 – 2017) and NCNHP diamondback terrapin observations.

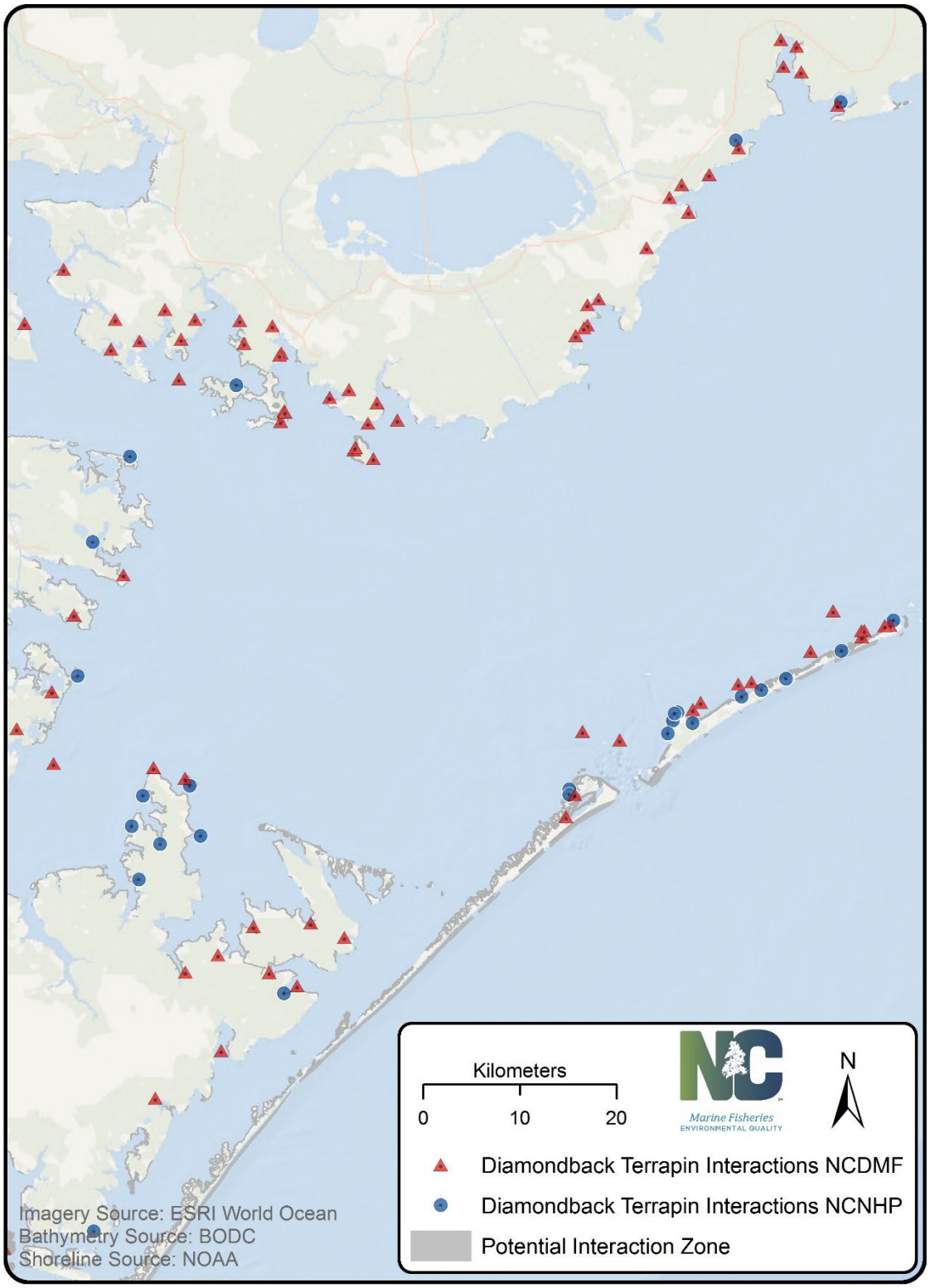

Figure 4.5.8. A map of western Pamlico Sound showing the potential interaction zone (< 3 m (9.8 ft.) deep, < 250 m (820.2 ft.) from any shoreline) of diamondback terrapins and crab pots, overlaid with NCDMF (1971 – 2017) and NCNHP diamondback terrapin observations.

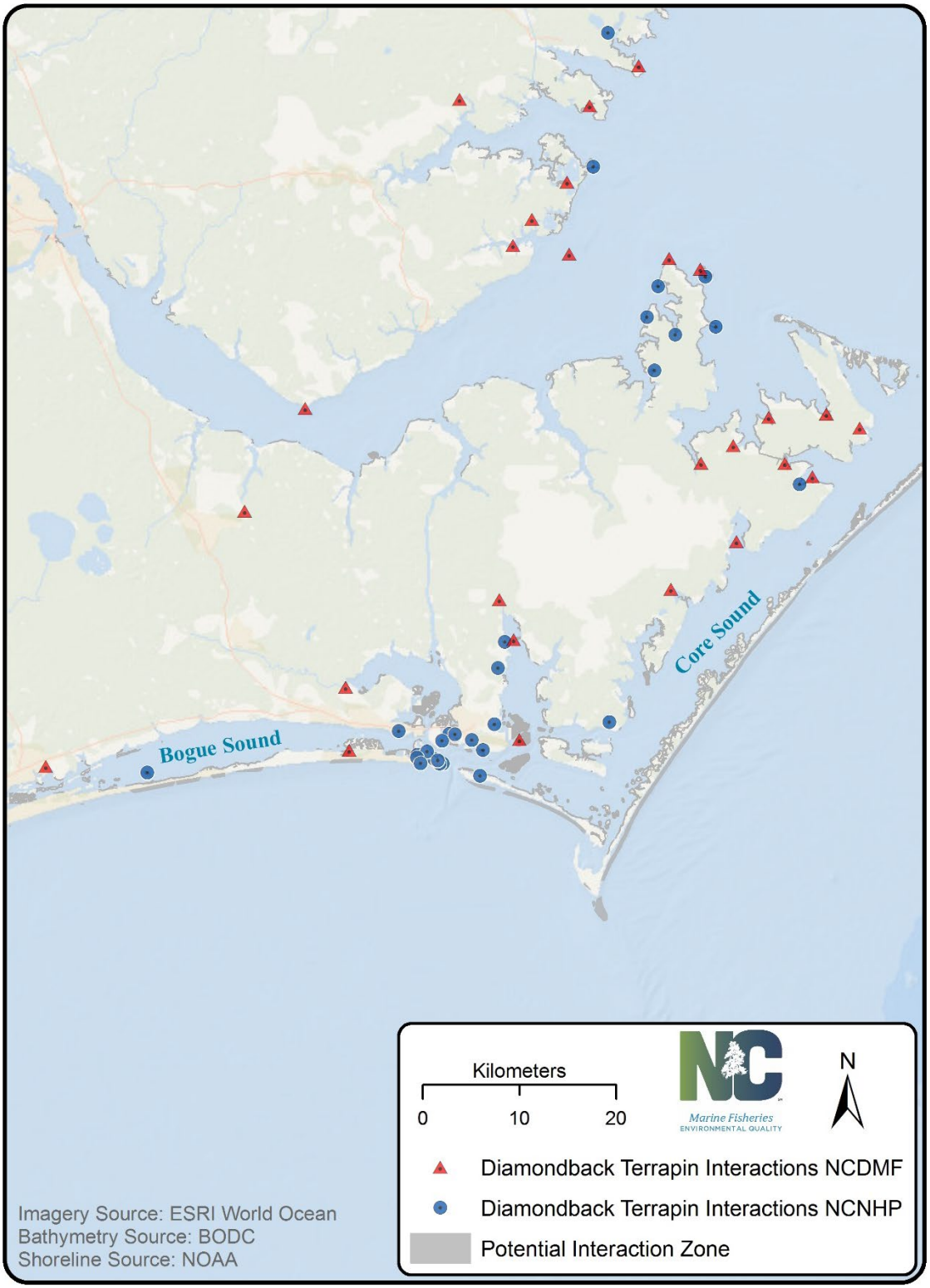

Figure 4.5.9. A map of Core and Bogue sounds showing the potential interaction zone (< 3 m (9.8 ft.) deep, < 250 m (820.2 ft.) from any shoreline) of diamondback terrapins and crab pots, overlaid with NCDMF (1971 – 2017) and NCNHP diamondback terrapin observations.

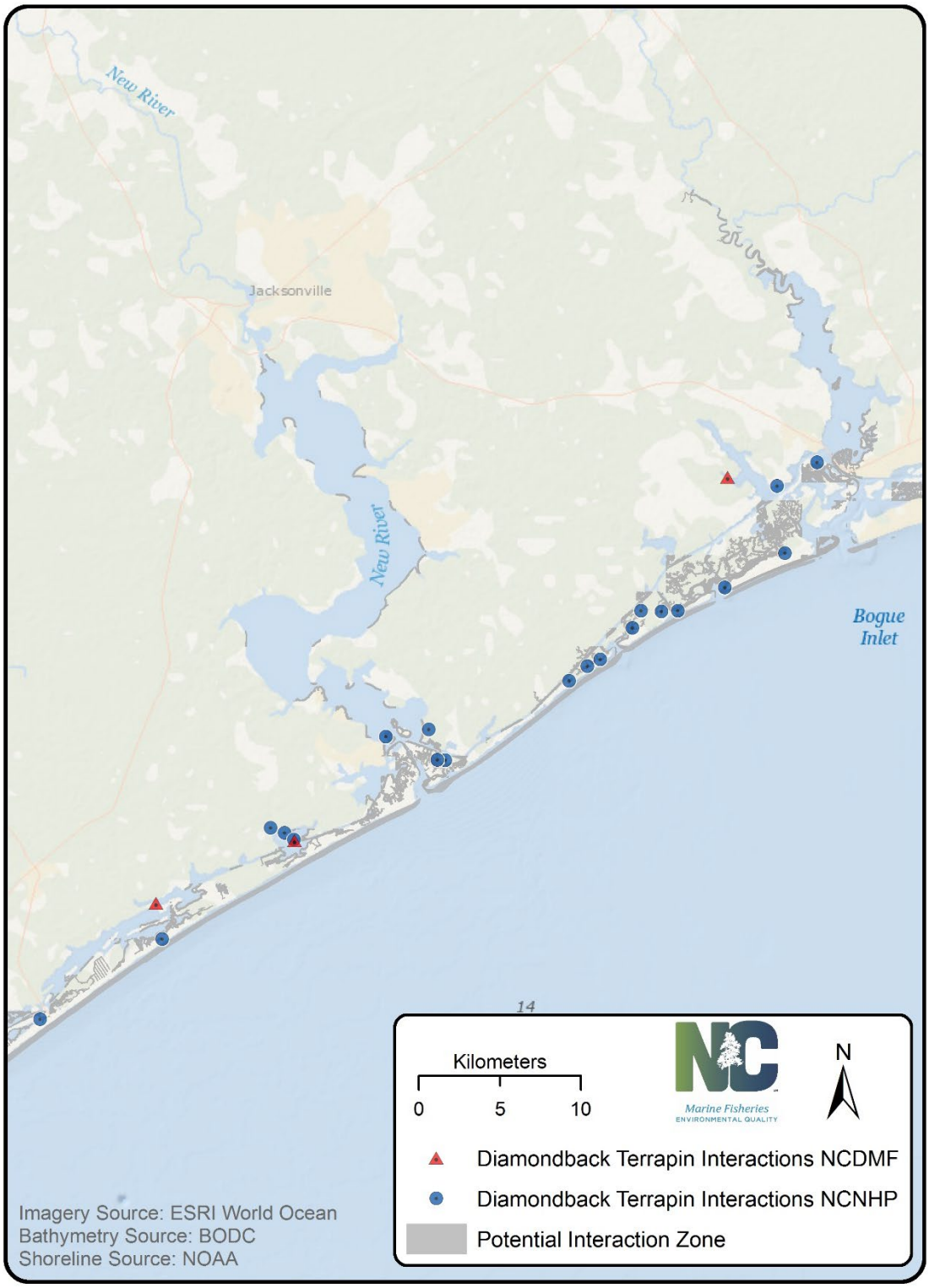

Figure 4.5.10. A map of coastal Onslow and Pender counties showing the potential interaction zone (< 3 m (9.8 ft.) deep, < 250 m (820.2 ft.) from any shoreline) of diamondback terrapins and crab pots, overlaid with NCDMF (1971 – 2017) and NCNHP diamondback terrapin observations.

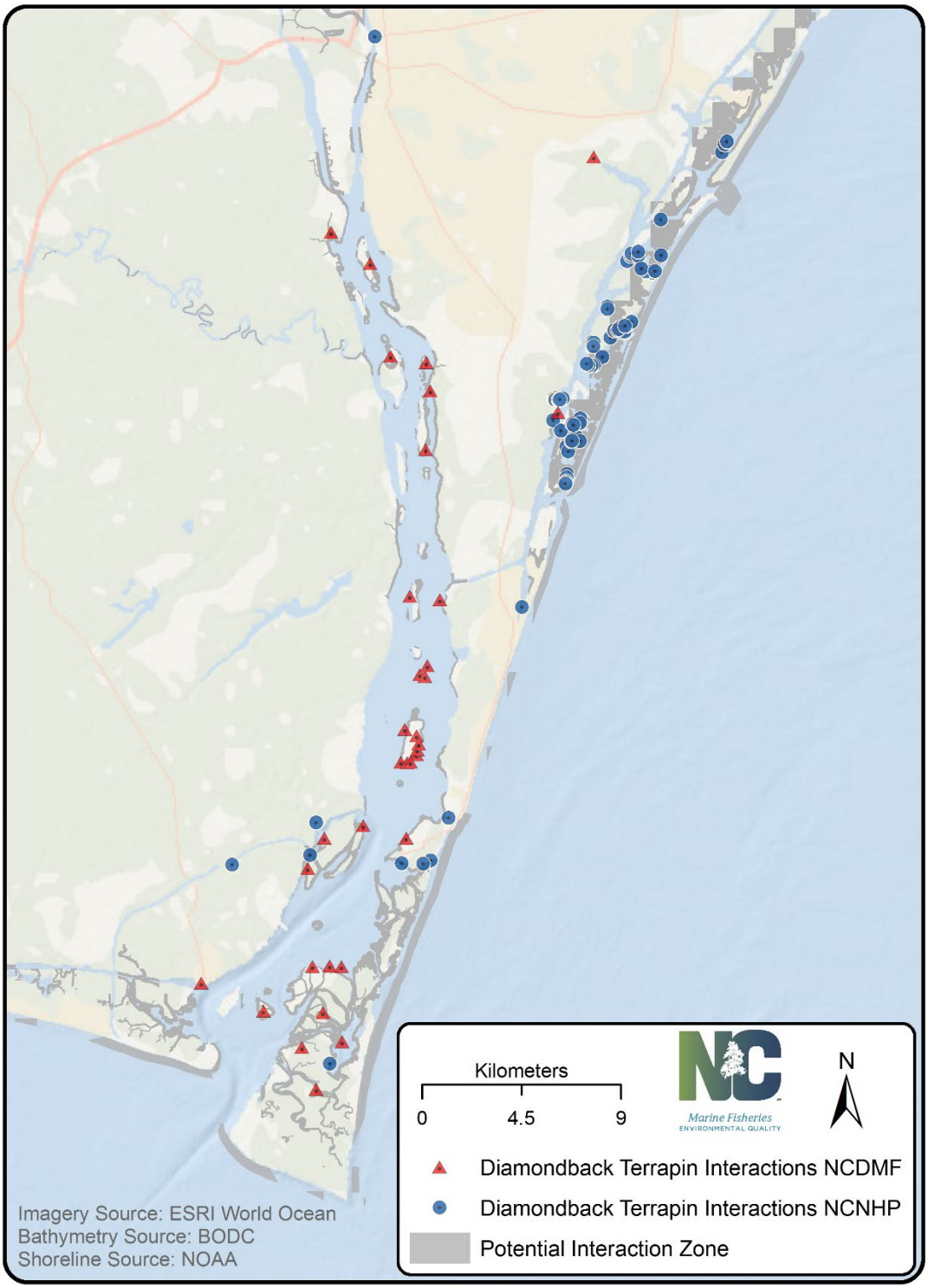

Figure 4.5.11. A map of coastal New Hanover and Brunswick counties showing the potential interaction zone (< 3 m (9.8 ft.) deep, < 250 m (820.2 ft.) from any shoreline) of diamondback terrapins and crab pots, overlaid with NCDMF (1971 – 2017) and NCNHP diamondback terrapin observations.

Step 6 Initial issue paper detailing the proposed DTMA will be presented to the appropriate regional committee and receive public comment

Once an area has been identified by NCDMF as an area where establishing a DTMA would be appropriate, an issue paper containing the following details of the proposed DTMA will be produced:

1) Map and coordinates of the proposed DTMA boundaries.
2) Cited sources and summary of diamondback terrapin presence data within the proposed DTMA.
3) Information on any existing natural or conservation areas overlapping with the proposed DTMA.
4) Data on the local blue crab fishery within the proposed DTMA.

Maps of the proposed DTMA shall illustrate the proposed DTMA boundaries as well as display the GIS layer illustrating the zone of potential diamondback terrapin interaction with crab pots based on the established depth and distance from shore criteria. Maps will also overlay known locations where diamondback terrapins have been documented to occur. Source data for diamondback terrapin occurrences from publications will be summarized and cited as references. Data sources such as NCDMF biological database records or NCNHP will also be listed and referenced. If the proposed location is within an existing natural or conservation areas (e.g. NERR, NWRS), supporting information about or from the managing agency will be provided. Participation and landings (pounds and value) data from the local blue crab pot fishery to be impacted by the proposed DTMA will also be presented and will include data for other marketable bycatch species. However, under certain situations limited data may be available to the public due to confidentiality requirements with landings data involving small numbers (less than three individuals) of fishery participants.

This initial issue paper will be presented to the appropriate regional advisory committee for their input and to receive public comment (see Attachment 1 **for an example** of how issue papers will be formatted). Public notice will be made via a press release and the issue paper describing the proposed DTMA will be made available with a 30-day public comment period open prior to the regional advisory committee meeting. Due to restrictions, public comment will not be accepted via email. Online and physical mail options will be included in the public comment period. The division will contact local crab fishers in the area to be impacted as well as regional diamondback terrapin researchers for their comment. The division will take into consideration advisory committee and public comments and may work with fishers and researchers to modify the proposed DTMA boundaries to maintain protections for diamondback terrapins while minimizing impacts to the local blue crab fishery. **See Step 7 added from the NCMFC motion for adoption of Amendment 3**.

Step 6 Summary:
The division shall produce an initial issue paper (with the information outlined above and structured as the example in Attachment 1), present the information to the appropriate regional advisory committee for their input, inform the public of the proposed DTMA via a press release,

hold a 30-day public comment period, and contact local crab fishers and diamondback terrapin researchers for their comment.

Step 7 NCMFC review documents and take action to adopt, adopt with modification, or deny proposed DTMA

Once advisory committee and public comment have been received, the division may create a revised issue paper to address topics including but not limited to boundary lines, area adjustments, additional impacts, and other public concerns within a reasonable vicinity of the proposed DTMA under consideration. Boundary modifications may be necessary in the revised issue paper due to division concerns brought forth by public comment, further internal review, and to best address public understanding for compliance. The public will be notified that the proposed DTMA is under NCMFC consideration via a press release for the NCMFC business meeting. The division will present documents including but not limited to a revised issue paper, justification for any necessary changes, public comments, and AC and NCDMF recommendations to the NCMFC at their next regularly scheduled meeting. The NCMFC will take into account advisory committee and NCDMF recommendations, as well as public comments in order to establish DTMA boundaries that maintain protections for diamondback terrapins while minimizing impacts to the local blue crab fishery. The NCMFC will adopt, modify for adoption, or deny the proposed DTMA.

Step 7 summary:
The division shall produce a revised issue paper which will be presented along with supporting documents to the NCMFC for action. The NCMFC shall adopt, modify for adoption, or deny the proposed DTMA.

Step 8 Implement adopted DTMA by proclamation and incorporate the finalized issue paper as a revision to the FMP

Proclamation issuance by the NCDMF director shall depend on NCMFC adoption of the proposed DTMA. If the NCMFC moved to adopt a DTMA, the division director shall issue a proclamation designating this DTMA under the authority granted in NCMFC Rule 15A NCAC 03L .0204. The proclamation will contain GPS coordinates, a description of the boundaries, a map illustrating the DTMA, and outline of terrapin excluder device requirements. This proclamation will specify, as stated in framework steps one and two, that all commercial and recreational hard or peeler crab pots fished within the DTMA shall be required to properly use at least one of the NCDMF approved terrapin excluder types in all funnels from March 1 through October 31. Additionally, the proclamation text will be drafted to maximize public understanding, compliance, and enforceability. Minor boundary modifications to the approved DTMA may be made when drafting proclamation text, however no separate new areas may be added to the DTMA at this time. Any area modifications will be made to better establish points that are both clear to the public and/or enforceable within the vicinity of NCMFC approved boundary lines.

The division will issue the DTMA proclamation at least one month prior to the effective date, and when possible, effective dates will be associated with the regional pot closure period.

NCDMF will mark boundaries of any proclaimed DTMAs and post informational signs similar to those marking other existing management areas. Posted signs will indicate all crab pots fished within the marked area will require the use of an approved terrapin excluder device from March 1 through October 31. A final version of the issue paper with NCMFC action will become a revision to the most recent Blue Crab Fishery Management Plan Amendment, named under the convention of: Revision year DTMA name(s). Revisions are then posted to the DMF website.

Step 8 Summary:
If adopted by the NCMFC, the division will issue a proclamation and mark the boundaries of the DTMA at least one month prior to its effective date. The final issue paper will become a revision to the most recent Blue Crab Fishery Management Plan Amendment.

DTMA Summary

The framework adopted in this Amendment 3 was the next step necessary in implementing the NCMFC selected management strategy initially adopted in the 2013 Blue Crab FMP Amendment 2. Amendment 2 granted proclamation authority for the director of the NCDMF to require the use of terrapin excluder devices in crab pots. This framework defines the proclamation use criteria, and creates a stepwise process involving public comment, Advisory Committee consultation, and the most current scientific data, to develop Diamondback Terrapin Management Areas.

The framework is this document in total and consists of the following criteria:

- Step 1 Determine NCDMF approved terrapin excluder device types and sizes to be required
- Step 2 Determine dates when terrapin excluder devices will be required
- Step 3 Identify the zone of potential diamondback terrapin interaction with crab pots
- Step 4 Validate diamondback terrapin presence and overlap with zone of potential crab pot interaction
- Step 5 Determine appropriate Diamondback Terrapin Management Area boundaries
- Step 6 Initial issue paper detailing the proposed DTMA will be presented to the appropriate regional committee and receive public comment
- Step 7 NCMFC review documents and take action to adopt, adopt with modification, or deny proposed DTMA
- Step 8 Implement adopted DTMA by proclamation and incorporate the finalized issue paper as a revision to the FMP

The targeted DTMA approach offers improved localized protection of diamondback terrapins and minimizes the impacts to the statewide crab fishery (commercial and recreational). As crabbers typically fish their pots within one specific region, terrapin excluder device requirements for DTMAs will disproportionally affect those fishers who set pots within the DTMA. While this may be viewed as unfair to these impacted fishers, these areas will be determined using the best available data to have significant overlap with diamondback terrapins and the highest probability of diamondback terrapin interactions occurring with crab pots. A broader seasonal application of a less restrictive 5 x 16 cm (2 x 6.3 in.) terrapin excluder device across all pots fished in less than 3 m (9.8 ft.) of water and less than 250 m (820.2 ft.) from

shore, may be viewed as more equitable. However, using pot set depth or distance from shore as criteria for requiring terrapin excluder devices is not realistically enforceable, and the use of less restrictive terrapin excluder devices may not be effective at preventing size selective mortality and localized extirpations. Broader regional requirements for the use of terrapin excluder devices would result in a greater reduction of diamondback terrapin bycatch overall but would also have a significant impact on blue crab commercial harvest and place an undue restriction on crab pots fished too deep or far from shore to incidentally capture diamondback terrapins.

The goal of this management strategy is to reduce diamondback terrapin capture and mortality in crab pots. Areas designated as DTMAs will minimize the inclusion of areas too deep or far from shore and help prevent the capture of diamondback terrapins in crab pots during the active season. However, not all areas within the zone of potential interaction will be designated as DTMAs. Smaller management areas within the overall zone of potential interaction will be created to protect specific areas documented to contain populations of diamondback terrapins and focus on including areas such as reserves or refuges designated as environmentally sensitive or important habitats for the protection of wildlife. This targeted DTMA approach is the most focused way to offer diamondback terrapin populations the greatest protection from bycatch mortality while having the least overall impact to the statewide blue crab fishery. Proactively taking these steps to address diamondback terrapin bycatch in crab pots may help mitigate the need to seek further state or federal protection (Threatened or Endangered listing) of diamondback terrapins. Additionally, addressing this issue may help improve future ratings the blue crab pot fishery receives from groups like Seafood Watch and the ability for the fishery to achieve sustainable harvest certifications from groups like the Marine Stewardship Council.

Initially, given the existing rule language, the division was not seeking NCMFC approval as an action under the framework prior to the issuance of a DTMA proclamation. The rationale was based on if the NCMFC did not agree with a particular DTMA established through this process, G.S. 113-221.1 allows the NCMFC to call an emergency meeting, at the request of five or more members, to review a proclamation issued under the authority delegated to the Fisheries Director. At that meeting the NCMFC may approve, cancel, or modify the proclamation. During the adoption of Amendment 3, the NCFMC formally added a step to bring proposed management areas back to the NCMFC at the next regularly scheduled NCMFC meeting following required regional advisory committee meetings for approval.

VI. PROPOSED RULE(S)

No rule change required. Proclamation authority is contained in existing rule (NCMFC Rule 15A NCAC 03L .0204(b)).

VII. RECOMMENDATIONS

NCMFC Selected Management Strategy

Adopted the framework and criteria presented by the NCDMF for identifying diamondback terrapin management areas, adding a step to bring proposed management areas back to the NCMFC following committee meetings at the next regularly scheduled meeting for approval.

NCMFC Summary
At their November 2019 business meeting, the NCMFC preferred management strategy for DTMAs was the use of science on locally specific pot funnel design to reduce terrapin interactions and identify individual areas with terrapin population hot spots that would be closed to potting unless an excluder is used.

At the February 2020 business meeting, the division asked for clarification of the preferred management strategy over concerns of limited criteria details and enforcement capabilities. The NCMFC changed their final management strategy to adopt the framework and criteria for designating DTMAs where use of an approved terrapin excluder device will be required. The NCMFC also added a step to the framework to bring proposed management areas back to the NCMFC following committee meetings at the next regularly scheduled meeting for approval

This eight-step framework covers criteria for approved terrapin excluder devices, time period when excluders are required in pots, terrapin interaction zone, terrapin presence, boundary designation, issue paper development with AC recommendations and public comment, NCMFC action, and implementation by proclamation.

The final issue paper for each NCMFC approved DTMA(s) will become a revision to the current FMP Amendment. See Attachment 1 for an **EXAMPLE** of an issue paper. These Amendment revisions may be made to approve additional terrapin excluder devices, amend DTMA boundaries, and create new DTMAs. Revision documents may be viewed on the DMF website.

See Appendix 4.7 for a summary of all comments and recommendations gathered from NCDMF, the NCMFC advisory committees, and public for the Blue Crab FMP Amendment 3.

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