The impact of lost fishing gear

A lesson for middle and high school students

developed by Project Terrapin of the Marine Academy of Technology and Environmental Science, Manahawkin, NJ 08050

MATES · OCVTS

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Project TERRAPIN

Overview

Lost fishing gear, sometimes referred to as abandoned or "ghost" fishing gear is a problem throughout coastal areas of the United States. Gear can be in the forms of fishing nets, devices called pots (both crab and lobster), and the line that is used. Along the east and Gulf coasts of the United States, thousands of crab pots are lost each year, most of these in estuaries such as Chesapeake Bay, Galveston Bay, and Barnegat Bay. Abandoned pots, both commercial and recreational, can continue to capture species like blue crabs and other non-targeted species, making them dangerous. Non-target species can be fish or other species like diamondback terrapins that enter the pots for various reasons. Once in an abandoned crab pot, these species will starve, or in a terrapin's case, drown. Abandoned pots are referred to as "ghost" pots, because they sometimes move on the bottom with strong storm wave energy and can end up in places where they were not originally set and can continue to capture species. There are programs that recover abandoned crab pots in some of coastal areas. One such program is a partnership with the Conserve Wildlife Foundation of New Jersey, Stockton University, the Marine Academy of Technology and Environmental Science (MATES), and Project Terrapin. Funding for the project is through the National Oceanic and Atmospheric Administration's Marine Debris Program. Please view the following video that provides an overview of the project….http://www.conservewildlifenj.org/about/media/videos/cleaner%20barnegat%20bay/

Fig. 1. Recovered, derelict crab pot with multiple species captured (Left Black Sea Bass, Green Crabs; Right, Oyster Toadfish, Tautog Blue Crab, and Rock Crab.

Marine Debris - Bycatch

Fig. 2. Recovered, derelict crab pot showing dense fouling with algae growth .

Some of the results of our first phase of the project in which we collected approximately 475 "crab pots" from Barnegat Bay, NJ in 2017... Out of 475 crab pots, there were 223 bycatch items, with some of the crab pots being opened. In NJ, crab pots must contain a biodegradable panel that can detach in time to allow for bycatch to escape. In some cases these fail or the crab pot has so much growth that the device cannot detach. If this is the case, species can stay trapped indefinitely. One of the means to prevent potential bycatch from entering a crab pot, is to use bycatch reduction devices (BRDs). These have been effective on shrimp trawling nets to prevent sea turtles from accessing the nets where they sometimes drown. On crab pots, BRDs are inserted into the funnels to reduce bycatch including fish and diamondback terrapins, but still allowing for blue crabs to enter the crab pots as intended.

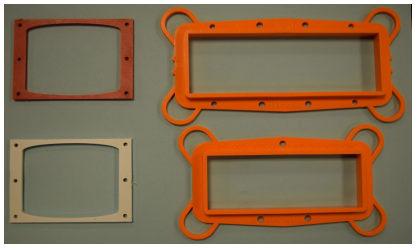

Fig. 3. Various BRDs types and prototype designs. Top right is a NJ BRD., below is the MD BRD,, and to left is a SC prototype that is being tested.

Results

This is the reported live finfish and crab bycatch from 2016—2017. We saved 223 individuals, 10 species types and recovered nearly the same number of individuals that suffered mortality. We also looked at the distribution of organisms growing on the crab pots to see if there was a difference in these between northern and southern Barnegat Bay, NJ. Barnegat Bay, being an estuary, has differences in salt levels in different locations, therefore, we wanted to see if our recovered crab pots showed any differences in growth and bycatch. We found some differences, but not as originally thought. We also found a crab pot with the remains of 17 terrapins in one location. It was in a location where BRDs are not required. Table 3 shows scientific estimations of the top shell (carapace) width and height measurements of the terrapins collected. We used a piece of their bottom shell (plastron) called the hyo- or hypoplastral scute to obtain a measurement and then related it to a ratio of an adult terrapin measurement based on the research of Dr. Ben Atkinson (Flagler College, Fl). The importance is to use these measurements to determine in diamondback terrapins could have been prevented from entering the crab pots using the NJ BRD. In other states, such as Maryland, BRDs are required on all crab pots for recreational purposes. Although required, compliance is low according to researchers. There is a difference between the MD (1.75" x 4.75" - 4.5 x 12 cm) and NJ (2" x 6" - 5 x 15 cm). In past research, the use a BRD, no matter what size, has been found effective to lower the amount of bycatch. However, there may be an impact on the number and size of crabs captured as a result of using BRDs. Many studies have been conducted and the results are mixed. We will be sharing results with you today to determine if the use of BRDs could have saved some individuals, fish and other bycatch using data that we collected throughout our NOAA sponsored study. We also will provide you with some actions that you can take based on your findings to help us to prevent bycatch, while preserving blue crab captures throughout Barnegat Bay, NJ. The data was collected by staff, students, and volunteers at MATES in conjunction with our partners coordinated through the Conserve Wildlife Foundation of New Jersey. Also, please visit Project Terrapin LLC for more information.

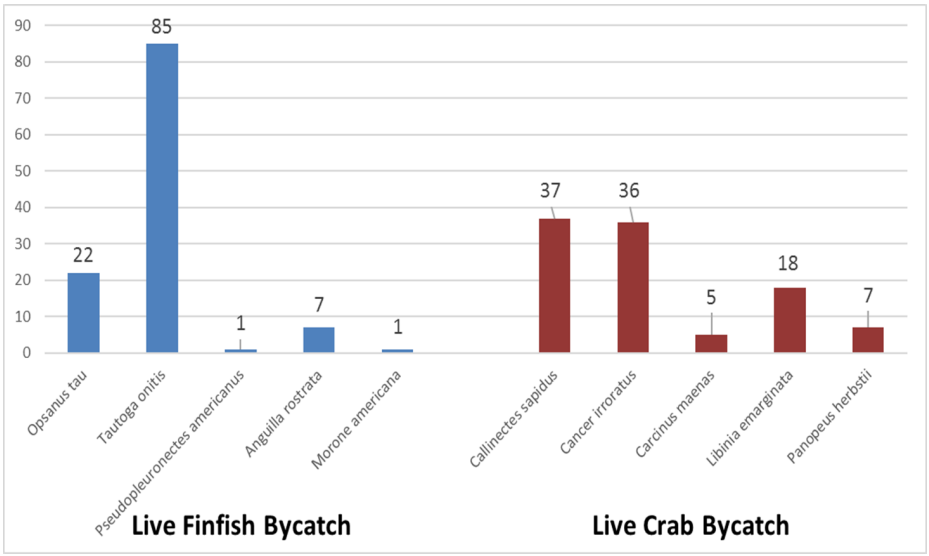

Fig. 4. Live finfish and crabs captured during the 2016-2017 seasons at Barnegat Bay , NJ

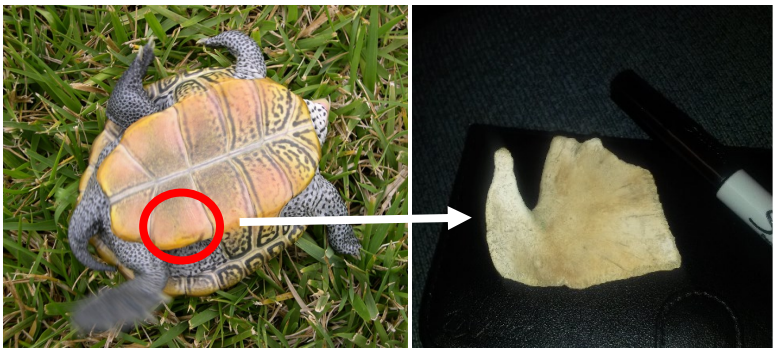

Fig. 5. Bottom of the terrapin and the remaining bone pieces (hyoplastral and hypoplastral) that sometimes get caught in the mesh of an abandoned crab pot. Using measurements of this bone, adult measurements can be estimated (mm) from research conducted by Dr. Ben Atkinson.

Lesson Overview

This lesson is designed for upper middle school and high school students and can be modified and/or adapted. The following Next Generation Science and Math Standards have been incorporated. This lesson also includes critical thinking components and will be addressed according to level….

Next Generation Science Standards:

Middle School: Science MS-ESS3-3.

Math 6.RP.A.1.; 7.RP.A.2

High School: Science HS-ESS3-3; HS-LS2-7.

Math HS.N.Q,A.2; HSS-IC.B.6

ELA RST.11-12.7

Table 1. List of bycatch items captured at Barnegat Bay. NJ as part of a study to determine the effectiveness of BRDs on crab pots during the summer 2018. Belo w is the scientific name, common name, and measurements (mm) . Also, there is a link to give you a better explanation of the species if necessary. All species information is from the Barnegat Bay Partnership.

Bycatch Item	Common Name	Crab Pot Funnel	Total Length (mm)	Width (mm)	Height (mm)
Opsanus tau	Oyster Toadfish	Control	290	75	50
Sphoeroides maculatus	N. Puffer	Control	200	60	65
Sphoeroides maculatus	N. Puffer	Control	190	60	60
Paralicthyes dentatus	Summer Flounder	Control	185	95	10
Paralicthyes dentatus	Summer Flounder	Control	125	70	7
Malaclemys terrapin	N. Diamondback terrapin	Control	135	70	50
Malaclemys terrapin	N. Diamondback terrapin	Control	150	90	65

Tables (Continued)

Table 2. Total capture data using BRD inserts into the funnel of crab pots at Banegat Bay, NJ during the summer of 2018 Four of each type of crab pots were fished for a total of 14 days, with all measurements made daily. Blue crabs and bycatch were released back to the Bay. However, blue crabs were released at least 1 mile from the capture location.

Crab Pot Funnel Treatment	Overall Number of *C. sapidus* captured	Maximum and Minimum Width (mm)	Mean Crab Width (mm) ± 1 SD	Mean Crab Length (mm) ± 1 SD	Mean Crab Height (mm) ± 1 SD
Control (No BRD)	291	86.0 155.0	107.9 ± 13.7	52.9 ± 6.0	30.6 ± 3.7
NJ BRD (5 x 15 cm)	256	65.6 153.1	103.4 ± 13.2	52.3 ± 6.6	29.7 ± 3.9
MD BRD (4.5 x 12 cm)	263	66.7 152.0	104.8 ± 15.2	53.0 ± 7.1	30.2 ± 3.7
SC Prototype BRD	281	78 151.9	104.6 ± 13.9	52.6 ± 5.9	29.9 ± 3.7

Middle School: (Please complete the questions below if you are in middle school)

1. Please use Fig.. 4 to determine how many finfish were considered live bycatch versus crabs. Which of the live bycatch was found the most? Why would you expect to find this species? (Hint: you can look up species using the Barnegat Bay Partnership Guide)

2. Using Table 2 above, please show the number of crabs captured using different types of inserts by using a column graph. Was this what you expected? Is there any trend in terms of the size of the BRDs and number of species captured?

3. Looking at the data in Table 1, what species do you feel could have been saved by using standard NJ BRD inserts (5 x 15 cm)?

4. Would you recommend the use of BRDs on crab pots? Please explain why or why not?

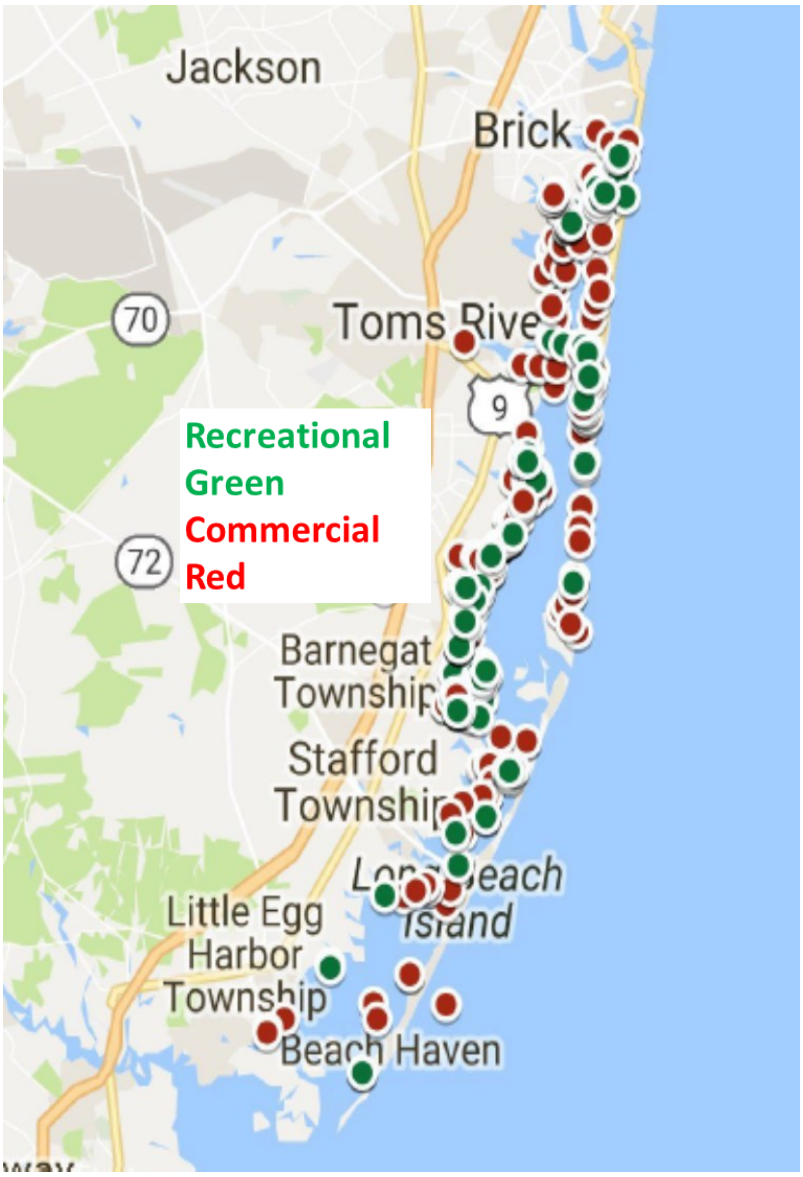

Fig. 6. Distribution of commercial versus recreational use crab pots recovered from Barnegat Bay (2016—2017). Green denotes recreational and Red denotes commercial use (n=400 identified pots).

Fig. 7. Commercially outfitted crab pot with BRDs inserted for reference. Crab pot is on its side for a look at the bottom. Notice the rebar frame and line tied at the bottom.

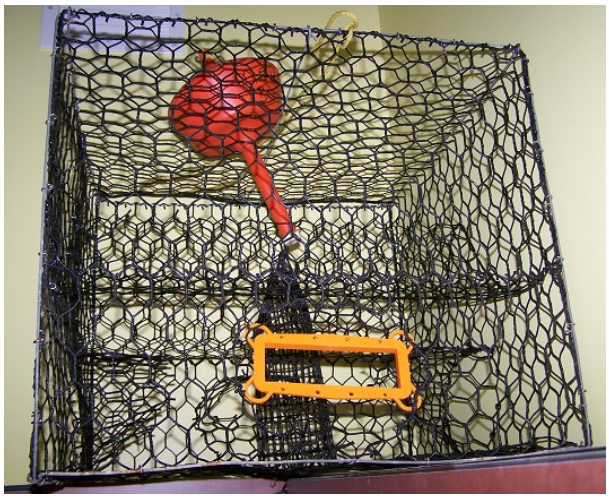

Fig. 8. Recreational crab pot (side view) where there is no rebar frame and line is tied on the top of the pot. Sometimes they have improper floats.

High School:

1. Using Table 1 for reference, how many species could have been kept out of crab pots using NJ BRDs? How about Maryland BRDs?
2. Using Fig. 6 above, what do you feel is the general distribution of crab pot types (commercial versus recreational) at Barnegat Bay? Do you feel that there is predominantly more of one type versus another?
3. Looking at the differences between commercial versus recreational crab pots, which do you feel is the most stable when set? Why?
4. Reviewing Table 2, please graph and determine if you feel that there is a trend in the number of blue crabs captured based on the sizes of the BRDs used in the study?

Table 3. Diamondback terrapins recovered from an abandoned crab pot at the Edwin B, Forsythe Refuge in January 2017 (n=17). Based on the hyo/hypo plastral scutes, the following measurements determined the thickness of the terrapin (height) and terrapin body width based on Atkinson 2014.

Terrapin ID Number	Carapace Height (mm)	Carapace Width (mm)
1001	40	80
1002	43	87
1003	47	98
1004	49	100
1005	49	102
1006	50	104
1007	53	106
1008	54	107
1009	54	108
1010	55	109
1011	56	111
1013	58	114
1014	60	115
1015	63	117
1016	64	118
1017	65	120

Research Extensions:

5. Using Table 3, graph the height versus the width using an x-y scatterplot. Once graphed, can you use the data to determine the following:

   A) If using a NJ BRD type, how many terrapins would not be able access the crab pot?

   B) If using a MD BRD type, how many terrapins would not be able to access the crab pot?

6. We know the negative aspects of abandoned (derelict crab pots), but please explain what are some positive aspects of abandoned crab pots that lose their biodegradable panels and remain on the bottom.

7. What would you recommend in terms of using BRDs (types) and why? (Remember, crab pots are still necessary to capture blue crabs).

References and Other Sources

Atkinson, B. 2014. Conservation Osteology: Investigating the Demographic Impacts of Ghost Traps on Diamond-Backed Terrapins, *Malaclemys terrapin*. Dissertation, University of Florida.

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Guillory, V. and P Prejean. 1998. Effect of a Terrapin Excluder Device on Blue Crab, *Callinectes sapidus*, Trap Catches. *Marine Fisheries* 60:38-40.

Hart, K.M. and L.B. Crowder. 2011. Mitigating Bycatch of Diamondback Terrapins in Crab Pots. *Journal of Wildlife Management* 75:264 - 272.

Lovich, J.E., M. Thomas, K. Ironside and S.R. Puffer. 2018. Spatial Distribution of Estuarine Diamond-Backed Terrapins (Malaclemys terrapin) and Risk Analysis from Commercial Blue Crab (Callinectes sapidus) Trapping at the Savannah Coastal Refuges Complex, USA. Ocean and Coastal Management 150: 160-167.

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Radzio, T.A., J.A. Smolinsky and W.M. Roosenburg. 2013. Low Use of Required Terrapin Bycatch Reduction Devices in a Recreational Crab Pot Fishery. *Herpetological Conservation and Biology* 8(1): 222-227.

Roosenburg, W.M. and J.P. Green. 2000. Impact of a Bycatch Reduction Device on Diamondback Terrapin and Blue Crab Capture in Crab Pots. *Ecological Applications* 10(3): 882 – 889.

Wood, R. C. 1997. The impact of commercial crab traps on northern diamondback terrapins, *Malaclemys terrapin terrapin*. Pages 21-27. In J. Van Abbema editor. Proceedings: Conservation, Restoration, and Management of Tortoises and Turtles--An International Conference. New York Turtle and Tortoise Society, New York, USA.

Other Links…

Asbury Park Pres Article (NJ)

Conserve Wildlife Foundation of New Jersey Podcast on Terrapins