CONSERVE WILDLIFE

FOUNDATION OF NEW JERSEY

Final Performance Narrative
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Abstract

In 2015, the Conserve Wildlife Foundation of New Jersey ("CWFNJ") along with partners from the Marine Academy of Technology and Environmental Science ("MATES"), Monmouth and Stockton Universities, and local fishermen, set out identify and retrieve 1,000 derelict crab pots in an effort to reduce bycatch of NOAA trust resources in Barnegat Bay, New Jersey. The NOAA trust resources identified to have benefited from this project include commercial and recreational fishery resources, catadromous species, and others that are in the coastal marsh waters including: Northern Diamondback Terrapins (*Malaclemys terrapin*), Blue Crab (*Callinectes sapidus*), American Eel (*Anguilla rostratq*), Flounder spp. (*Plueronectes or Paralicthyes*) , Black Sea Bass (*Centropristis striata*) , Atlantic Croaker (*Micropogonias undulates*), White Perch (*Morone americana*), Catfish (*Ameiurus nebulosus*), Spot (*Leiostomus xanthurus*), Tautog (*Tautoga onitis*), Oyster Toadfish (*Opsanis tau*) , Whelks (*Busycon spp.*), and others.

Two teams, made up of Stockton and Monmouth Universities contributed 136 hours of survey work to locate derelict pots using Edgetech 6205 sidescan sonar. Once a pot was located and marked with a waypoint, the targets were transferred to retrieval teams consisting of MATES and three local community members, two of them local fishermen. Over the course of two field seasons, project teams identified and recovered 1,278 derelict pots. The majority of the recovered pots were crab traps (1,062), however several other types of pots were recovered. Of the crab pots that were retrieved, 58% of pots were recreational, 20% were commercial, and 22% of pots were unable to be classified. A rapid assessment of the pot was done immediately after it was recovered to look for things such as incidental bycatch and encrusting organisms. Of particular note, one commercial style pot contained the remains of 17 Northern Diamondback Terrapins. In total, 20 different species of incidental bycatch were recovered from all pots.

All derelict gear was brought to Spencer's Bayside Marina, a private facility in Waretown, New Jersey. Pots were sorted and placed into piles where student teams from MATES would further assess the pots, looking at pot design and structure. Pots were found to be a variety of design structures. Of all crab pots recovered, 11% did not contain a required biodegradable escape panel and less than 1% had a bycatch reduction device ("BRD")[1]. Spencer's Marina hosted a bin provided by National Fish and Wildlife Foundation and Covanta's Fishing for Energy Program. Once bins were full, they were hauled off to Covanta's facility in Edison, NJ where they were stripped for their recyclable metal and non-recyclable materials were turned into combustible energy. In total, 5.39 tons of derelict fishing gear were pulled from Barnegat Bay. Several lessons were learned during two years of collections, lending to the notion that a longer-term dataset is needed to look at the annual accumulation of pots within Barnegat Bay.

[1] As per New Jersey Division of Fish and Wildlife, all non-collapsible Chesapeake-style crab pots et in any manmade lagoon or any water body less than 150 feet wide must include a turtle excluder device inside all pot entrance funnels.

NOAA Trust Resources and Habitat Enhancement Benefits

The Barnegat Bay-Little Egg Harbor estuary ("Barnegat Bay") covers over 42 miles of shoreline, is protected from the open ocean by a system of barrier beaches, wetland and dunes, and is designated a National Estuary Program site. Freshwater rivers and creeks flow eastward from Ocean County and meet the saltwater of the Atlantic Ocean in Barnegat Bay to form New Jersey's largest body of brackish water; thus creating a unique ecosystem for various species of wildlife. In addition to being a National Estuary Program site, Essential Fish Habitat designations for Flounder spp., and Black Sea Bass are outlined within Barnegat Bay.

Our project area focused primarily on the marsh creeks from Brick to Stafford Township, New Jersey. Of the 1,278 derelict pots that were collected, 83% (1,062) pots were crab traps with the remaining intended for eel, lobster, conch, oyster and various fish species. Incidental bycatch was assessed in 39%(505) of all traps that were collected. The remaining 61% (773) of traps were non-fishable or unable to be assessed for bycatch by observers. Traps that were assessed for bycatch and still considered fishable (26% or 131 traps) contained 20 different species of bycatch: Oyster Toadfish, Black Sea Bass, Rock Crab, Green Crab, Northern Diamondback Terrapin, White Perch, American Eel, Tautog, Spider Crab, Black-fingered Mud Crab, Blue Crab, Jonah Crab, Seahorse, Sheepshead Fish, Channeled Whelk, American Lobster, Hard Clam, Hermit Crab, Winter Flounder, and Mantis Shrimp (Table 1). As per New Jersey Division of Fish and Wildlife regulations, all non-collapsible Chesapeake-style crab pots must contain a biodegradable panel to allow crabs and other organisms to escape should the pot be lost or abandoned. A third (36% or 469) of the pots retrieved were remnants of pots, or were damaged in the recovery process and therefore unable to determine if pots met standard regulations.

Common Name	Scientific Name	Species Individual Bycatch Totals
Tautog	*Tautoga onitis*	94
Blue Crab	*Callinectes sapidus*	65
Rock Crab	*Cancer irroratus*	40
Oyster Toadfish	*Opsanis tau*	24
Spider Crab	*Libinia emarginata*	20
Northern Diamondback Terrapin	*Malaclemys terrapin*	20
Channeled Whelk	*Busycotypus canaliculatus*	13
American Eel	*Anguilla rostratq*	9
Black Fingered Mud Crab	*Panopeus herbstii*	7
Black Sea Bass	*Centropristis striata*	6
Green Crab	*Carcinus maenas*	5
American Lobster	*Homarus americanus*	2
White Perch	*Morone americana*	1
Jonah Crab	*Cancer borealis*	1
Seahorse spp.	*Hippocampus* spp.	1
Sheepshead Fish	*Archosargus probatocephalus*	1
Hard Clam	*Mercenaria mercenaria*	1
Hermit Crab spp.	*Paguroidea* spp.	1
Winter Flounder	*Pseudopleuronectes americanus*	1
Mantis Shrimp spp.	*Stomatopoda* spp.	1

Table 1. *Bycatch species present in recovered derelict fishing gear*

Among New Jersey's non-game species of special concern most impacted by derelict pots are Northern Diamondback Terrapins. Terrapin population declines, reduced growth, and changes in sex ratios have been directly attributed to bycatch mortality in derelict crab pots (Wood 1997; Dorcas et al. 2007; Wolak et al. 2010). While the total terrapin population in Barnegat Bay is not known, the tidal creeks where the majority of pots are being pulled have known terrapin occurrences in those areas (Figure 1). Of the 1,278 pots that were pulled, four pots contained the remains of deceased terrapins. One pot was retrieved from the tidal creeks surrounding Edwin B. Forsythe National Wildlife Refuge and contained the remains of 17 deceased terrapins. The other three pots were pulled from the central and southern reaches of the bay and contained the remains of three other individual terrapins. Due to the deterioration of the individuals, further analysis of the hypoplastron (bottom-shell bone plates) determined the approximate size of the individuals. A standard size bycatch reduction device (152.5mm x 50.6mm) on pots containing terrapin remains would have potentially saved a majority (70%) of these terrapins by preventing them from entering the crab pot through the funnel (Fig. 2). New Jersey does require users of non-collapsible, Chesapeake-style crab pots set in any body of water less than 150-feet wide at mean low tide must include a BRD. Less than 1% (13) of all pots removed from Barnegat Bay had BRDs.

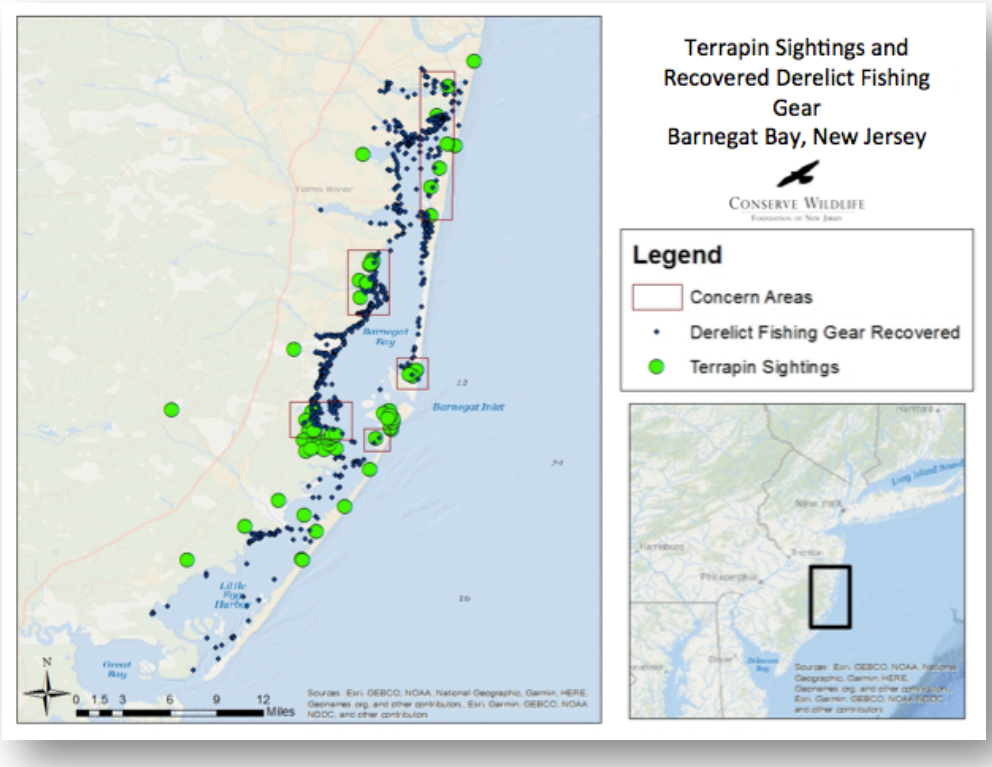

Figure 1. *Map overlaying recorded sightings of Diamondback Terrapins provided by NJDFW and derelict fishing gear recovered in 2015-2017 field seasons. Terrapin occurrence data provided by NJDFW.*

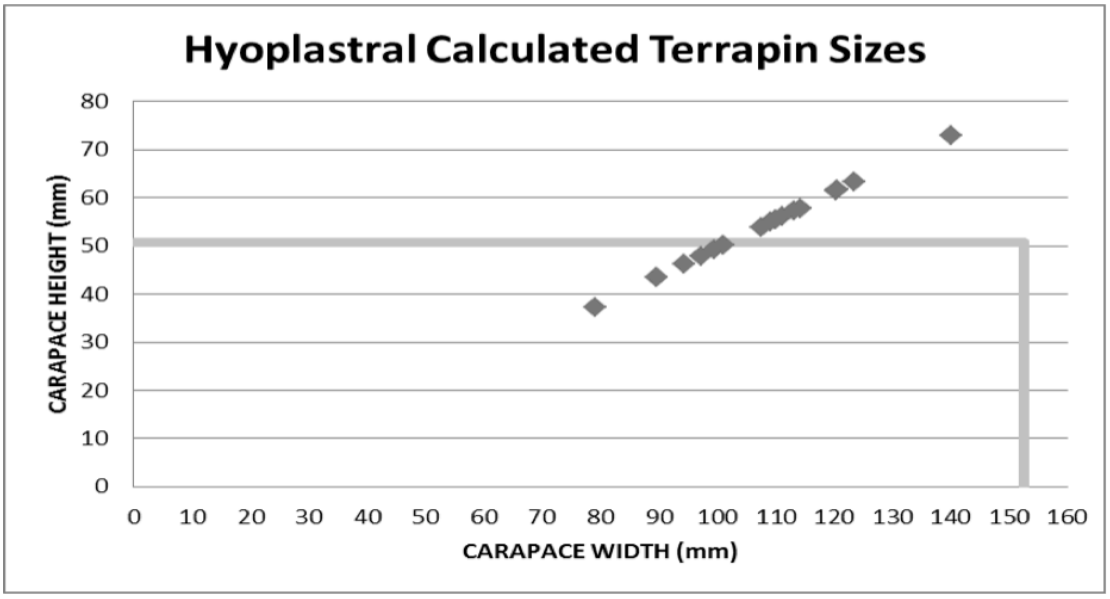

Fig. 2. *Terrapin size compared to a standard size bycatch reduction device (152.5mm x 50.6mm). 70% of terrapins found as bycatch would have been excluded if the lost pot had been fitted with a BRD.*

Independent of the negative biological effects of derelict fishing gear, economic depletions of resources in the bay were also found throughout this project. The bay and surrounding marshlands directly and indirectly support over 60,000 jobs and have an economic value of $2 to $4 billion dollars annually (Kauffman 2012). During the summer months, the population doubles to host over 500,000 visitors, attracted in large part to the eco-tourism of the area. The New Jersey Division of Fish and Wildlife estimates that commercial and recreational crabbers harvest around 6 million Blue Crabs per year (NJDFW 2009). Barnegat Bay, along with Little Egg Harbor and the Maurice River estuary comprise approximately 65-86% of the state's annual recreational harvest (NJDFW 2014). During two seasons of retrievals, 65 Blue Crabs were removed from derelict pots with 41 individuals deceased resulting in a 63% mortality rate. Blue crabs accounted for 22% of all bycatch individuals (Table 1). Of the dead Blue Crabs removed from derelict gear, 43% were female crabs that would have likely went on to reproduce and further contribute to the Blue Crab fishery in the bay.

Methods

Throughout two field seasons (December 2015-March 2016, December 2016-March 2017), six subcontractors performed survey and recovery work from Brick to Stafford Township, New Jersey (Figs. 4A-D). Stockton University and Monmouth University spent 21 days surveying the upper, central, and lower portions of the bay using Edgetech 6205 side-scan sonar to locate derelict pots. Once a pot was located, it was marked with a waypoint and classified using an "A", "B", or "C" ranking scheme to estimate confidence in target identification. Through using this ranking scheme, recovery crews maximized their time on "A" pots versus "C" pots.

The project aimed at recruiting and compensating local fishermen and watermen to perform recoveries. The project's recovery crews consisted of four subcontractors (three local watermen and one research high school). RJ Cericola and Jeffrey Silady have spent much of their careers working in Barnegat Bay and contributed a combined 308 hours to recovering pots. Jeffrey Silady also works closely with ReClam the Bay, which aims to involve and educate the public about the estuary's water quality and the importance of shellfish. Through ReClam the Bay, 23

volunteers contributed 216 hours of recovery work on Jeffrey's boat. The Marine Academy of Technology and Environmental Science ("MATES") is a local high school specializing in students wishing to pursue math and sciences. Dr. John Wnek, MATES supervisor, and his students dedicated approximately 230 hours to recovering pots.

Recovery teams used surveyed waypoints to locate pots to maximize efficiency on the water. Waypoints were divided into working regions for each recovery crew. Humminbird Helix 9 (Fig. 4A) units were used to relocate targets. Upon relocation of a pot, boat captains would direct crew members where to throw five pound grappling hooks (Fig. 4B). Typically, one to two crew members would be assisting the boat captain with recoveries. Once a pot was hooked with a grapple, it was cleated and the boat would pull the pot for a short period of time to reduce the amount of substrate that had accumulated in the pot (Fig.4C). Pots were rapidly assessed for bycatch and encrusting organisms on the boat (Fig. 4D). Any bycatch was identified, placed into a plastic bin with a ruler for measurements, photographed and released. Pots were tagged with the recovery team name and pot number. Recovered pots were brought to Spencer's Marina and placed into piles for MATES students to further assess. Students assessed pots for constructed material type, buoy attachment, pot type, cull rings, escape panel, and funnel type (Fig. 4E). After assessment, pots were placed in disposal bins provided by the Fishing for Energy Program[2].

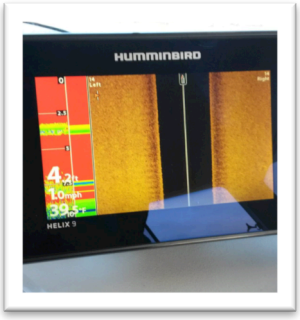

Fig. 4A. *A Humminbird Helix 9 side-scan sonar unit allows crews to relocate surveyed pots.*

Fig. 4B. *Upon relocation, crew is instructed where to throw grappling hooks.*

Fig. 4C. *Crew hauls pots onto the boat deck for rapid assessment.*

Fig. 4D. *Bycatch is placed in a plastic tub for measurements and documentation before being release*

Fig. 4E. *Pots are further assessed at disposal port. After assessment, pots are disposed of at Covanta's*

[2] The Fishing for Energy Program is sponsored by National Fish and Wildlife Foundation, Covanta Energy, Schnitzer Steel and NOAA's Marine Debris Removal Program

Accomplishments

The project's initial goal to remove 1,000 pots was based on data collected by Stockton University on their NOAA Marine Debris Program funded project focused on removing pots from the Mullica River/Great Bay Estuary. During year one of retrievals, 395 pots were removed from the northern, central, and southern reaches of Barnegat Bay (Figs. 5A-B). RJ Cericola and MATES pulled the majority of derelict pots in year one. Retrievals were performed by Monmouth University, but it was realized that their time was best used surveying for targets in the northern reaches of the bay while Stockton University surveyed for targets in the southern and central reaches of the bay. Efforts to retrieve pots in year one were initially hindered due to weather conditions. Additionally, crews had to learn the skill involved with retrieving pots. Year two yielded 883 recovered pots or 60.5% of the overall project goal of 1,000 recovered pots. The project increased effort by adding a second subcontracted fisherman and crews were more experience relocating and retrieving pots. In total, the project was able to retrieve 1,278 derelicts fishing pots from the bay and exceeded the initial project goal by 27.5% (Figs. 5A-C).

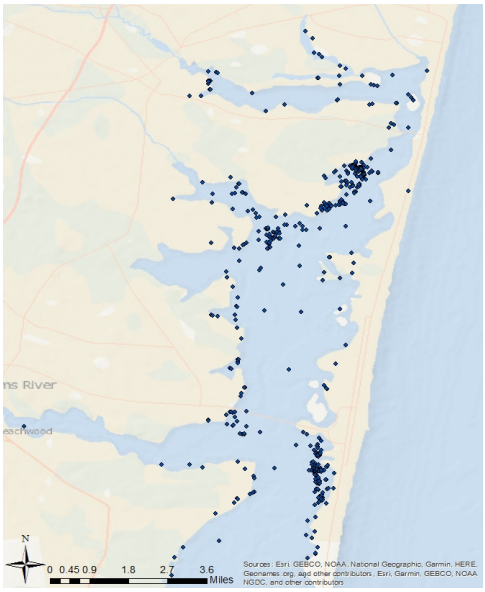

Fig. 5A. *Recoveries in Northern Barnegat Bay*

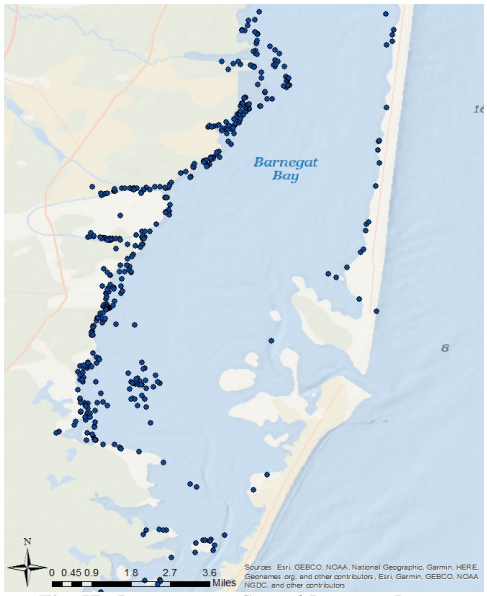

Fig. 5B. *Recoveries in Central Barnegat Bay*

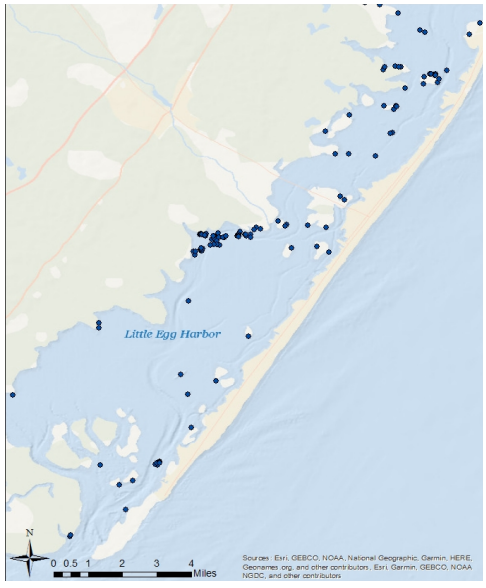

Fig. 5C. *Recoveries in Southern Barnegat Bay*

The Fishing for Energy Program provided match to the project by providing disposal bins at no cost and covered hauling and tipping fees. Disposal bins were 30-cubic yard dumpsters that were placed at approved ports nearby retrieval efforts. Two ports were initially nominated, but upon issues with public dumping at one location, it was decided to have one bin at Spencer's Marina in Waretown, New Jersey. The initial assessment of filling 360-cubic yards was overinflated considering only two 30-cubic yard dumpsters were filled in year one with 395 pots. An adjusted estimate of 210-cubic yards or seven dumpsters was made. Seven bins were filled over the two field seasons yielding 210-cubic yards of debris disposed of. The weight of debris removed total 5.39 tons.

Students from MATES and Monmouth University contributed 785 hours on retrieval assistance, data analysis, and outreach. Of particular note, MATES students contributed approximately 450 hours to the project. A NOAA student team was organized each year consisting of 26 students who participated in field recoveries, performed rapid assessment of pots, and later, provided a more thorough assessment of pots at the marina. Students further analyzed data in the classroom, creating a GIS story map of pulled pots and scientific posters for student research projects (Fig. 6). Additionally, students used data to inform and guide educational materials to be used in presentations and at community outreach events.

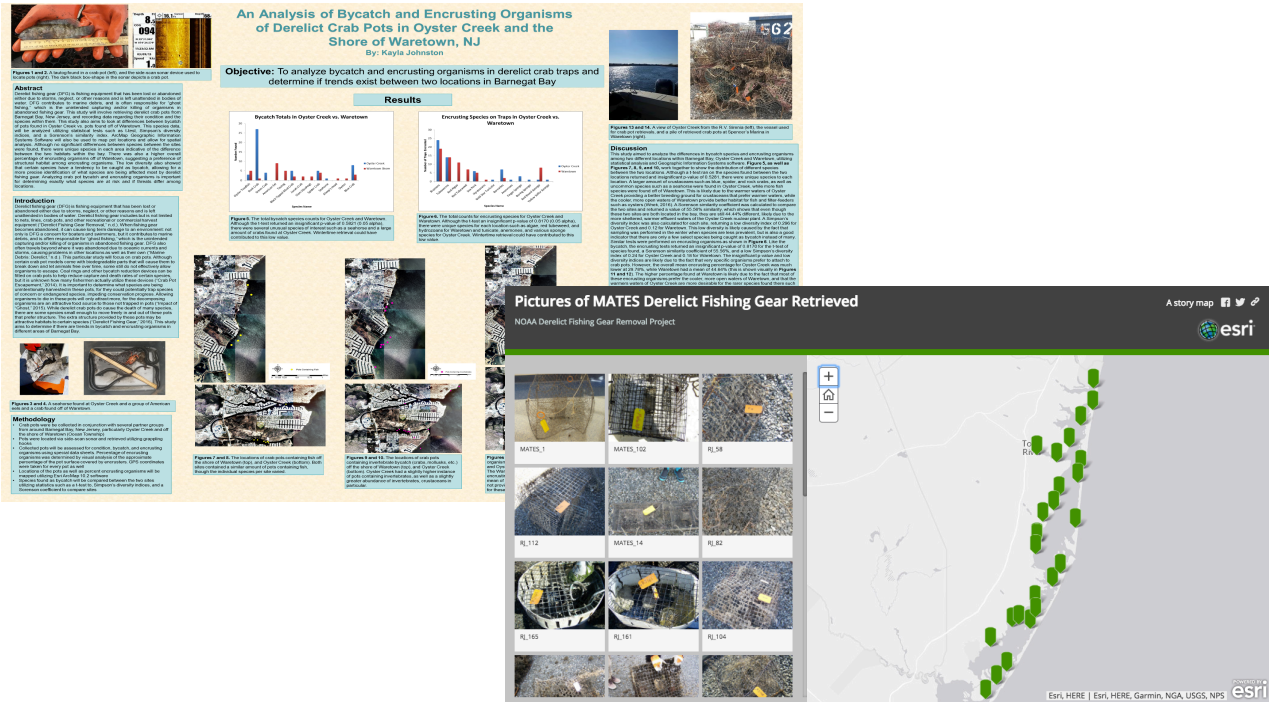

Fig. 6. *Examples of MATES student work. MATES student, Kayla Johnston compiled and analyzed bycatch and encrusting organism data to present a scientific poster. A team of MATES students created an interactive ArcGIS Story Map featuring all derelict pots recovered by MATES.*

Lessons learned

During two years of project surveys and recoveries, significant lessons were learned that will aide in future recoveries of derelict fishing gear in the Barnegat Bay region. Weather conditions during winter months varied from year to year. Storm and ice events prevented retrieval crews from heading out during the early weeks of year one. All retrievals took place in a three-month period during the coldest months of the year. In the future, consideration for one to two week buffer periods in permit requests would be advisable to account for weather events.

RJ Cericola took advantage of extreme low tidal events to survey and retrieve pots on his own. RJ relied on these low tide events to pull pots from shallow areas of the bay. Using his 26-foot pontoon boat, RJ was able to reach shallow areas of the bay and visually locate pots. In addition, RJ pulled several pots from the banks after extreme storm or wind events would blow pots on land from the water. This practiced yielded 463 retrieved pots over the course of two field season. RJ's retrieval method should be implemented in future projects considering he was able to retrieve over 36% of the total project goal in this manner.

Stockton University provided two days of training to retrieval crews over the two-year project period. Training days allowed new subcontractors to learn how to use the side-scan sonar units, relocate marked waypoints, throw grapple hooks, and pull pots. Stockton also communicated regularly with retrieval crews to provide assistance on retrieval issues. Training days and troubleshooting support was imperative to the success of the project and should be included in future projects.

Volunteer resources were also vital in the project's success. Jeffrey Silady recruited 23 volunteers to aide his recovery efforts in year two of retrievals. Jeffrey used volunteers to recover pots while he relocated targets and guided the boat between waypoint targets. Recoveries require at least one additional person on the boat if using the side-scan sonar and grappling hook method. Volunteers improved efficiency of recoveries and a volunteer source should be accounted for on projects moving forward.

Outreach and Education accomplishments

The outreach and education components focused on targeting the general public, local students (k-12 and undergraduate), the recreational crabbing community, and volunteer recruitment.

A region-wide student art contest (Species on the Edge: Marine Debris Edition) was held in May 2016 with over 80 submissions and a winner selected in June 2016. The decals vividly illustrate the deleterious effects of marine debris on bycatch and gave many students the opportunity to research, consider, and educate themselves and their schoolmates on marine debris prevention (Fig. 7). The winning decals were printed and over 2,000 have been distributed at presentations, festivals, and outreach events.

Fig. 7. *Submissions for the Species on the Edge: Marine Debris Edition art contest. Over 80 students submitted artwork and the winner's art (center) was featured on a decals used as educational materials.*

Outside of retrieval months, the project focused on raising awareness of derelict fishing gear within the local community. Between CWFNJ and MATES, six K-12 school presentations, two university presentations, and 22 community outreach presentations were delivered. All presentations were well attended and we approximate our reach at 1,200 community members and 1,500 school children. All presentations focused on the effects of derelict fishing gear in the marine environment, the numerous hazards it can cause for wildlife and human safety, and what the project was doing to address it. Additionally, Diamondback Terrapin KITs (Kids Interact with Terrapins) are modules built to provide teachers with lesson plans, activity books, and other tools to teach students stewardship and conservation of terrapins in Barnegat Bay. MATES reached approximately 520 students through an adapted lesson plan built in to the Terrapin KITs addressing derelict fishing gear and its threat to terrapin conservation in the bay. Project partners, MATES and CWFNJ, also attended 17 festivals with an approximate reach of 4,300 local community members and summer visitors.

The project initially sought to develop and conduct a survey through the commercial and recreational fishing community to gain a better understanding of the percentage of pots that are lost annually. Several challenges were met in this process. Staff changes within partnerships attributed to delays on survey creation and lack of interest in participation within the commercial community became apparent. Project partners believed it was best to change the survey aspect of the project to target crab pot manufacturers and retailers in the area. After two years of retrievals, it was found that pots varied in design, structure, materials and safety requirements. The project surveyed over 30 crab pot retailers and found that 70.5% sold the Maryland-style crab pot, and that out of these only 65% included BRDs. Out of the retailers surveyed, 34.9% included BRDs on their crab pots. One retailer provided them at for free, but did not fit the BRDs prior to sale. Out of those that did not include BRDs, 37.5% of the retailers had them for sale at an additional cost. In terms of crab pot types, there were a variety of crab pots including two funnel quarter traps (Delaware Traps), two funnel (flat traps), four funnel flat traps (Florida traps), a half trap with two funnels (New Jersey trap), ¾ traps (with four or three funnels) and Maryland traps that were 18" x 24" x 24" as opposed to the full traps that are 24" x 24" x 24". All of these designs had a "vinyl coated chicken wire mesh funnel" as opposed to thicker gauge vinyl mesh "hard funnel". In fact, 95% of the traps possessed the mesh funnel. Some other traps

of interest were eel pots, Green Crab traps, and traps for fish such as Spot. There were at least eight different types of crab traps for sale in addition to traps for the aforementioned species.

Moving Forward

Reducing the amount of existing derelict crab traps and preventing the annual accumulation of new ones is a long-term goal of this project. The removal of 1,278 derelict pots from Barnegat Bay over a two-year period reduced the number of pots; and subsequently reduced the amount of incidental bycatch, navigational hazards, and provided a small boost to local fisheries. A long-term dataset is needed to estimate the rate of addition and annual accumulation of derelict gear to Barnegat Bay. Through the project's strong partnership with Stockton University and the work they have been doing throughout coastal New Jersey, we hope to provide data to feed a larger, more in depth model discussing the overall effects of marine debris throughout New Jersey.

In 2017, NOAA's Marine Debris Grant Program renewed our project for an additional two years of funding. The funds will allow us to remove additional derelict fishing gear and add to a long-term dataset of removals in Barnegat Bay with hopes of estimating annual accumulation. The project will also continue to bring the issues of derelict fishing gear to the local community. Funding has also been secured through New Jersey Corporate Wetlands Restoration Partnership to support educational efforts. An educational video is in progress to bring the project's message to a larger audience.

Through strong partnerships and an overall willingness to work together for a better Barnegat Bay, the project aims to build on the success of this project in the future.

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