

Hooked!
**An Analysis of Sea Turtle Bycatch in the
Recreational Rod and Reel Pier Fishery of North Carolina**

Researched and Written by

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EXECUTIVE SUMMARY

Fisheries bycatch is a major threat to the five species of endangered and threatened sea turtles found in North Carolina's waters. There are four main outcomes of a bycatch event: acute death, sub-acute death, delayed mortality, or survival. Survival may be accompanied by sub-lethal impacts affecting general fitness of the sea turtle, potentially decreasing reproductive success, the turtle's ability to forage, and increasing the risk to threats (e.g., boat strike). Post Interaction Mortality (PIM) after interaction with hook and line gear is influenced by hook-type, the ease of removing the hook from the turtle, if hooks (or line) couldn't be removed, and a myriad of environmental factors. While the commercial fishery has measures in place to decrease and mitigate bycatch of sea turtles, there are no such measures for the recreational fisheries of North Carolina. Both commercial and recreational fishing contribute substantially to North Carolina's coastal economy, and recreational fishing continues to grow, building on a long history of pier fishing on North Carolina's coast. Taking lessons learned from bycatch mitigation in the commercial longline fishery presents a good starting point for similar studies in the recreational rod and reel fishery.

To address a research gap, and in support of a NOAA initiative to better understand and consider how to reduce sea turtle bycatch at recreational fishing sites, I analyzed incidental sea turtle captures in North Carolina reported in the Sea Turtle Stranding and Salvage Network (STSSN) database over 15 years. My aim was to examine incidentally captured sea turtle demographics and any trends between reported captures and fishing methods. To complement my historical data analysis I conducted surveys with fishers (anglers) on three piers in Carteret County to investigate cofactors of fishing methods and sea turtle incidental captures in order to make recommendations to inform potential mitigation measures, such as voluntary gear modifications.

Historical data were obtained from STSSN from 2008 to 2022. The survey was created by NOAA for their Reducing Sea Turtle Bycatch at Recreational Fishing Sites Project. We sought information about angler habits including fishing methods (hook type, bait type), and frequency of sea turtle interactions. Outreach on the importance of reporting bycaught sea turtles was done opportunistically, most often after the final question: "What would you do if you accidentally caught a sea turtle?". I directed anglers to the STSSN signs that were posted at the entrance to the pier and discussed the importance of these data, even if the "turtle seems fine." I conducted data analysis and testing for statistical significance in R, and performed spatial analysis and construction of a publicly available spatial GIS tool through arcGIS Pro.

From 2008 to 2022 there were 427 reported interactions with sea turtles with recreational rod and reel fishers from piers in North Carolina. I examined relationships between species, geographical location (county), hook location, hook type, and season. Kemp's ridley sea turtles represented 60% of reported interactions overall, and based on these reported interactions, are statistically more likely to be caught than any other sea turtle species. Overall the most reported captures occurred in May, though monthly numbers of incidental captures varied by county. Shrimp was the most commonly used bait type in incidental sea turtle captures and j-hooks were the most often reported hook type. Kemp's ridleys had the highest number and proportion of captures by the mouth. Captures by the mouth comprised the largest percentage of each species' known hook locations; only greens and loggerheads had a nearly equivalent amount of captures by mouth and flipper.

I conducted 77 angler surveys in the fall of 2023, capturing data for 150 anglers at three piers in Carteret County: Bogue Inlet Fishing Pier, Oceanana Pier, and Newport River Pier. The

first half of the survey covered general fishing habits and preferences. Most fishers interviewed preferred fishing in the spring and fall. Shrimp were statistically more likely to be chosen as bait, and j-hooks most likely to be chosen for hook-type. Twenty-seven percent of respondents spent at least 16 days fishing in at least one season (3 months), while 49% of respondents were only visiting North Carolina, spending 5 days or less at the pier per season. Angler surveys indicated there is likely significant under-reporting due to local fishers perceiving easily dehooked and healthy turtles as unnecessary to report.

There are several key points to consider when interpreting the results of this study. First, relationships between co-factors and incidental captures are difficult to reliably determine because little baseline data exist to compare to. When conducted at a state-wide scale, the angler survey data will provide additional background data and therefore allow for better analysis of potential cofactors with incidental captures in the future. Self-reported data always presents challenges, as it is impossible to know whether increases in reports are due to a true increase in incidental takes or if they are due to increased reporting. While attempting to control for the background popularity of j-hooks and shrimp, use of these bait and hook types were not statistically significant, suggesting that those are the most common hook and bait types associated with incidental takes because they are also the most common hook and bait types used at the piers. There was no relationship between where sea turtles are hooked (mouth or flipper) based on hook type. This result is counter to what might be expected from the success of switching to circle hooks in the commercial long-line fishery. A possible explanation is that the circle hooks used by pier anglers weren't large enough to prevent swallowing the hook.

At the end of any good research study, there are more questions to be answered. I will incorporate habitat data into my sea turtle maps to obtain distances of piers to preferred sea turtle habitat. Will this help inform which sea turtle species are most often reported as caught at that pier or the level of incidental captures generally? After answering this question, I will publish the analysis of the historical data including the dashboard tool. I am hoping the dashboard tool can be used to suggest trends that can inform potential mitigation measures.

A few potential voluntary measures that could decrease bycatch at the piers in North Carolina include temporary restrictions. One option is to implement temporary closures during the months of highest incidental captures at each pier, for example a temporary closure in May for Carteret and Pender Counties. The other option is to enforce bait restrictions, restrict bait use apart from lures or gotcha plugs during months of highest incidental captures. The finding the captures by the mouth were most common in all species indicates that this may reduce incidental captures of loggerheads, Kemp's ridleys, and green sea turtles that are likely attracted to the bait as a food item.

Being the first person to conduct this survey in North Carolina I have a few suggestions for future surveyors. Plan to conduct surveys in the spring and fall to capture the highest volume of fishers and the highest numbers of incidental takes. It would be useful to include a question to determine if anglers are aware of the STSSN signage at the pier. This question would also offer an easy transition into effective and efficient outreach explaining why people should report a captured sea turtle. Although, even if made aware some fishers will still not want to take the time or effort to report the sea turtle or wait for someone to arrive. Training or pamphlets on what to do if you cannot contact the stranding network should be provided (for example cutting the line as close to the hook as possible). Lastly, fishing piers are popular and can get crowded; if there are a lot of fishers at the pier and you have limited resources and time, consider screening people by how often they fish at the pier - if it's 2-3 days every few years, or this is their 3rd visit their answers won't be very informational.

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INTRODUCTION

Five species of sea turtles inhabit North Carolina waters: green, loggerhead, Kemp's ridley, leatherback, and occasionally hawksbills. Kemp's ridley and hawksbills are listed as critically endangered globally on the IUCN Red List and all five species are listed as endangered or threatened by the U. S. Endangered Species Act (ESA) ("Red List Assessments," n.d.). Fisheries bycatch - the occurrence of a species other than the target fish species being caught in fishing gear and either kept or discarded - is a major threat to the survival of sea turtles globally. Wallace et al. (2010) found that sea turtles impacted by bycatch are significantly under-reported and the true number of bycaught sea turtles is likely in the millions from 1990-2008. There are four main outcomes of a bycatch event - acute death, sub-acute death, delayed mortality, or survival. Acute death occurs shortly after a bycatch event - through drowning or severe trauma and blood loss; sub-acute mortality has a slightly longer time frame (hours to days) from severe but not acute injuries or inability to recover from hypoxic or exertional trauma; and delayed mortality can occur weeks or even months after the event due to secondary infections from swallowed hooks (Swimmer et al. 2014). Even if the sea turtle survives the interaction there can be sublethal impacts, which can interfere with the sea turtle's ability to forage, increase the risk of boat strikes or predation, or decrease reproductive success, and generally lower fitness (Stacy et al. 2016). Post Interaction Mortality (PIM) after interaction with hook and line gear is influenced by hook-type, the ease of removing it from the turtle, if hooks (or line) couldn't be removed, and a myriad of environmental factors. In one study performed by Swimmer et al. (2014) post interaction mortality estimates ranged from 7% (for shallow-hooked turtles) to 55% (for deep-hooked turtles) for loggerhead sea turtles incidentally caught in the Pacific pelagic long-line fishery, yet they specified that post-interaction mortality estimates can range from 5% to 85% depending on gear left with the sea turtle.

Most of these studies on post interaction mortality have been done in the commercial longline fishery. These studies have led to further research to create federal regulations and mitigation measures to protect sea turtles in commercial fisheries (such as required hook-and-bait combinations - minimum size of circle hooks and fish bait, limited entry into certain fishing areas, etc. in the long-line fishery (Swimmer et al. 2017). After implementing these measures, bycatch rates for sea turtles decreased by 40% [leatherbacks] and 60% [loggerheads] in the Atlantic (Swimmer et al. 2017). Other commercial fisheries also have mitigation measures, such as the TEDs (Turtle Excluder Devices) required in several trawl fisheries, including the Summer Flounder Fishery (NMFS 2023). However, there are few regulations and little research on the impact of bycatch by recreational fisheries (Barco et al.

2016). Research that is urgently needed, as there is a claim that recreational fishing has overtaken the federally managed shrimp fleet as the fishery with the largest take of Kemp's ridley and green sea turtles in the Southeast United States (Putman et al. 2023).

Both commercial and recreational fishing contribute substantially to North Carolina's coastal economy. Commercial fishing provides livelihoods for 3,500 fishers and many more people along the fish value chain. While commercial fishing is on a slight decline, the recreational fishery has only continued to grow; in 2009 state officials estimated that more than 800,000 recreational fishers were spending over \$943 million over the course of 7 million fishing trips each year (Crosson 2010). While most of the economic impact is generated by tourists or out-of-towners, fishing has deep roots in Carteret County and in North Carolina generally. In fact, the rod and reel pier fishery was established in North Carolina in 1923, with the first pier built at Kure Beach. But it wasn't until 1950 when it really took off and was written up in newspapers around the state for the huge tarpon and great king mackerel fishing to be had at the pier (Baird 2011). A pier's popularity is in direct relationship with the quality and size of the fish that can be caught there. Jennette's Pier was first built in 1939, the first pier north of Wilmington. A series of hurricanes and rebuilds later, it was badly in need of funding to rebuild. North Carolina knew the cultural and economic importance of pier fishing so had set up the "Waterfront Access Study Committee" (WASC) and gave North Carolina Aquariums \$1.5 million to construct the pier in 2007- able to withstand hurricanes this time around (Baird 2011). On the other end of the spectrum, many commercial fishers have been fishing nearly all their lives and have a generational history of fishing in Carteret County that they can trace back 400 years to early colonizers, "the sea is in their blood and fishing is how they want to spend their time," (Andreatta and Parlier 2010). Subsequently they value fishing as their livelihood and their heritage, which provides a service to others, compared with recreational fishers who put emphasis on the large amount of tourism revenue generated by fishing (Boucquey 2017). This has led to rising tensions between the commercial and recreational fishing industries in North Carolina over limited space and limited fish, each group assigning blame to the other for overfishing and commercial fisheries concerned with the disparity in regulations (Boucquey 2017).

For both commercial and recreational fishers, the ESA prohibits the 'taking' of any species protected, defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (NMFS 2023a). The recreational fishers have no authorization for take under the ESA either through an incidental take permit (section 10 of the ESA) or Biological Opinion (section 7 of the ESA); each accidentally hooked turtle

counts as a take and is illegal under federal law. The Magnuson–Stevens Fishery Conservation and Management Act (MSFCMA), which authorizes the United States Fishing fleet, requires “that conservation and management measures shall, to the extent practicable, minimize bycatch, and to the extent bycatch cannot be avoided, minimize the mortality of such bycatch” (NMFS, n.d.). This stipulation of the MSFCMA is reinforced by NOAA’s National Bycatch Reduction Strategy.

Studies in several commercial fisheries have found effective measures to decrease bycatch of sea turtles. For example, in the pelagic longline fishery, the commercial fishery most similar to rod and reel, it has been observed that large circle hooks decrease the incidence of captures of loggerhead sea turtles, and decreases PIM as the use of J hooks increases the rate of gut-hooking in turtles compared with turtles captured on circle hooks. This is assumed to be due to the difference in hook direction; with circle hooks the point curves inward, while j-hooks have the point more exposed (Swimmer et al. 2017). This would be a good starting point for similar studies to be done on effective mitigation measures in the recreational rod and reel fishery.

Several previous studies examined sea turtle bycatch in recreational fisheries, often focusing on Kemp’s ridley sea turtles, largely from fishing piers in states bordering the Gulf of Mexico, including Florida (Rudloe and Rudloe 2005), Texas (Seney 2008), and Mississippi, Louisiana, and Alabama (Coleman et al. 2016). Key results are concerned with management challenges presented by sea turtles’ high site fidelity. Exemplified as a tendency to continue associating with heavily used fishing piers [in Florida and the Mississippi Sound], leading to slower growth rates compared to other populations, and requiring that these piers have plans in place to handle hooked turtles (Rudloe and Rudloe 2005; Coleman et al. 2016). Texas also needs to plan for the return of nesting sea turtles to the upper Texas coast, for the duration of nesting season before they leave to forage in Louisiana (Seney and Jr 2008).

In order to develop a more cohesive regional view, NOAA developed the project, “Reducing Sea Turtle Bycatch at Recreational Fishing Sites.” A pilot survey was developed in 2013 for Mississippi by NOAA’s National Marine Fisheries Service (NOAA Fisheries), NOAA’s MS Laboratories (MS Labs), and the Institute for Marine Mammal Studies (IMMS) to collect data on angler fishing practices and sea turtle interactions (Cook et al, 2020). The main purpose of the project is to increase understanding of recreational bycatch and develop methods to reduce that bycatch, focusing on shore-based recreational fishing locations; such as fishing piers, bridges, and other shoreline structures (personal communication, Piniak, 2024). The Sea Turtle Stranding and Salvage Network (STSSN) responds to and documents incidentally captured sea

turtles all along the Atlantic Coast and the Gulf of Mexico. However, this database only represents a fraction of the incidental captures that are occurring, as it largely relies on self-reporting by fishers. The STSSN first started documenting strandings in North Carolina in 1980, and started more targeted outreach in 2017, putting up signs informing anglers of what to do if they caught a sea turtle and who to call on the most popular fishing piers.

The aims of this study are to analyze STSSN data for threatened populations of loggerhead and green, and endangered Kemp's ridley sea turtles incidentally caught in the North Carolina recreational hook and line pier fishery from 2008 through 2022. I focused on determining demographics of captured sea turtles and examined those trends over time, trends in reported captures and fishing methods used, and major characteristics of piers with large numbers of incidental captures. To complement this historical analysis, I conducted on-site angler surveys at three piers in Carteret County; examining frequency of sea turtle-angler interactions at those piers, possible co-factors between target catch, fishing method, (hook type, bait type, etc.) and sea turtle interactions, as well as awareness among fishers of STSSN signage at the pier. This study will aid in better understanding recreational bycatch of sea turtles in North Carolina and recommend potential mitigation measures to decrease bycatch.

METHODS

Historical Sea Turtle Incidental Capture Data

Volunteers and state officials respond to reports of incidentally captured turtles to the STSSN hotline. Once at the scene, they assess the turtle and determine if the hook can be removed and the turtle can be released on site, or if the sea turtle needs to be taken for rehabilitation. Data on location, pier, sea turtle size and condition, time of day are recorded, as well as any notes known about the interaction including bait type, hook type, species, etc. All these data are entered into a publicly available database. I received the data for hook and line interactions from Sarah Finn, Coastal Wildlife Diversity Biologist, from North Carolina Wildlife Resources Commission. I verified that the entries were true incidental takes and categorized the 'notes' section into several data columns.

Data Analysis

Data were checked for quality and accuracy, reformatted, and analyzed using R 4.2.2 (R Core Team 2022). Tables were reformatted and chi-squared tests were run on frequency of use to test for statistical significance. For further analysis I converted the data into a shapefile that could be manipulated in arcGIS Pro 3.1. This map was transformed into a publicly available

dashboard in arcOnline that allows the data to be queried along several different selectors, changing the map display and information tables accordingly.

Angler Surveys

Site Selection

There are twenty-two ocean-facing piers in the state of North Carolina, but only eight of these piers have greater than ten reported incidental captures in the 15 years of our study. Ideally, a state-wide survey study design would examine piers spaced along the coast; including relatively geographically close piers with significantly different historically reported captures to account for reporting bias (to some degree). A good example would be Jennette's Pier, in Dare County, with 27 captures and Outer Banks Fishing Pier with three captures only two miles away.

I conducted a pilot study using the angler survey, focusing in Carteret County. I chose three piers, two of which had historically high capture rates and one for contrast with only one capture in our 15 year period - Oceanana Pier in Atlantic Beach on the eastern end of Bogue Banks, Bogue Inlet Pier in Emerald Isle on the western end of Bogue Banks, and Newport River Pier between Morehead City and Beaufort, respectively (Figure 1).

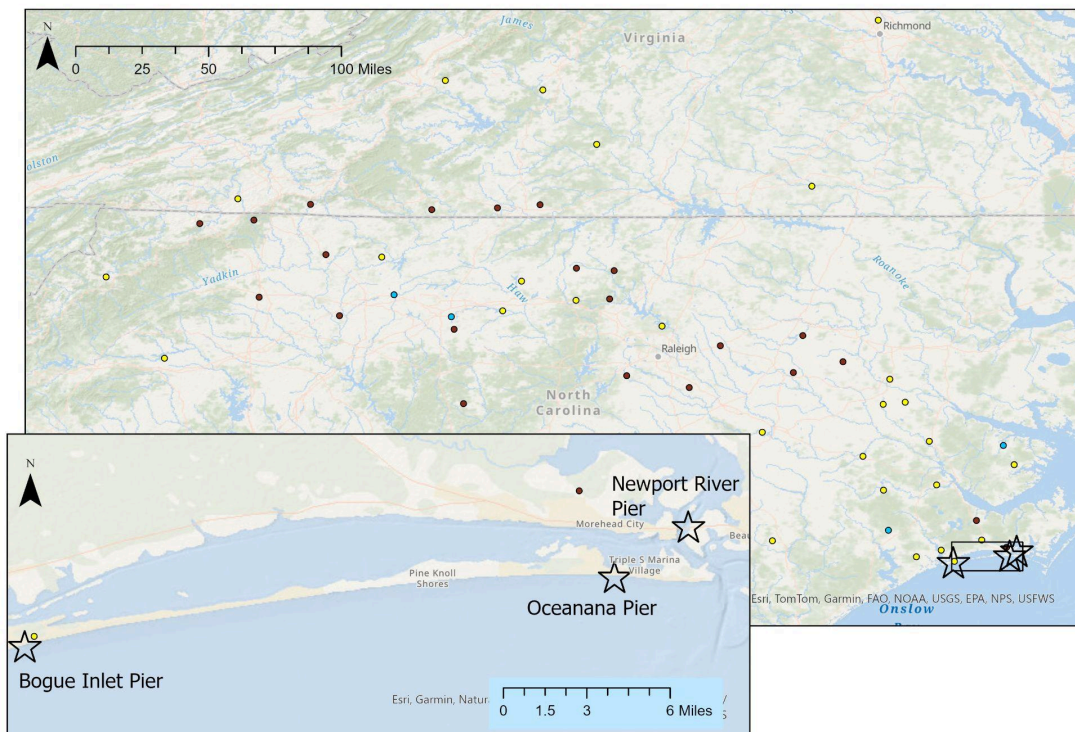


Figure 1. Piers chosen for angler surveys in Carteret County, North Carolina.

Angler Survey

Robson & Jones (1989) have shown that angler surveys obtained in the field can assess recreational fishing effort over a large geographical area with few surveyors. The Fishing Pier Angler Survey Cover Sheet and Angler Survey (Appendix) were designed based on similar surveys conducted by the Chicago Zoological Society/Sarasota Dolphin Research Program by the NOAA Fisheries Southeast Fisheries Science Center (Cook et al. 2020). The survey used in this study incorporated both questions to assess typical angler fishing practices as well as sea turtle interactions. The survey and associated data collection forms have undergone independent review pursuant to the Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501 et. seq.), OMB Control Number 0648-0774, and are compliant with The Privacy Act of 1974 (5 U.S.C. 552a). These data are needed to determine the most effective way to reduce incidental takes and manage these species under the ESA. All recorded data were entered into an excel spreadsheet prior to transcription into a database.

Angler Interviews

Before beginning the survey, I identified myself as a student working with NOAA Fisheries in collecting data on angler habits and sea turtle interactions, both for a master's project as well as for fisheries research. All fishers were advised that the survey would take about 10 minutes, participation was voluntary, and could be withdrawn at any time. No personally identifiable information was collected. As all the interviews were conducted by one person, there was no need for concern about consistency. Interviews were conducted one-on-one by me, Amanda Sajewski from the Duke University Marine Lab. They were done opportunistically (dependent on schedule availability) from late September through late October 2023 on both weekends and week days, generally in the late afternoon as day fishers were wrapping up and afternoon/evening fishers were arriving. I used the same surveying methods presented in Cook et al. (2020). Documenting general characteristics of the fishing at the pier - number of anglers and lines, weather conditions, and wave height. Questions asked of fishers ranged from state residency, preferred location and time to fish, bait and hook type, and bait disposal to specific sea turtle questions. These sea turtle questions centered around the circumstances of any incidental takes observed by the survey participant, such as where the sea turtle was hooked, what was the outcome, and whether or not it was reported to a state agency or STSSN. Outreach on the importance of reporting incidentally caught sea turtles was done opportunistically, most often after the final question: "What would you do if you accidentally caught a sea turtle?" Attention was directed to the STSSN signs that were posted at the entrance to the pier and importance of this data was mentioned, even if the "turtle seems fine."

Data Analysis

I checked data for accuracy, reformatted it, and analyzed the data using R 4.2.2 (R Core Team 2022). A zip code database of the United States was joined to the dataframe so fishers, based on their self-reported home zip code, could be separated into tourists and locals. I chose fifty miles from each pier (about an hour drive by car) as the cut-off for defining local fishers. After I reformatted the tables, I ran chi-squared tests on frequency of use to test for statistical significance. Occasionally, I used Fisher's exact tests and Kruskal-Wallis tests to test for significant relationships. For further spatial analysis, the data were converted into a shapefile that could be manipulated in arcGIS Pro 3.1.

RESULTS

Historical Sea Turtle Incidental Take Data

From 2008 to 2022 there were 427 reported interactions with sea turtles from recreational rod and reel fishers (anglers) from piers in North Carolina. I examined relationships between geographical location (county), species, hook location, hook type, and season. There was a sharp increase from 4 total reported interactions in 2012 to 30 reported interactions in 2013 and a subsequently sustained increase in reported interactions in 2013 until 2022, seen in Figure 2. It is impossible to know if this increase was due to increased awareness of the importance of reporting sea turtle interactions or if there were truly more interactions at piers in North Carolina.

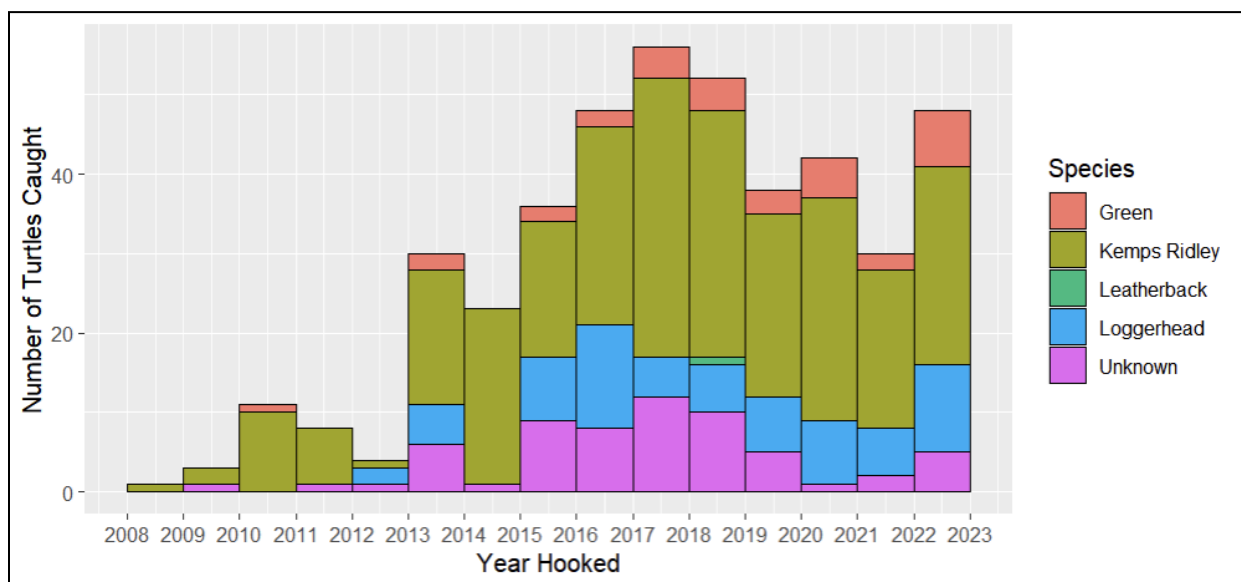


Figure 2: Sea turtle species and the numbers incidentally caught by year and over the entirety of our time frame of interest.

Due to this marked increase and the low number of captures from 2008 to 2012, my data analyses focused on the years from 2013-2022, shortening the time frame to 10 years instead of 15 so the data would more accurately represent what has recently been occurring and is currently being reported as occurring.

While hawksbills are occasionally found in North Carolina waters they did not show up in the stranding data from 2008 to 2022. There was one leatherback reported as incidentally caught in 2018. Kemp's ridley sea turtles represented 60% of reported interactions overall, and based on these reported interactions, were statistically more likely to be caught than any other sea turtle species ($p < 0.0001$) in each time frame examined [2008-2022, 2013-2022, 2018-2022].

The majority of reported incidental captures were in the late spring, early summer: 33% (130/400) of the reports were in May, with few to no reported captures from November to March during our time frame. Although overall there were the most reported captures in May, monthly numbers of incidental captures vary by county (see the the map of the coastal counties of North Carolina, with their respective shoreline distances in the Appendix). As seen in Figure 3, Carteret and Pender counties had higher numbers of reported incidental captures in May; and Brunswick County with the highest number of reported incidental captures, had those reported captures relatively evenly spread out among the summer months.

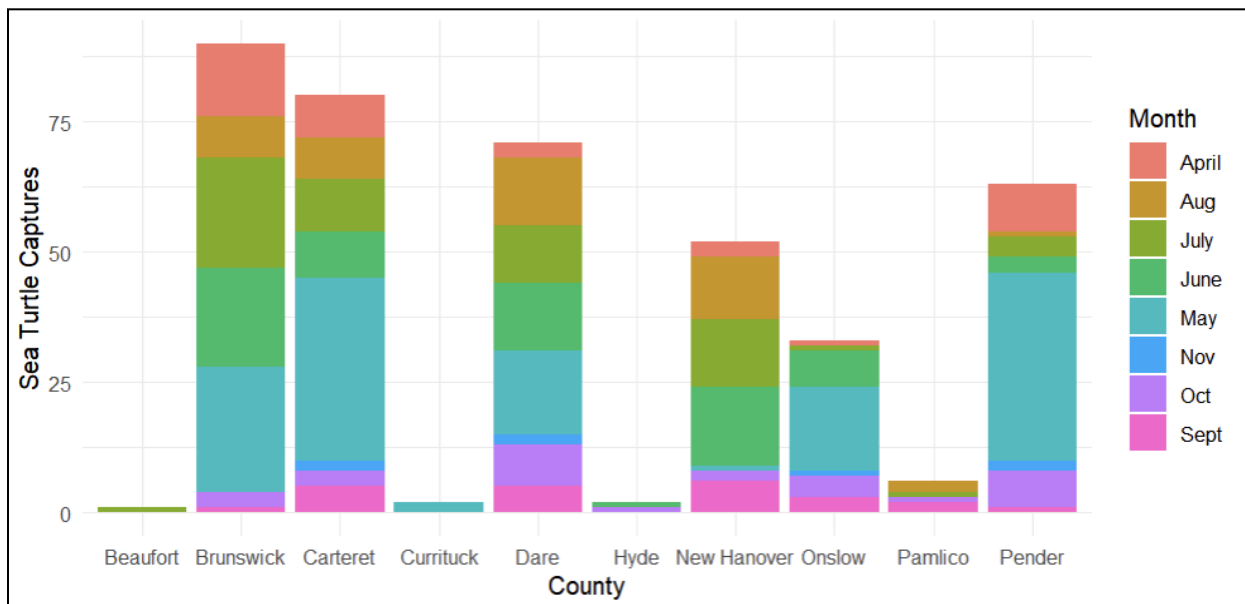


Figure 3: Reported sea turtle captures by Month and County

This outlook changes even more if broken down by species, as in Figure 4. Dare County, overall, had the third highest number of reported interactions, however by species it had the most interactions for both loggerhead and green sea turtles in August and October, respectively. Carteret County had the most interactions where the sea turtle species could not be verified, and May retains the largest share of reported interactions. Unsurprisingly, when Kemp’s ridleys are examined, Brunswick County remains the county with the highest number of reported interactions, followed by Pender County. Most counties were consistent with most captures occurring in May, except New Hanover, where captures shifted to be evenly spread across June, July and August.

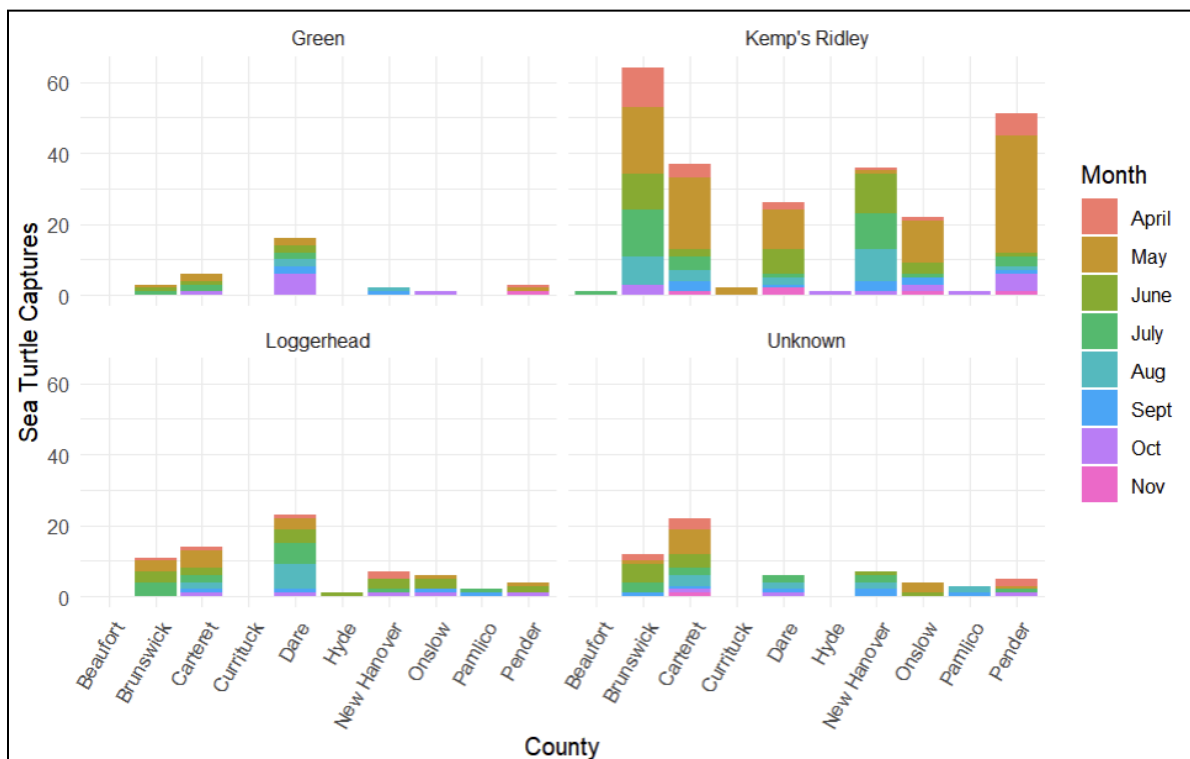


Figure 4: Reported Incidental sea turtle captures broken down by country, month, and species.

Not all categories of data were complete for every incidental capture entry in the database; such as hook-type (52/400 entries), bait-type (31/400 entries) and “where hooked” (238/400 entries). Shrimp was the most common bait type, in the 8% of interactions that had data on bait type 55% of them occurred when the fisher was using shrimp as bait. The second most common bait type was fish bites (~10%). In regards to hook type, j-hooks were most often reported as having been used when a turtle was incidentally captured (65% of interactions). Circle hooks were a distant second at 27% of captures, and treble hooks made up just under 8% of incidental captures. I performed a chi-squared test and a fisher’s exact test; however, hook type frequency in incidental captures was not significant ($p = 0.199$) compared to expected

hook type frequency in incidental captures, taking into account the popularity of hook types among fishers. Hook type was also not statistically significant when it came to where sea turtles were hooked. As can be seen in Figure 5, 42% of all reported incidental captures were hooked by the mouth, 69% of these were Kemp's ridley sea turtles. This accounts for 44% of all the known hook locations of incidentally caught Kemp's ridleys. In fact, while Kemp's ridleys had the highest number and proportion of captures by the mouth, captures by the mouth comprised the largest percentage of each species' known hook locations; only greens and loggerheads had a nearly equivalent amount of captures by mouth and flipper.

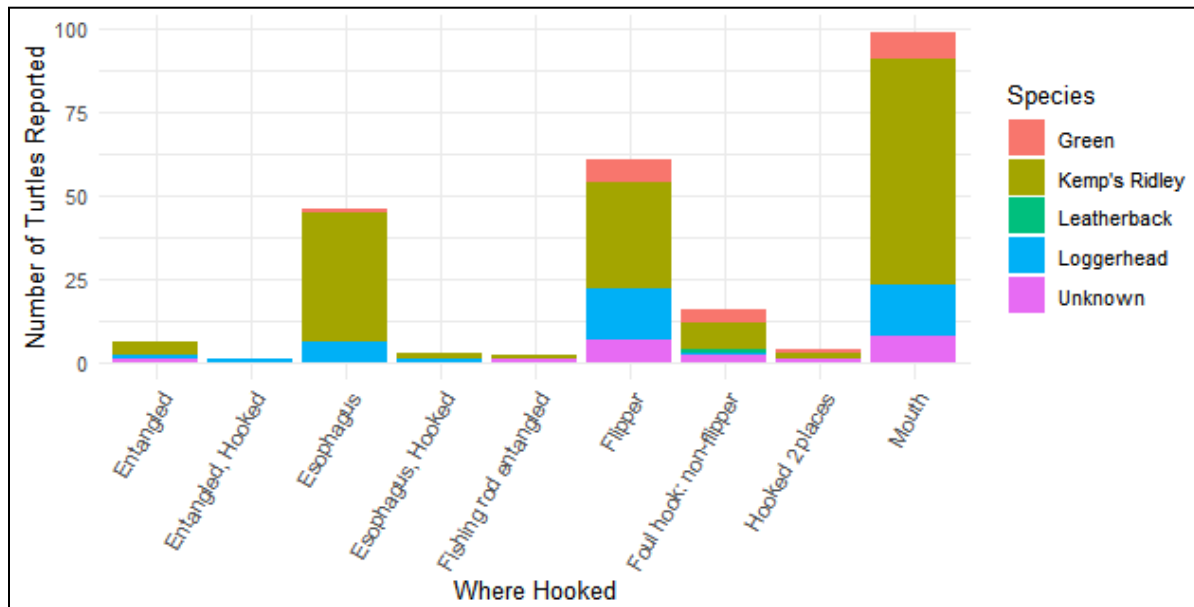


Figure 5: Sea turtle species and where they were reportedly hooked when they were incidentally captured.

The last thing I wanted to examine was final disposition and if this differed by species. Most sea turtles (64%) were released alive or broke free at the pier at which they were caught. However, 34% of sea turtles reported as incidentally captured were taken to a rehabilitation center, and 2.8% of these sea turtles died as a result of injuries received when they were incidentally captured. While the numbers for Kemp's ridley were higher because they were statistically more likely to be reportedly captured, there was not a statistically significant relationship between species and whether the sea turtle was taken to a rehabilitation center.

Angler Surveys

I conducted 77 surveys, capturing data for 150 anglers at three piers in Carteret County. I visited Bogue Inlet Fishing Pier three times, Oceanana Pier three times, and Newport River Pier twice during September and October, 2023. 63 survey respondents were from North Carolina, 32% of fishers overall were local to the pier where they were surveyed (Oceanana: 5/30, Newport River: 7/12, Bogue Inlet: 13/36). Most people spent 1-3 hours fishing at the pier

per day, although some fishers spent up to 11 hours fishing per day. Most survey responses captured data for more than one person, and more than one line in the water. Fishing effort, as measured by the number of lines in the water at the time of the surveys can be seen in Figure 6. Fishers ranged from having 1-2 lines up to 11 for a group of 8.

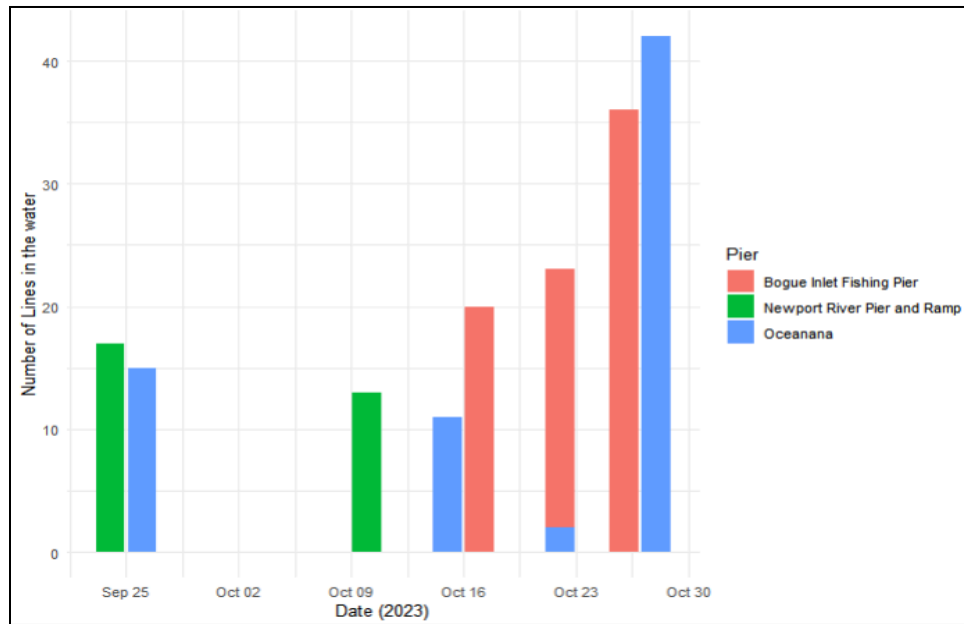


Figure 6: Fishing effort, as measured by number of lines in the water, at the time of each survey.

The first half of the survey covered general fishing habits and preferences. Most fishers interviewed preferred fishing in the spring and fall, with only 7 respondents fishing year-round. Shrimp was the most popular bait type by far, with 44% of lines using shrimp as bait; shrimp was statistically more likely to be chosen than any other type of bait for fishing, ($p < 0.0001$). As shown in Figure 7, I simplified responses for hook type to three choices; j-hook, circle hook, and treble hook. J-hooks were statistically more likely to be used than any other hook type ($p < 0.001$). Twenty-seven percent of respondents spent at least 16 days fishing during at least one season (3 months), while 49% of respondents were only visiting the coast, spending 5 days or less at the pier per season.

Bait_Type	Frequency
Artificial	4
Fish	14
Fish bites	17
Gotcha plug	12
Other	19
Shrimp	51

Hook_Type	Frequency
Circle hook	18
J-hook	50
Treble hook	30

Days Fishing	Frequency
Frequent (30+)	12
Infrequent (1-5)	36
Just started	2
Moderate (6-15)	19
Often (16-30)	9

Figure 7: Bait types and hook types and their frequency of use, measured by how many lines were using those bait types or hook types. And how many days survey respondents spent fishing per season (3 month quarters).

The second half of the survey focused on interactions between fishers and sea turtles. Only 43% of respondents (32 people) reported seeing a sea turtle in the vicinity of the pier in the previous 6-9 months; 20, 2, and 10 at Bogue Inlet, Newport River, and Oceanana Piers respectively. No turtles were seen eating discarded bait. Sixteen percent of respondents observed a sea turtle get hooked or captured (10 at Bogue Inlet Pier, 2 at Oceanana Pier). Eight of the sea turtles were foul-hooked (caught by the hook anywhere other than their mouth), and at least two of them had the hook in their mouth. Five captures were definitely reported and three were collected to go to a rehabilitation center. Of the five that were known to be unreported, four respondents said they didn't know who to call or that someone should be notified. The final question of the survey asked fishers what they would do in the future if they were to accidentally catch a turtle. Most respondents answered along the lines of remove the hook and release it (30%) or cut the line (24%). Some respondents were unsure and would either check the sign, call the "sea turtle people", the Coast Guard, or 911 (25%) or ask the Pier house or a local what they should do (12%). One local, when asked, clarified "If the turtle is injured we would call, more signage is needed, most of the regulars know what they're doing and can get the hook out and release the turtle with the net." Two people stated that they didn't like turtles and one survey respondent would take the opportunity presented and kiss the sea turtle.

DISCUSSION

This study aimed to fill a data gap in our understanding of sea turtle interactions with recreational fishers on piers in North Carolina in order to make recommendations to inform potential mitigation measures to decrease sea turtle bycatch. The study used a dual-method approach - historical data analysis and angler surveys - to attain a well-rounded picture of reported incidental captures at NC piers over the last 15 years and survey data on fisher preferences and behavior at those piers.

The historical data from STSSN shares characteristics with opportunistic survey data. For example, there is no baseline or absence data - out of 40 j-hooks using shrimp one hooked a turtle. Since these data are lacking, relationships between cofactors (e.g., if one hook-type is more likely to hook Kemp's ridleys in the esophagus) cannot be reliably determined. The angler preference survey questions are starting to collect that information - such as the statistically significant relative popularity and use frequency of j-hooks and shrimp when fishing. So, when this project is conducted at a state-wide scale, the surveys will provide that additional background data and therefore allow for better analysis of potential cofactors with incidental captures in the future.

Another challenge in interpreting self-reported data is the uncertainty if trends can be ascribed to true changes or if they merely represent an increase in reporting. There is an added layer of uncertainty here because of the probable high level of underreporting, for instance while conducting angler surveys many fishers expressed the view that there was no reason to report the capture if the turtle seemed fine. There is evidence supporting this tendency to assume sea turtles are fine, as their apparently tough external features and a flight response could easily deceive a casual observer that they were not injured (Putman et al. 2023). Indeed people often overestimate the probability of survival in sea turtles. Even non-apparent injuries can lead to secondary infection and death or decreased fitness and eventual death (Putman et al. 2023). This tendency to report turtles that are more difficult to dehook may partially account for the high percentage of reported incidental captures that were hooked by the mouth (42%) and reported 'deep hookings' when the sea turtles swallowed the hooks. It would also explain the disparity between historical data and survey data, survey data only had 25% (2/8) of sea turtles hooked by the mouth and 75% were foul-hooked compared to the ~33% of foul-hooked turtles in the historical data. It is likely that many of the unreported incidental captures are foul-hooked turtles.

An interesting point to consider is that according to Rose et al. (2022) there was a similar increase in reports of incidentally captured sea turtles in Virginia in 2013, just as there was in North Carolina, (from 4 reports to 30). In Virginia this was accompanied by a "targeted outreach program" that led to increased reports of hooked sea turtles by recreational fishers (Rose et al. 2022). Many of the fishers that fish at piers in North Carolina come from Virginia, (personal obs, 2023) so it is conceivable that the outreach program had an effect at North Carolina piers as well. Or it's an argument that this increase represents a true increase in incidental captures of sea turtles because presumably if there was a sea turtle event of some kind in Virginia it would also extend to North Carolina. Something to keep in mind for any future analysis of the historical data from South Carolina and Georgia. There is a less striking increase in reported captures in 2017; though this can likely be attributed to an increase in reports as this was the year the STSSN signs were put out on the popular fishing piers in North Carolina.

While attempting to control for the popularity of j-hooks and shrimp, use of these bait and hook types were not significant, suggesting that those are the most common hook type and bait type associated with incidental takes because they're the most common hook type and bait type used at the piers. This sort of secondary analysis could be done with the baseline data provided by the angler habit survey data. When looking at where sea turtles are hooked based on hook type, there is no relationship. This is counter to what might be expected from the success of switching to circle hooks in the commercial long-line fishery. A possible explanation is that the circle hooks used by pier anglers weren't large enough to prevent swallowing the hook. There is no statistical relationship but looking at frequency of use data, it could've been

expected that more sea turtles were caught by treble hooks. A potential reason they were not could have been because I did not separate gotcha plugs from other treble hooks, and perhaps gotcha plugs are less likely to hook sea turtles.

Most of the studies on mitigation measures and PIM have been concerned with commercial fisheries or PIM after entanglement in gill nets. To begin to investigate PIM after a hooking with a recreational rod and reel, I looked at the 2.8% of the turtles who died after being taken for rehabilitation. Seven out of the ten turtles died from injuries incurred after deeply swallowing a hook - both j-hooks and circle hooks - either from internally bleeding out or esophageal tears that were badly infected. One of these seven turtles most likely died from the hook penetrating its lung from where the hook was in the esophagus. These turtles had been in generally good body condition before being hooked, hook removals are usually successful and the turtle is expected to make a full recovery, but then the next day they are found dead and the cause is found either by radiograph or necropsy. One of the ten turtles died from complications of wounds incurred after deeply swallowing a large circle hook and after multiple surgeries failed to close the large wound left. The sea turtle deaths I've so far described were all either acute or subacute (Swimmer et al. 2014). One turtle died from effects of forced submergence after the trailing line was tangled on the bottom - most likely from capture myopathy. This is a different type of sub acute death, as opposed to death from a wound. One turtle died from long term effects of the sub-lethal impacts of entanglement, this was evident from the turtle's emaciated body condition and the high presence of epibiota. From this data, one could conclude that sea turtles with trailing line left are more likely to die as a complication of entanglement; and would most likely otherwise recover. On the other hand, sea turtles that swallow the hook can sustain injuries impossible to recover from. Therefore, it's important to focus efforts on mitigation methods that would decrease the amount of sea turtles that swallow the hooks.

At the end of any good research study, there are more questions to be answered. I will incorporate habitat data into my sea turtle maps to obtain distances of piers to preferred sea turtle habitat. Will this help inform which sea turtle species are most often reported as caught at that pier or the level of incidental captures generally? After answering this question, I will publish the analysis of the historical data including the dashboard tool. I hope the dashboard tool can be used to suggest trends that can inform potential mitigation measures.

CONCLUSION

From this study, we now have a better understanding of recreational bycatch of sea turtles in North Carolina. There are certain spatio-temporal trends that can inform localized mitigation measures to decrease bycatch at piers with historically high levels of incidental

captures. Some of these potential voluntary measures that could decrease sea turtle bycatch by recreational fishers include temporary restrictions. One option is to implement temporary closures during the months of highest incidental captures at each pier, for example a temporary closure in May for Carteret and Pender counties. Another potential mitigation measure is to restrict bait use other than lures or gotcha plugs during months of highest incidental captures. The finding that captures by the mouth were most common in all species indicates that this restriction of bait use may reduce incidental captures of loggerheads, Kemp's ridleys, and green sea turtles that are likely attracted to the bait as a food item.

Being the first person to conduct this survey in North Carolina I have a few suggestions for future surveyors. Plan to conduct surveys in the spring and fall to capture the highest volume of fishers and the highest numbers of incidental takes. However, fishing piers are popular and can get crowded; if there are a lot of fishers at the pier and you have limited resources and time, consider screening people by how often they fish at the pier - if it's 2-3 days every few years, or this is their 3rd visit their answers won't be very informational. It would be useful to include a question to determine if anglers are aware of the STSSN signage at the pier. This question would also offer an easy transition into effective and efficient outreach explaining why people should report a captured sea turtle. Although, even if made aware some fishers will still not want to take the time or effort to report the sea turtle or wait for someone to arrive. Training or pamphlets on what to do if you cannot contact the stranding network should be provided (for example cutting the line as close to the hook as possible).

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APPENDIX

Map of North Carolina's coastal counties with their corresponding miles of coastline. Surveys were conducted in Carteret County



Publicly available Dashboard: Species, Hook Type, Hook Location, Beach, and County can be queried

Sea Turtle Bycatch Events in North Carolina (2013-2022) Sea Turtle Species: Select a Species | Hook Location: No category selected | Beach: Select a Beach | County: Carteret

Year	County	Species	Hook Type
2022	Carteret	Kemps Ridl...	NA
2022	Carteret	Kemps Ridl...	NA
2022	Carteret	Kemps Ridl...	NA
2022	Carteret	Kemps Ridl...	NA
2022	Carteret	Unknown	NA
2022	Carteret	Unknown	NA
2021	Carteret	Loggerhead	Circle hook
2021	Carteret	Loggerhead	NA
2021	Carteret	Loggerhead	NA
2021	Carteret	Kemps Ridl...	NA
2021	Carteret	Kemps Ridl...	NA
2021	Carteret	Kemps Ridl...	NA
2021	Carteret	Kemps Ridl...	NA
2020	Carteret	Green	NA
2020	Carteret	Kemps Ridl...	NA
2020	Carteret	Kemps Ridl...	J hook
2020	Carteret	Kemps Ridl...	NA
2020	Carteret	Loggerhead	NA
2019	Carteret	Kemps Ridl...	NA
2019	Carteret	Kemps Ridl...	NA
2019	Carteret	Kemps Ridl...	NA

Pender

OID	2
Date	5/16/2021
County	Pender
RehabDisposition	R
Notes	Caught on pier (1 hook @ left side of Mouth

80

Sea Turtle Captures

<https://www.arcgis.com/apps/dashboards/e5494a51d63b4f0fa6c5549efa94fdc7>

Recreational Angler Survey used in this study: page 1 focuses on angler preferences/habits

THIS IS A VOLUNTARY SURVEY

Recreational Angler Survey of Sea Turtle Interactions
Shore-Based Angler Intercept Survey

Date: ___/___/___ Time: _____ (use 24 h) Survey ID: _____ Survey # _____

Location Name: _____ Data Collector: _____

Residential State: _____ Residential Zip Code: _____ # of People: _____ # of Lines in Water _____

Where was angler fishing? F) Pier: First 1/3, near land M) Pier: Middle 1/3 E) Pier: End 1/3, over water
S) Shore B) Boat O) Other _____

Is the angler: A) Active (i.e. artificial/casting and reeling) I) Inactive (i.e. not moving rod & reel)

1. How long have you been fishing today? _____ hours (record in decimals, i.e. 0.5 h)

2. What time of day do you usually fish at this location? (Circle all that apply)
M) Morning A) Afternoon E) Evening N) Night AD) All day V) Varies

3. During what seasons do you fish at this location? (Circle all that apply) J- Just started (1st or 2nd time fishing)
Sp) Spring (Mar-May) Su) Summer (Jun-Aug) F) Fall (Sep-Nov) W) Winter (Dec-Feb)

4. During each season mentioned above, how many days per season do you fish at this location?
A) Just started (1st or 2nd time fishing) B) Infrequent (1-5 days/season) C) Moderate (6-15 days/season)
D) Often (16-30 days/season) E) Frequent (30+ days/season)
Sp) Spring (Mar-May): _____ Su) Summer (Jun-Aug): _____ F) Fall (Sep-Nov): _____ W) Winter (Dec-Feb): _____

5. What are you fishing for today? (If more than 2, circle Anything)
A) Anything B) Catfish C) Croaker D) Drum (Red/Redfish/Black) E) Flounder
F) Ground mullet/Whiting G) Mackerel (King/Spanish) H) Trout I) Shark
J) Other: _____

6. How many poles are you fishing? 1 2 3 4 >4

7. Are all your fishing poles rigged the same way? YES (record Q8-14 in Pole 1) NO (if no, record Q8-14 for each pole)

8. How many hooks per pole?
A) All poles or Pole 1: _____ B) Pole 2: _____ C) Pole 3: _____ D) Pole 4: _____

9. What type of line connects to your hook? M) Monofilament B) Braid D) Dacron W) Wire (single or multi strand)
Other: _____
A) All poles or Pole 1: _____ B) Pole 2: _____ C) Pole 3: _____ D) Pole 4: _____

10. What type of hook are you using? JI) J-hook, inline JO) J-hook, offset CO) Circle, offset CI) Circle, inline K) Kahle
G) Jig T) Treble Other: _____
A) All poles or Pole 1: _____ B) Pole 2: _____ C) Pole 3: _____ D) Pole 4: _____

11. Is the hook barbless? N) No Y) Yes
A) All poles or Pole 1: _____ B) Pole 2: _____ C) Pole 3: _____ D) Pole 4: _____

12. What is the hook length (mm)? Measure length for all hook types. (Length = top of the hook to the bottom)
A) All poles or Pole 1: _____ B) Pole 2: _____ C) Pole 3: _____ D) Pole 4: _____

13. If the hook is a circle hook, the gape should be measured (mm). (Gape = tip of the point to the inside of the shaft)
A) All poles or Pole 1: _____ B) Pole 2: _____ C) Pole 3: _____ D) Pole 4: _____

14. What bait are you using today? DS) Dead shrimp LS) Live shrimp S) Squid C) Crab AR) Artificial
W) Whole fish (live/dead? what kind?): _____ CB) Cut bait/fish (what kind?): _____
O) Other (what kind?): _____
A) All poles or Pole 1: _____ B) Pole 2: _____ C) Pole 3: _____ D) Pole 4: _____

THIS IS A VOLUNTARY SURVEY

15. What do you do with your unused bait?
 T) Throw in water G) Give to other angler H) Take home D) Discard elsewhere N) Never have unused bait
16. Where do you usually clean your fish? D) Do not clean fish S) on site H) at home O) Other _____
17. If on site, where do you discard fish remains? W) Water T) Trash can O) Other _____

The next several questions all deal with what you have observed in the last 6 months while fishing at this location:

18. Have you observed sea turtles in the water around this location? NO YES
19. Have you observed sea turtles eating discarded bait near this location? NO YES
20. Have you observed anyone catch a sea turtle at this location? NO YES
21. What would you do if you caught/hooked a sea turtle?
 A) Report incident to _____ B) Cut line C) Take to wildlife rehab D) Other _____
22. Have **YOU** caught a sea turtle at this location? NO YES

END OF SURVEY IF PARTICIPANT DID NOT CATCH ANY SEA TURTLES OR ASK BELOW QUESTIONS

23. If YES, How many? A) _____ within last 30 days B) _____ 2-3 months ago C) _____ 4-6 months ago
24. What time were the turtle(s) caught? A) Daytime (8 am – 8 pm) B) Nighttime (8 pm – 8 am) C) Both
 A) _____ within last 30 days B) _____ 2-3 months ago C) _____ 4-6 months ago
25. Have you caught or hooked a sea turtle today? NO YES
26. Was the most recently captured sea turtle: H) Hooked E) Entangled HE) Hooked & entangled
 U) Unknown O) Other: _____
27. If hooked, could you tell where the sea turtle was hooked? External is anywhere on the body, flippers or head.
 E) External M) Inside mouth S) Swallowed NS) Not sure
28. If hooked, was the hook removed? NO YES Not sure
29. Was all the line removed? NO YES Not sure
30. If NO: amount of line remaining _____ (feet/inches)
31. What happened to the sea turtle?
 A) Turtle released on site with ALL gear removed B) Turtle released on site with some gear attached
 C) Turtle collected by rehab facility staff
32. How was the sea turtle landed? A) Used a net B) Pulled up by line C) Walked to shore D) Not landed
33. Were there any tags/markings on sea turtle? NO YES (circle all that apply): F) Flipper S) Satellite P) Paint
34. Did you notify anyone about the capture? (Rehab facility, state or federal agency) YES NO
35. If YES, who did you call? R) Rehab facility S) State agency F) Federal agency O) Other: _____
36. If NO, why was the turtle capture not reported? A) Did not know B) No phone C) Afraid to get in trouble
 D) Did not want to wait/unable to wait for rehab staff E) Too time consuming

Final Disposition of sea turtles

	AR	ATfR	LFNR	Sum
Green	22	10	0	32
Kemp's Ridley	136	126	0	262
Leatherback	1	0	0	1
Loggerhead	51	17	2	70
Unknown	57	0	5	62
Sum	267	153	7	427

Key: AR: alive released at scene, ATfR: Alive taken for rehab, LFNR: Left floating, not retrieved

Counts of incidentally captured sea turtles by Species by Year

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Sum
CC	0	0	0	0	2	5	0	8	13	5	5	7	8	6	11	70
CM	0	0	1	0	0	2	0	2	2	4	4	3	5	2	7	32
DC	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
LK	1	2	10	7	1	17	21	17	25	35	31	22	28	20	25	262
UN	0	1	0	1	1	6	1	9	8	12	10	5	1	2	5	62
Sum	1	3	11	8	4	30	22	36	48	56	51	37	42	30	48	427

Counts of incidentally captured sea turtles by Species by Month

	4	5	6	7	8	9	10	11	Sum
CC	5	13	18	15	10	4	5	0	70
CM	1	6	5	5	3	3	8	1	32
DC	0	1	0	0	0	0	0	0	1
LK	25	107	38	39	23	10	15	5	262
UN	7	12	12	11	9	7	3	1	62
Sum	38	139	73	70	45	24	31	7	427

Counts of incidentally captured sea turtles by County by Year

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Sum
Beaufort	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Brunswick	1	0	1	1	1	2	7	5	7	17	11	8	13	9	11	94
Carteret	0	0	1	1	2	4	5	7	14	6	15	12	5	6	6	84
Currituck	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Dare	0	1	0	1	1	1	1	9	8	13	7	6	7	2	17	74
Hyde	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	3
New Hanover	0	2	2	1	0	10	2	7	8	3	3	2	9	2	6	57
Onslow	0	0	0	1	0	4	1	1	2	7	6	2	7	0	3	34
Pamlico	0	0	0	0	0	2	0	0	1	0	1	0	0	2	0	6
Pender	0	0	6	3	0	7	6	7	7	10	8	7	0	7	4	72
Sum	1	3	11	8	4	30	22	36	48	56	51	37	42	30	48	427

Counts of incidentally captured sea turtles by Species by Hook Type

	Circle hook	J hook	Treble	Sum
Green	2	4	0	6
Kemp's Ridley	5	20	3	28
Leatherback	0	0	0	0
Loggerhead	7	11	2	20
Unknown	1	1	0	2
Sum	15	36	5	56

56/427: 13% of entries had data for hook-type

Counts of incidentally captured sea turtles by Species by Bait Type

	Croaker	Cut bait	Finger mullet	Fishbites	Live menhaden	Mussel	Shrimp	Squid	Sum
Green	0	0	1	1	0	0	2	0	4
Kemp's Ridley	1	1	1	2	0	0	15	2	22
Leatherback	0	0	0	0	0	0	0	1	1
Loggerhead	0	1	0	0	1	0	1	2	5
Unknown	0	0	1	0	0	1	0	0	2
Sum	1	2	3	3	1	1	18	5	34

34/427: 8% of entries had data for bait type

Counts of incidentally captured sea turtles by Species and Where they were hooked

	Entangled	Entangled, Hooked	Esophagus	Esophagus, Hooked	Fishing rod entangled	Flipper	Foul hook: non-flipper	Hooked 2 places	Mouth	Sum
Green	0	0	1	0	0	7	4	1	8	21
Kemp's Ridley	4	0	42	2	1	34	8	2	73	166
Leatherback	0	0	0	0	0	0	1	0	0	1
Loggerhead	1	1	6	1	0	15	1	0	16	41
Unknown	1	0	0	0	1	7	2	1	8	20
Sum	6	1	49	3	2	63	16	4	105	249

58% of entries had data for how turtles were hooked

Key: entangled, entangled, hooked: turtle was either hooked or entangled and brought to pier and either had line or another hook, esophagus, hooked: turtle had at least 2 hooks- one swallowed and one foul-hooked, fishing rod entangled: turtle was still dragging a fishing rod, Foul hook: non-flipper: turtle was caught anywhere other than it's mouth or flipper, Hooked 2 places: at least 2 hooks - either both external or one in the mouth and one external

Counts of incidentally captured Kemp's ridley turtles by County by Year

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Sum
Beaufort	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Brunswick	1	0	0	1	0	1	7	1	5	12	9	5	9	7	8	66
Carteret	0	0	1	1	1	1	4	1	8	2	6	5	3	3	4	40
Currituck	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Dare	0	0	0	0	0	0	1	4	3	4	2	2	3	0	7	26
Hyde	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2
New Hanover	0	2	2	1	0	7	2	5	2	3	2	2	8	2	3	41
Onslow	0	0	0	1	0	2	1	1	0	6	5	2	5	0	0	23
Pamlico	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Pender	0	0	6	3	0	6	6	5	6	8	7	6	0	5	2	60
Sum	1	2	10	7	1	17	21	17	25	35	31	22	28	20	25	262

Counts of incidentally captured Kemp's ridley turtles by County by Month

	January	February	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Sum
Beaufort	0	0	0	0	0	0	1	0	0	0	0	0	1
Brunswick	0	0	0	11	19	11	14	8	0	3	0	0	66
Carteret	0	0	0	4	20	3	5	3	3	1	1	0	40
Currituck	0	0	0	0	2	0	0	0	0	0	0	0	2
Dare	0	0	0	2	11	7	1	2	1	0	2	0	26
Hyde	0	0	0	0	1	0	0	0	0	1	0	0	2
New Hanover	0	0	0	1	1	12	13	9	3	2	0	0	41
Onslow	0	0	0	1	12	4	1	0	2	2	1	0	23
Pamlico	0	0	0	0	0	0	0	0	0	1	0	0	1
Pender	0	0	0	6	41	1	4	1	1	5	1	0	60
Sum	0	0	0	25	107	38	39	23	10	15	5	0	262

Counts of incidentally captured Loggerhead turtles by County by Year

	2012	2013	2015	2016	2017	2018	2019	2020	2021	2022	Sum
Brunswick	1	0	1	2	1	0	2	2	1	2	12
Carteret	1	3	1	2	0	3	1	1	3	0	15
Dare	0	0	5	4	3	1	3	3	1	3	23
Hyde	0	0	0	0	0	0	0	1	0	0	1
New Hanover	0	1	0	4	0	0	0	0	0	2	7
Onslow	0	1	0	1	1	0	0	1	0	2	6
Pamlico	0	0	0	0	0	1	0	0	1	0	2
Pender	0	0	1	0	0	0	1	0	0	2	4
Sum	2	5	8	13	5	5	7	8	6	11	70

Counts of incidentally captured Loggerhead turtles by County by Month

	January	February	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Sum
Brunswick	0	0	0	1	3	3	5	0	0	0	0	0	12
Carteret	0	0	0	1	5	2	2	3	1	1	0	0	15
Dare	0	0	0	1	3	4	6	7	1	1	0	0	23
Hyde	0	0	0	0	0	1	0	0	0	0	0	0	1
New Hanover	0	0	0	2	0	3	1	0	0	1	0	0	7
Onslow	0	0	0	0	1	3	0	0	1	1	0	0	6
Pamlico	0	0	0	0	0	0	1	0	1	0	0	0	2
Pender	0	0	0	0	1	2	0	0	0	1	0	0	4
Sum	0	0	0	5	13	18	15	10	4	5	0	0	70

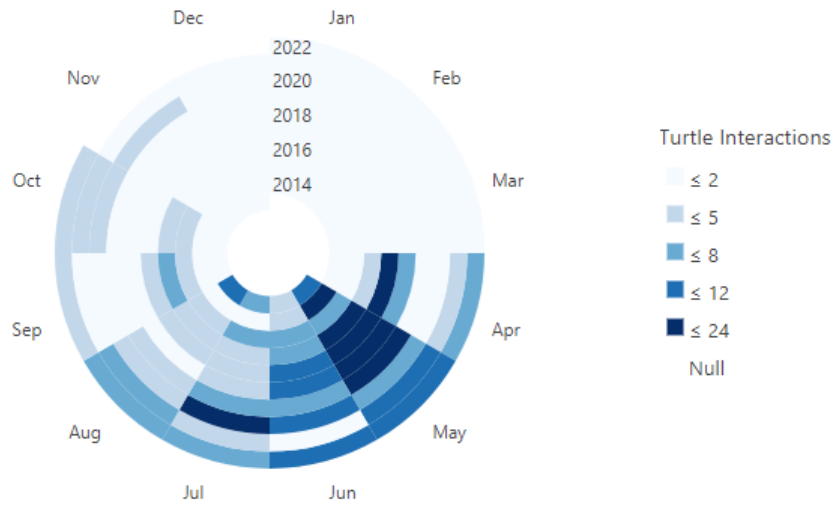
Counts of incidentally captured Green turtles by County by Year

	2010	2013	2015	2016	2017	2018	2019	2020	2021	2022	Sum
Brunswick	1	1	0	0	0	0	1	1	0	0	4
Carteret	0	0	2	1	0	1	1	1	0	0	6
Dare	0	1	0	0	4	3	1	1	0	6	16
New Hanover	0	0	0	0	0	0	0	1	0	1	2
Onslow	0	0	0	0	0	0	0	1	0	0	1
Pender	0	0	0	1	0	0	0	0	2	0	3
Sum	1	2	2	2	4	4	3	5	2	7	32

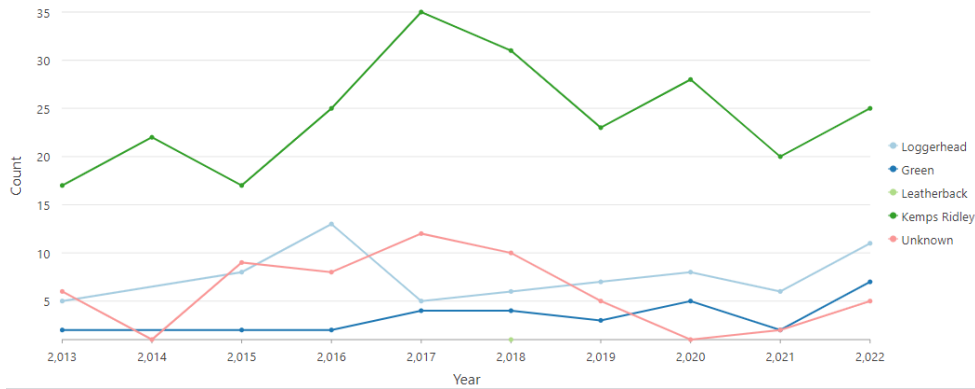
Counts of incidentally captured Green turtles by County by Month

	January	February	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Sum
Brunswick	0	0	0	0	1	2	1	0	0	0	0	0	4
Carteret	0	0	0	0	2	1	2	0	0	1	0	0	6
Dare	0	0	0	0	2	2	2	2	2	6	0	0	16
New Hanover	0	0	0	0	0	0	0	1	1	0	0	0	2
Onslow	0	0	0	0	0	0	0	0	0	1	0	0	1
Pender	0	0	0	1	1	0	0	0	0	0	1	0	3
Sum	0	0	0	1	6	5	5	3	3	8	1	0	32

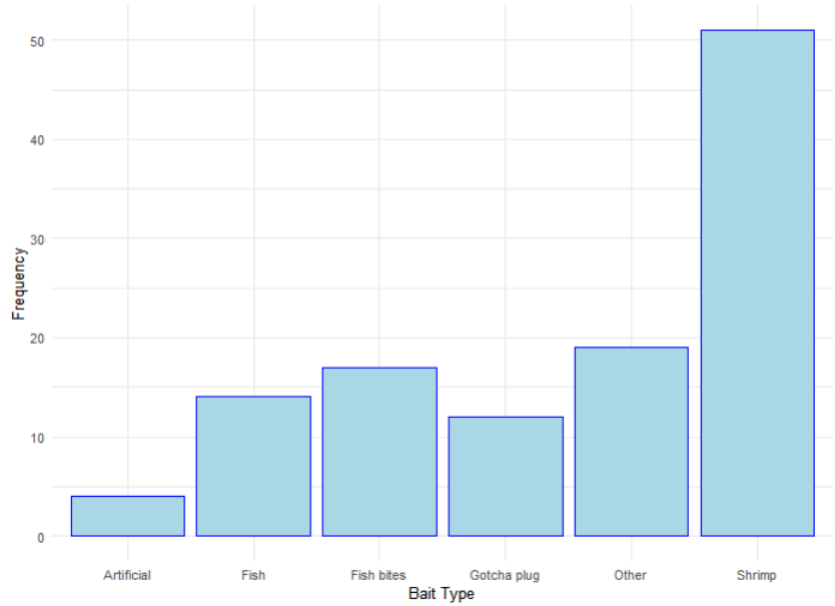
Turtle Interactions by Month over Years



Reported Captures over Years by Species



Frequency of Bait Types



15 Years, 2008-2022 of Incidental Capture Data in a Table 1

Percentages of Reported captures of Sea Turtle Species by County, Beach, Hook-Type, Hook Location, Bait-Type, Rehab disposition, and Final Disposition

	Total (N=427)	Green (N=32)	Kemp's Ridley (N=262)	Leatherback (N=1)	Loggerhead (N=70)	Unknown (N=62)
County						
Beaufort	1 (0.2%)	0 (0%)	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)
Brunswick	94 (22.0%)	4 (12.5%)	66 (25.2%)	0 (0%)	12 (17.1%)	12 (19.4%)
Carteret	84 (19.7%)	6 (18.8%)	40 (15.3%)	1 (100%)	15 (21.4%)	22 (35.5%)
Currituck	2 (0.5%)	0 (0%)	2 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Dare	74 (17.3%)	16 (50.0%)	26 (9.9%)	0 (0%)	23 (32.9%)	9 (14.5%)
Hyde	3 (0.7%)	0 (0%)	2 (0.8%)	0 (0%)	1 (1.4%)	0 (0%)
New Hanover	57 (13.3%)	2 (6.3%)	41 (15.6%)	0 (0%)	7 (10.0%)	7 (11.3%)
Onslow	34 (8.0%)	1 (3.1%)	23 (8.8%)	0 (0%)	6 (8.6%)	4 (6.5%)
Pamlico	6 (1.4%)	0 (0%)	1 (0.4%)	0 (0%)	2 (2.9%)	3 (4.8%)
Pender	72 (16.9%)	3 (9.4%)	60 (22.9%)	0 (0%)	4 (5.7%)	5 (8.1%)
Month						
Mean (SD)	6.41 (1.78)	7.53 (2.06)	6.16 (1.74)	5.00 (NA)	6.63 (1.60)	6.66 (1.79)
Median [Min, Max]	6.00 [4.00, 11.0]	7.00 [4.00, 11.0]	5.00 [4.00, 11.0]	5.00 [5.00, 5.00]	6.00 [4.00, 10.0]	6.50 [4.00, 11.0]
Beach						
Albemarle Sound	2 (0.5%)	1 (3.1%)	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)
Atlantic Beach	24 (5.6%)	2 (6.3%)	8 (3.1%)	0 (0%)	3 (4.3%)	11 (17.7%)
Bald Head Island	3 (0.7%)	1 (3.1%)	2 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Beaufort/Down East	4 (0.9%)	0 (0%)	3 (1.1%)	0 (0%)	1 (1.4%)	0 (0%)
Bodie Island	1 (0.2%)	1 (3.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Camp Lejeune	3 (0.7%)	0 (0%)	2 (0.8%)	0 (0%)	0 (0%)	1 (1.6%)
Cape Lookout NS	10 (2.3%)	1 (3.1%)	3 (1.1%)	1 (100%)	4 (5.7%)	1 (1.6%)
Caswell Beach	5 (1.2%)	0 (0%)	4 (1.5%)	0 (0%)	1 (1.4%)	0 (0%)
Core Sound (floating/spoil island)	2 (0.5%)	0 (0%)	1 (0.4%)	0 (0%)	1 (1.4%)	0 (0%)
Emerald Isle	29 (6.8%)	2 (6.3%)	18 (6.9%)	0 (0%)	2 (2.9%)	7 (11.3%)
Ft. Fisher SRA	7 (1.6%)	0 (0%)	7 (2.7%)	0 (0%)	0 (0%)	0 (0%)
Ft. Macon	2 (0.5%)	0 (0%)	1 (0.4%)	0 (0%)	1 (1.4%)	0 (0%)
Harkers Island	5 (1.2%)	0 (0%)	1 (0.4%)	0 (0%)	2 (2.9%)	2 (3.2%)
Hatteras Island	24 (5.6%)	5 (15.6%)	5 (1.9%)	0 (0%)	11 (15.7%)	3 (4.8%)
Holden Beach	29 (6.8%)	1 (3.1%)	18 (6.9%)	0 (0%)	5 (7.1%)	5 (8.1%)
Hwy 24/Morehead City	2 (0.5%)	0 (0%)	2 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Neuse/Pamlico Rivers	10 (2.3%)	0 (0%)	6 (2.3%)	0 (0%)	1 (1.4%)	3 (4.8%)
Oak Island	31 (7.3%)	2 (6.3%)	23 (8.8%)	0 (0%)	4 (5.7%)	2 (3.2%)
Ocean Isle Beach	9 (2.1%)	0 (0%)	6 (2.3%)	0 (0%)	0 (0%)	3 (4.8%)
Ocracoke Island	1 (0.2%)	0 (0%)	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)
Pamlico Sound (floating/spoil island)	4 (0.9%)	1 (3.1%)	0 (0%)	0 (0%)	1 (1.4%)	2 (3.2%)
Pea Island NWR	1 (0.2%)	1 (3.1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Pleasure Island	40 (9.4%)	0 (0%)	30 (11.5%)	0 (0%)	5 (7.1%)	5 (8.1%)
Southport	1 (0.2%)	0 (0%)	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)
Sunset/Bird Islands	14 (3.3%)	0 (0%)	10 (3.8%)	0 (0%)	2 (2.9%)	2 (3.2%)
Swansboro	1 (0.2%)	0 (0%)	0 (0%)	0 (0%)	1 (1.4%)	0 (0%)
Topsail Island	102 (23.9%)	4 (12.5%)	81 (30.9%)	0 (0%)	9 (12.9%)	8 (12.9%)
VA border to Nags Head	47 (11.0%)	8 (25.0%)	22 (8.4%)	0 (0%)	12 (17.1%)	5 (8.1%)
Western Pamlico Sound	2 (0.5%)	0 (0%)	0 (0%)	0 (0%)	2 (2.9%)	0 (0%)
Wilmington	5 (1.2%)	1 (3.1%)	4 (1.5%)	0 (0%)	0 (0%)	0 (0%)
Wrightsville Beach	7 (1.6%)	1 (3.1%)	2 (0.8%)	0 (0%)	2 (2.9%)	2 (3.2%)

Hook.Type						
Circle hook	15 (26.8%)	2 (33.3%)	5 (17.9%)	NA	7 (35.0%)	1 (50.0%)
J hook	36 (64.3%)	4 (66.7%)	20 (71.4%)	NA	11 (55.0%)	1 (50.0%)
Treble	5 (8.9%)	0 (0%)	3 (10.7%)	NA	2 (10.0%)	0 (0%)
Missing	371 (86.9%)	26 (81.3%)	234 (89.3%)	1 (100%)	50 (71.4%)	60 (96.8%)
Hooked.Where						
Entangled	6 (2.4%)	0 (0%)	4 (2.4%)	0 (0%)	1 (2.4%)	1 (5.0%)
Entangled, Hooked	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)	1 (2.4%)	0 (0%)
Esophagus	49 (19.7%)	1 (4.8%)	42 (25.3%)	0 (0%)	6 (14.6%)	0 (0%)
Esophagus, Hooked	3 (1.2%)	0 (0%)	2 (1.2%)	0 (0%)	1 (2.4%)	0 (0%)
Fishing rod entangled	2 (0.8%)	0 (0%)	1 (0.6%)	0 (0%)	0 (0%)	1 (5.0%)
Flipper	63 (25.3%)	7 (33.3%)	34 (20.5%)	0 (0%)	15 (36.6%)	7 (35.0%)
Foul hook: non-flipper	16 (6.4%)	4 (19.0%)	8 (4.8%)	1 (100%)	1 (2.4%)	2 (10.0%)
Hooked 2 places	4 (1.6%)	1 (4.8%)	2 (1.2%)	0 (0%)	0 (0%)	1 (5.0%)
Mouth	105 (42.2%)	8 (38.1%)	73 (44.0%)	0 (0%)	16 (39.0%)	8 (40.0%)
Missing	178 (41.7%)	11 (34.4%)	96 (36.6%)	0 (0%)	29 (41.4%)	42 (67.7%)
Bait.Type						
Croaker	1 (2.9%)	0 (0%)	1 (4.5%)	0 (0%)	0 (0%)	0 (0%)
Cut bait	2 (5.9%)	0 (0%)	1 (4.5%)	0 (0%)	1 (20.0%)	0 (0%)
Finger mullet	3 (8.8%)	1 (25.0%)	1 (4.5%)	0 (0%)	0 (0%)	1 (50.0%)
Fishbites	3 (8.8%)	1 (25.0%)	2 (9.1%)	0 (0%)	0 (0%)	0 (0%)
Live menhaden	1 (2.9%)	0 (0%)	0 (0%)	0 (0%)	1 (20.0%)	0 (0%)
Mussel	1 (2.9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50.0%)
Shrimp	18 (52.9%)	2 (50.0%)	15 (68.2%)	0 (0%)	1 (20.0%)	0 (0%)
Squid	5 (14.7%)	0 (0%)	2 (9.1%)	1 (100%)	2 (40.0%)	0 (0%)
Missing	393 (92.0%)	28 (87.5%)	240 (91.6%)	0 (0%)	65 (92.9%)	60 (96.8%)
RehabDisposition						
	275 (64.4%)	24 (75.0%)	134 (51.1%)	1 (100%)	54 (77.1%)	62 (100%)
D	11 (2.6%)	1 (3.1%)	8 (3.1%)	0 (0%)	2 (2.9%)	0 (0%)
R	141 (33.0%)	7 (21.9%)	120 (45.8%)	0 (0%)	14 (20.0%)	0 (0%)
FinalDisposition						
AR	267 (62.5%)	22 (68.8%)	136 (51.9%)	1 (100%)	51 (72.9%)	57 (91.9%)
ATFR	153 (35.8%)	10 (31.3%)	126 (48.1%)	0 (0%)	17 (24.3%)	0 (0%)
LFNR	7 (1.6%)	0 (0%)	0 (0%)	0 (0%)	2 (2.9%)	5 (8.1%)

10 Years, 2013-2022 of Incidental Capture Data in a Table 1

Percentages of Reported captures of Sea Turtle Species by County, Beach, Hook-Type, Hook Location, Bait-Type, Rehab disposition, and Final Disposition

	Total (N=400)	Green (N=31)	Kemp's Ridley (N=241)	Leatherback (N=1)	Loggerhead (N=68)	Unknown (N=59)
County						
Beaufort	1 (0.3%)	0 (0%)	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)
Brunswick	90 (22.5%)	3 (9.7%)	64 (26.6%)	0 (0%)	11 (16.2%)	12 (20.3%)
Carteret	80 (20.0%)	6 (19.4%)	37 (15.4%)	1 (100%)	14 (20.6%)	22 (37.3%)
Currituck	2 (0.5%)	0 (0%)	2 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Dare	71 (17.8%)	16 (51.6%)	26 (10.8%)	0 (0%)	23 (33.8%)	6 (10.2%)
Hyde	2 (0.5%)	0 (0%)	1 (0.4%)	0 (0%)	1 (1.5%)	0 (0%)
New Hanover	52 (13.0%)	2 (6.5%)	36 (14.9%)	0 (0%)	7 (10.3%)	7 (11.9%)
Onslow	33 (8.3%)	1 (3.2%)	22 (9.1%)	0 (0%)	6 (8.8%)	4 (6.8%)
Pamlico	6 (1.5%)	0 (0%)	1 (0.4%)	0 (0%)	2 (2.9%)	3 (5.1%)
Pender	63 (15.8%)	3 (9.7%)	51 (21.2%)	0 (0%)	4 (5.9%)	5 (8.5%)
Month						
Mean (SD)	6.41 (1.80)	7.58 (2.08)	6.16 (1.76)	5.00 (NA)	6.60 (1.61)	6.63 (1.81)
Median [Min, Max]	6.00 [4.00, 11.0]	7.00 [4.00, 11.0]	5.00 [4.00, 11.0]	5.00 [5.00, 5.00]	6.00 [4.00, 10.0]	6.00 [4.00, 11.0]
Beach						
Albemarle Sound	2 (0.5%)	1 (3.2%)	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)
Atlantic Beach	24 (6.0%)	2 (6.5%)	8 (3.3%)	0 (0%)	3 (4.4%)	11 (18.6%)
Bald Head Island	3 (0.8%)	1 (3.2%)	2 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Beaufort/Down East	4 (1.0%)	0 (0%)	3 (1.2%)	0 (0%)	1 (1.5%)	0 (0%)
Bodie Island	1 (0.3%)	1 (3.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Camp Lejeune	3 (0.8%)	0 (0%)	2 (0.8%)	0 (0%)	0 (0%)	1 (1.7%)
Cape Lookout NS	10 (2.5%)	1 (3.2%)	3 (1.2%)	1 (100%)	4 (5.9%)	1 (1.7%)
Caswell Beach	5 (1.3%)	0 (0%)	4 (1.7%)	0 (0%)	1 (1.5%)	0 (0%)
Core Sound (floating/spoil island)	1 (0.3%)	0 (0%)	0 (0%)	0 (0%)	1 (1.5%)	0 (0%)

Emerald Isle	28 (7.0%)	2 (6.5%)	17 (7.1%)	0 (0%)	2 (2.9%)	7 (11.9%)
Ft. Fisher SRA	7 (1.8%)	0 (0%)	7 (2.9%)	0 (0%)	0 (0%)	0 (0%)
Ft. Macon	1 (0.3%)	0 (0%)	0 (0%)	0 (0%)	1 (1.5%)	0 (0%)
Harkers Island	4 (1.0%)	0 (0%)	1 (0.4%)	0 (0%)	1 (1.5%)	2 (3.4%)
Hatteras Island	23 (5.8%)	5 (16.1%)	5 (2.1%)	0 (0%)	11 (16.2%)	2 (3.4%)
Holden Beach	29 (7.3%)	1 (3.2%)	18 (7.5%)	0 (0%)	5 (7.4%)	5 (8.5%)
Hwy 24/Morehead City	2 (0.5%)	0 (0%)	2 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Neuse/Pamlico Rivers	10 (2.5%)	0 (0%)	6 (2.5%)	0 (0%)	1 (1.5%)	3 (5.1%)
Oak Island	29 (7.3%)	1 (3.2%)	22 (9.1%)	0 (0%)	4 (5.9%)	2 (3.4%)
Ocean Isle Beach	9 (2.3%)	0 (0%)	6 (2.5%)	0 (0%)	0 (0%)	3 (5.1%)
Pamlico Sound (floating/spoil island)	3 (0.8%)	1 (3.2%)	0 (0%)	0 (0%)	1 (1.5%)	1 (1.7%)
Pea Island NWR	1 (0.3%)	1 (3.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Pleasure Island	36 (9.0%)	0 (0%)	26 (10.8%)	0 (0%)	5 (7.4%)	5 (8.5%)
Sunset/Bird Islands	13 (3.3%)	0 (0%)	10 (4.1%)	0 (0%)	1 (1.5%)	2 (3.4%)
Swansboro	1 (0.3%)	0 (0%)	0 (0%)	0 (0%)	1 (1.5%)	0 (0%)
Topsail Island	92 (23.0%)	4 (12.9%)	71 (29.5%)	0 (0%)	9 (13.2%)	8 (13.6%)
VA border to Nags Head	46 (11.5%)	8 (25.8%)	22 (9.1%)	0 (0%)	12 (17.6%)	4 (6.8%)
Western Pamlico Sound	2 (0.5%)	0 (0%)	0 (0%)	0 (0%)	2 (2.9%)	0 (0%)
Wilmington	4 (1.0%)	1 (3.2%)	3 (1.2%)	0 (0%)	0 (0%)	0 (0%)
Wrightsville Beach	7 (1.8%)	1 (3.2%)	2 (0.8%)	0 (0%)	2 (2.9%)	2 (3.4%)
Hook.Type						
Circle hook	14 (26.9%)	2 (33.3%)	4 (16.7%)	NA	7 (35.0%)	1 (50.0%)
J hook	34 (65.4%)	4 (66.7%)	18 (75.0%)	NA	11 (55.0%)	1 (50.0%)
Treble	4 (7.7%)	0 (0%)	2 (8.3%)	NA	2 (10.0%)	0 (0%)
Missing	348 (87.0%)	25 (80.6%)	217 (90.0%)	1 (100%)	48 (70.6%)	57 (96.6%)
Hooked.Where						
Entangled	6 (2.5%)	0 (0%)	4 (2.6%)	0 (0%)	1 (2.5%)	1 (5.0%)
Entangled, Hooked	1 (0.4%)	0 (0%)	0 (0%)	0 (0%)	1 (2.5%)	0 (0%)
Esophagus	46 (19.3%)	1 (4.8%)	39 (25.0%)	0 (0%)	6 (15.0%)	0 (0%)
Esophagus, Hooked	3 (1.3%)	0 (0%)	2 (1.3%)	0 (0%)	1 (2.5%)	0 (0%)
Fishing rod entangled	2 (0.8%)	0 (0%)	1 (0.6%)	0 (0%)	0 (0%)	1 (5.0%)
Flipper	61 (25.6%)	7 (33.3%)	32 (20.5%)	0 (0%)	15 (37.5%)	7 (35.0%)
Foul hook: non-flipper	16 (6.7%)	4 (19.0%)	8 (5.1%)	1 (100%)	1 (2.5%)	2 (10.0%)
Hooked 2 places	4 (1.7%)	1 (4.8%)	2 (1.3%)	0 (0%)	0 (0%)	1 (5.0%)
Mouth	99 (41.6%)	8 (38.1%)	68 (43.6%)	0 (0%)	15 (37.5%)	8 (40.0%)
Missing	162 (40.5%)	10 (32.3%)	85 (35.3%)	0 (0%)	28 (41.2%)	39 (66.1%)
Bait.Type						
Croaker	1 (3.2%)	0 (0%)	1 (4.8%)	0 (0%)	0 (0%)	NA
Cut bait	2 (6.5%)	0 (0%)	1 (4.8%)	0 (0%)	1 (20.0%)	NA
Finger mullet	2 (6.5%)	1 (25.0%)	1 (4.8%)	0 (0%)	0 (0%)	NA
Fishbites	3 (9.7%)	1 (25.0%)	2 (9.5%)	0 (0%)	0 (0%)	NA
Live menhaden	1 (3.2%)	0 (0%)	0 (0%)	0 (0%)	1 (20.0%)	NA
Shrimp	17 (54.8%)	2 (50.0%)	14 (66.7%)	0 (0%)	1 (20.0%)	NA
Squid	5 (16.1%)	0 (0%)	2 (9.5%)	1 (100%)	2 (40.0%)	NA
Missing	369 (92.3%)	27 (87.1%)	220 (91.3%)	0 (0%)	63 (92.6%)	59 (100%)
RehabDisposition						
	264 (66.0%)	24 (77.4%)	128 (53.1%)	1 (100%)	52 (76.5%)	59 (100%)
D	11 (2.8%)	1 (3.2%)	8 (3.3%)	0 (0%)	2 (2.9%)	0 (0%)
R	125 (31.3%)	6 (19.4%)	105 (43.6%)	0 (0%)	14 (20.6%)	0 (0%)
FinalDisposition						
AR	256 (64.0%)	22 (71.0%)	130 (53.9%)	1 (100%)	49 (72.1%)	54 (91.5%)
ATfR	137 (34.3%)	9 (29.0%)	111 (46.1%)	0 (0%)	17 (25.0%)	0 (0%)
LFNR	7 (1.8%)	0 (0%)	0 (0%)	0 (0%)	2 (2.9%)	5 (8.5%)

5 Years, 2018-2022 of Incidental Capture Data in a Table 1

Percentages of Reported captures of Sea Turtle Species by County, Beach, Hook-Type, Hook Location, Bait-Type, Rehab disposition, and Final Disposition

	Total (N=208)	Green (N=21)	Kemp's Ridley (N=126)	Leatherback (N=1)	Loggerhead (N=37)	Unknown (N=23)
County						
Beaufort	1 (0.5%)	0 (0%)	1 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Brunswick	52 (25.0%)	2 (9.5%)	38 (30.2%)	0 (0%)	7 (18.9%)	5 (21.7%)
Carteret	44 (21.2%)	3 (14.3%)	21 (16.7%)	1 (100%)	8 (21.6%)	11 (47.8%)
Currituck	1 (0.5%)	0 (0%)	1 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Dare	39 (18.8%)	11 (52.4%)	14 (11.1%)	0 (0%)	11 (29.7%)	3 (13.0%)
Hyde	2 (1.0%)	0 (0%)	1 (0.8%)	0 (0%)	1 (2.7%)	0 (0%)
New Hanover	22 (10.6%)	2 (9.5%)	17 (13.5%)	0 (0%)	2 (5.4%)	1 (4.3%)
Onslow	18 (8.7%)	1 (4.8%)	12 (9.5%)	0 (0%)	3 (8.1%)	2 (8.7%)
Pamlico	3 (1.4%)	0 (0%)	1 (0.8%)	0 (0%)	2 (5.4%)	0 (0%)
Pender	26 (12.5%)	2 (9.5%)	20 (15.9%)	0 (0%)	3 (8.1%)	1 (4.3%)
Month						
Mean (SD)	6.39 (1.78)	7.52 (2.09)	6.25 (1.76)	5.00 (NA)	6.54 (1.56)	5.96 (1.61)
Median [Min, Max]	6.00 [4.00, 11.0]	8.00 [4.00, 10.0]	6.00 [4.00, 11.0]	5.00 [5.00, 5.00]	6.00 [4.00, 10.0]	6.00 [4.00, 10.0]
Beach						
Albemarle Sound	2 (1.0%)	1 (4.8%)	1 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Atlantic Beach	10 (4.8%)	0 (0%)	4 (3.2%)	0 (0%)	1 (2.7%)	5 (21.7%)
Beaufort/Down East	1 (0.5%)	0 (0%)	0 (0%)	0 (0%)	1 (2.7%)	0 (0%)
Bodie Island	1 (0.5%)	1 (4.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cape Lookout NS	7 (3.4%)	1 (4.8%)	2 (1.6%)	1 (100%)	2 (5.4%)	1 (4.3%)
Caswell Beach	5 (2.4%)	0 (0%)	4 (3.2%)	0 (0%)	1 (2.7%)	0 (0%)
Core Sound (floating/spoil island)	1 (0.5%)	0 (0%)	0 (0%)	0 (0%)	1 (2.7%)	0 (0%)
Emerald Isle	20 (9.6%)	2 (9.5%)	13 (10.3%)	0 (0%)	1 (2.7%)	4 (17.4%)
Ft. Fisher SRA	2 (1.0%)	0 (0%)	2 (1.6%)	0 (0%)	0 (0%)	0 (0%)
Harkers Island	3 (1.4%)	0 (0%)	1 (0.8%)	0 (0%)	1 (2.7%)	1 (4.3%)
Hatteras Island	16 (7.7%)	4 (19.0%)	2 (1.6%)	0 (0%)	8 (21.6%)	2 (8.7%)
Holden Beach	18 (8.7%)	1 (4.8%)	13 (10.3%)	0 (0%)	3 (8.1%)	1 (4.3%)
Neuse/Pamlico Rivers	5 (2.4%)	0 (0%)	4 (3.2%)	0 (0%)	1 (2.7%)	0 (0%)
Oak Island	18 (8.7%)	1 (4.8%)	12 (9.5%)	0 (0%)	3 (8.1%)	2 (8.7%)
Ocean Isle Beach	7 (3.4%)	0 (0%)	5 (4.0%)	0 (0%)	0 (0%)	2 (8.7%)
Pleasure Island	12 (5.8%)	0 (0%)	12 (9.5%)	0 (0%)	0 (0%)	0 (0%)
Sunset/Bird Islands	4 (1.9%)	0 (0%)	4 (3.2%)	0 (0%)	0 (0%)	0 (0%)
Swansboro	1 (0.5%)	0 (0%)	0 (0%)	0 (0%)	1 (2.7%)	0 (0%)
Topsail Island	44 (21.2%)	3 (14.3%)	32 (25.4%)	0 (0%)	6 (16.2%)	3 (13.0%)
VA border to Nags Head	21 (10.1%)	5 (23.8%)	12 (9.5%)	0 (0%)	3 (8.1%)	1 (4.3%)
Western Pamlico Sound	2 (1.0%)	0 (0%)	0 (0%)	0 (0%)	2 (5.4%)	0 (0%)
Wilmington	2 (1.0%)	1 (4.8%)	1 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Wrightsville Beach	6 (2.9%)	1 (4.8%)	2 (1.6%)	0 (0%)	2 (5.4%)	1 (4.3%)
Hook.Type						
Circle hook	6 (21.4%)	2 (50.0%)	1 (7.1%)	NA	3 (30.0%)	NA
J hook	21 (75.0%)	2 (50.0%)	12 (85.7%)	NA	7 (70.0%)	NA
Treble	1 (3.6%)	0 (0%)	1 (7.1%)	NA	0 (0%)	NA
Missing	180 (86.5%)	17 (81.0%)	112 (88.9%)	1 (100%)	27 (73.0%)	23 (100%)

Hooked.Where						
Entangled	1 (0.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (14.3%)
Entangled, Hooked	1 (0.8%)	0 (0%)	0 (0%)	0 (0%)	1 (4.5%)	0 (0%)
Esophagus	23 (18.4%)	0 (0%)	19 (24.7%)	0 (0%)	4 (18.2%)	0 (0%)
Esophagus, Hooked	1 (0.8%)	0 (0%)	1 (1.3%)	0 (0%)	0 (0%)	0 (0%)
Flipper	42 (33.6%)	7 (38.9%)	20 (26.0%)	0 (0%)	11 (50.0%)	4 (57.1%)
Foul hook: non-flipper	7 (5.6%)	3 (16.7%)	2 (2.6%)	1 (100%)	0 (0%)	1 (14.3%)
Hooked 2 places	2 (1.6%)	1 (5.6%)	1 (1.3%)	0 (0%)	0 (0%)	0 (0%)
Mouth	48 (38.4%)	7 (38.9%)	34 (44.2%)	0 (0%)	6 (27.3%)	1 (14.3%)
Missing	83 (39.9%)	3 (14.3%)	49 (38.9%)	0 (0%)	15 (40.5%)	16 (69.6%)
Bait.Type						
Croaker	1 (6.3%)	0 (0%)	1 (9.1%)	0 (0%)	0 (0%)	NA
Finger mullet	2 (12.5%)	1 (50.0%)	1 (9.1%)	0 (0%)	0 (0%)	NA
Fishbites	1 (6.3%)	0 (0%)	1 (9.1%)	0 (0%)	0 (0%)	NA
Shrimp	9 (56.3%)	1 (50.0%)	7 (63.6%)	0 (0%)	1 (50.0%)	NA
Squid	3 (18.8%)	0 (0%)	1 (9.1%)	1 (100%)	1 (50.0%)	NA
Missing	192 (92.3%)	19 (90.5%)	115 (91.3%)	0 (0%)	35 (94.6%)	23 (100%)
FinalDisposition						
AR	132 (63.5%)	14 (66.7%)	70 (55.6%)	1 (100%)	25 (67.6%)	22 (95.7%)
ATfR	75 (36.1%)	7 (33.3%)	56 (44.4%)	0 (0%)	12 (32.4%)	0 (0%)
LFNR	1 (0.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (4.3%)