

**National Fish and Wildlife Foundation  
Final Programmatic Report**

**Project Name and Number:** Reducing Impacts of Lost Crab Traps on Fishery Resources - # 2009-0062-005

**Recipient Organization/Agency:** Virginia Institute of Marine Science

**Recipient Organization Web Address:** [www.vims.edu](http://www.vims.edu)

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**1) Summary of Accomplishments**

There was no significant difference in catch rates between blue crab traps modified with biodegradable cull panels and standard (control) traps. Citizens who participate in recreational crabbing showed some willingness to pay the additional cost of including biodegradable panels in recreational blue crab traps.

**2) Project Activities & Results**

Species trapped by both modified and unmodified traps were compared to determine if there is a significant difference in catch rates. A survey was conducted to determine whether recreational crabbers would be willing to pay extra for a trap that is deemed 'green' and promotes a sustainable fishery concept. The purpose was to 1) determine if catch rates differ in the recreation or commercial crabbing effort between modified and unmodified traps, and 2) assess the willingness of citizens to pay for a modification that would reduce mortality if the trap is lost.

Activities	Project Outputs	Post-Project Outcomes	Indicator	Baseline Value	Predicted Value Project Output	Predicted Post-Project Outcome
Determine if catch rates differ in the recreation or commercial crabbing effort between modified and unmodified traps	Information on biodegradable cull panels' affect on blue crab catch in recreational or commercial crabbing	Biodegradable cull panels do not affect blue crab catch.	No significant difference in catch	0	No difference	Biodegradable panels could be considered for incorporation into blue crab traps
Investigate the willingness of citizens to pay for a modification that would reduce mortality if the trap is lost.	Information on citizens' willingness to pay some additional money for incorporation of biodegradable cull panels in blue crab traps.	Forty seven percent of respondents are willing to pay some additional cost for biodegradable panels in recreational crab traps.	Willingness to pay	0	Average additional pay \$3.99	There is some willingness from recreational crabbing participants to pay additional costs to incorporate biodegradable panels in crab traps.

## **Reducing Impacts of Lost Crab Traps on Fishery Resources.**

### **Problem Description**

Lost or abandoned (derelict) commercial fishing gear, including nets and traps, can present safety, nuisance, and environmental impacts in estuarine waters. Blue crabs and various fish species that are entrapped and die in derelict traps can act as an attractant to crabs resulting in a self-baiting effect. Derelict fishing gear damages sensitive habitat and continues to capture both target and by-catch species, leading to reduced fitness and significant acute and delayed mortalities (Guillory 2001; Matsuoka et al. 2005; Havens et al. 2008). Animals captured in derelict traps experience starvation, cannibalism, infection, disease, or prolonged exposure to poor water quality (i.e., low dissolved oxygen) (Van Engel 1982; Guillory 1993). The effect of derelict blue crab traps on diamondback terrapins (*Malaclemys terrapin*) and commercially important finfish has been documented (Roosenburg et al. 1997; Guillory and Prejean 1997). In the Gulf of Mexico, evidence that derelict traps contribute to significant mortalities in the blue crab fishery prompted the development of removal strategies to reduce the ecologic and economic impacts of derelict traps (Guillory et al. 2001). In Florida, Alabama, Mississippi, and Louisiana, estimates derived from trap loss calculations suggest derelict traps numbered at 605,000 in 1993. Guillory et al (2001) using an annual total number of traps fished commercially at 1 million and a 25% loss/abandonment rate suggests 250,000 derelict traps are added to the Gulf of Mexico annually.

Investigations by the project team were conducted using experimental traps to calculate catch rates of marine organisms, trap degradation rates, and test degradable trap material (rot cord, degradable panels). It is estimated that between 50,000 and 100,000 traps are added annually to the Chesapeake Bay derelict trap population. Species captured in these lost or derelict traps include blue crab, croaker, perch, catfish, spot, red drum, striped bass, flounder, muskrat and diamondback terrapins. Derelict pots have been shown to capture between 50 and 100 blue crabs per trap per season and over a dozen croaker per pot per season. Of the blue crabs captured by derelict traps, a significant portion is comprised of reproductively viable females that, if they remained in the population, could produce 2 to 3 broods of a couple million larvae each. Derelict traps continued to capture organisms for several years after they are lost which suggests derelict traps could affect blue crab populations (Havens et al. 2008).

An effort to remove derelict crab traps was conducted in Virginia (Havens et al. 2011) during the crab fishery offseason (winter) of 2008, 2009, and 2010. Commercial watermen participated and removed over 28,000 derelict traps ([http://ccrm.vims.edu/marine\\_debris\\_removal/](http://ccrm.vims.edu/marine_debris_removal/)). This project will continue in the winter months for one more year. Annual accumulation rates of derelict traps are estimated at around 20%. It is important to have a mechanism in place, once the removal program ends, which will render lost or derelict crab traps ineffective at capturing organisms.

In an earlier National Fish and Wildlife Foundation funded study, "Testing of gear modification for blue crab traps", the project team investigated the use of various degradable components on commercially available traps. The project's four working assumptions were 1) the modification must render the trap ineffective of capturing marine life within one season of loss, 2) the material, once degraded must be environmental neutral, 3) the modification must be relatively

inexpensive in order to be of practical use and 4) the modification must be relatively easy to enforce. Some states along the east and gulf coasts (Florida, New Jersey, and Texas) require biodegradable material on traps but most (Alabama, Delaware, Georgia, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Virginia, and the Potomac River Basin Commission) do not. The study found that degradable (rot cord) latch connectors were not as effective at allowing escape as degradable cull ring panels. Cull rings, or escape rings, allow small sublegal crabs to escape pots and commercial watermen must install them on traps anyway. In fact, the study found that relocating the cull ring from the upper chamber wall to flush with the upper chamber floor increased the likelihood of escape by undersized crabs by 39 times (Havens et al.2009, and Appendix A). The cull ring ‘panels’ expand the size of the units so that, once degraded, the hole matches the entrance funnel size. In practical terms, anything that can enter the trap would then be able to escape. The study found the best candidate, which met all four criteria, was the environmental safe degradable polymer polyhydroxyalkanoate or polycaprolactone. Polyhydroxyalkanoate and polycaprolactone were chosen based on their melting point and molding capacity. The degradable plastic timeframe, which degrades in one season, coincides with annual removal and repair of pots and will allow for seasonal replacement of panels as well as the removal of a derelict crab pots ability to trap that, most likely, would persist for several years if not addressed.

**Project**

This project involved testing of panels by incorporating them into recreational and commercial blue crab fishing operations from April-October. Ten residents who regularly deploy crab traps from their piers were recruited from a waterfront community to test traps modified with degradable panels against unmodified control traps. Each participant was asked to check their traps at least once per week and note the species trapped and count, sex, and measure the crabs trapped. The waterfront community was surveyed to determine whether they would be willing to pay extra for a trap that is deemed ‘green’ and promotes a sustainable fishery concept. Five commercial crabbers from various regions of the VA portion of the Chesapeake Bay incorporated 5 modified traps as part of their normal operation. The five modified traps and five control traps were checked daily for one week in the spring, summer, and fall. The crabs trapped were identified, counted, and measured.

**Results**

There was no significant difference in commercial blue crab catch between traps outfitted with biodegradable cull panels and control traps (see Appendix B). Pooled data from recreational participants found similar blue crab catch rates between experimental and control traps (Table 1). Sixty eight citizens responded to the survey (Appendix C) regarding willingness to pay for traps outfitted with biodegradable cull panels. One response was considered an outlier and removed (\$100). Of the remaining 67, the mean value was \$3.99 with a SE of \$0.70 and StDev of \$5.72. The median however, was \$0.00 with a minimum of \$0 and a maximum of \$25.00. Of the 31 respondents showing a willingness to pay, the mean value was \$8.63 with a SE of \$0.99 and StDev of \$5.53. The median was \$10.00 with a minimum of \$1.00 and a maximum of \$25.00.

	Trap	# crabs	Male	Female	Unknown	Average
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	days					
Biodegradable cull panel	126	1167	967 (82%)	199 (17%)	11 (1%)	9.3
Control	141	1267	1011 (79.8%)	250 (19.7%)	6 (0.5%)	9.0


Table 1. Pooled recreational crabbing data.

There was no evidence that biodegradable cull panels adversely affected the commercial watermen participant's crab catch. In all locations and time periods, legal catches were similar (or greater) in abundance, biomass, and size between modified and standard (control) traps. Evident catch differences can be attributed to seasonal and location factors corresponding to blue crab life history and migration patterns. Properly designed biodegradable panels appear to be a viable solution to mitigate the impact of derelict traps.


There is a need for a follow-up study to incorporate biodegradable cull panels in commercial watermen trap lines for an entire crabbing season to refine the panel decomposition rates. It has been shown in previous work that biodegradable plastic can provide the desired degradation timeframe but it needs testing by commercial participants. It is important for the panels to degrade at a rate that provides reasonable escape of crabs and bycatch from lost traps but allows the watermen a functional crabbing season before requiring replacement. Successful testing with commercial watermen participants would increase the likelihood of acceptance of degradable panels in traps.

## Appendix A.

Poster presented at 5<sup>th</sup> International Marine Debris Conference, March 21-25, 2011.



### Biodegradable Cull Ring Panels Decreases Lethality of Lost and Abandoned Blue Crab Traps

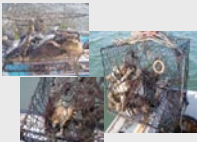


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#### Introduction

Derelict traps are a source of mortality to blue crabs and other by-catch.

- Traps become lost when a boat propeller severs the buoy line, a storm rolls the trap or when traps are abandoned.
- The derelict traps are self baiting.
- There are 368,900 licensed blue crab traps in Virginia (VMRC 2009). Annual loss of traps is estimated to be ~20% of deployed traps.
- Traps continue to fish for 2-6 years depending on the salinity, fouling and the material used to make the traps.
- Derelict traps catch 50.6 crabs per trap per season (Havens et al. 2008), for a potential loss of millions of crabs.
- Since derelict traps are continually added to the Chesapeake Bay a method to disarm the lost traps is needed.



#### Objectives

Investigate different degradable materials to determine which material performs the best, does not effect catch rate and meets the following criteria;

1. Modification should render the trap ineffective of capturing marine life within one season of the trap being lost.
2. The material, once degraded, must be environmentally neutral.
3. The modification must be relatively inexpensive in order to be of practical use.
4. The modification must be relatively easy to install and enforce.

#### Recommendations

Every state with fisheries that use traps/ pots should have an environmentally friendly marine biodegradable escape panel.

- Degradable cull panels should be the same size as the entrance funnels.
  - This will allow any organism that can enter a trap to exit.
- The cull panel should last for only one season.
  - Reduces cost and effort to the watermen but if the trap is lost it will disarm the trap.
- 2 panels should be required.
  - Placed on opposite walls which allows for escape even if the trap rolls on it's side.
- If the trap is lost, the degradable cull panel would minimize the by-catch while still allowing the trap to become habitat for bivalves, juvenile crabs and small fish.

#### Testing of the Biodegradable Material

Multiple types of degradable materials were tested including those that are currently required in other states regulations.

Pine, luan and poplar wood panels were tested and failed within seven months.



Cotton, Jute, Sisal and metal wire "rot cords" were all tested and failed in less than eight months.

Two types of environmentally friendly marine degradable plastics polymers were tested

- PCL (Polycaprolactone)
- PHA (Polyhydroxyalkanoate)


Panels were soaked in different salinity regimes to test degradation rates simulating a lost trap while commercial watermen tested the panels in their traps recording catch and degradation rates.

- There was no evidence that the biodegradable plastic cull ring panels adversely affected crab catch (Bilkovic et al. in review).
- Plastic polymers retained over 50% of their weight and did not fail during the eight month crabbing season.
- The biodegradable cull ring panels are an effective method of disarming a lost trap and allowing a trap to become habitat.





2009 – 2011 over 25,000 pots have been removed & documented in Virginia waters by 70 watermen during the off crabbing season.

In 2005, 676 derelict traps were identified using side scan sonar in 33.5 km<sup>2</sup> of the lower York River. Over 500 traps per year were removed in this area from 2009-11.



• Degradable plastic cull ring panels are estimated to cost under one dollar.



## Appendix B.

Manuscript under review at the *Marine Pollution Bulletin*.

## Appendix C.

Survey questionnaire for waterfront community.

### Survey Questions

1. Do you own crab pots for private use?

- Yes
- No

If **Yes** please proceed to the next questions.

2. How many pots do you generally fish?

3. How often do you fish your pots during the summer? (circle one)

- A couple times a week
- A couple weekends a month
- A couple times over the summer

4. If a pot costs \$35.00, how much more would you be willing to pay, if any, to incorporate biodegradable components so that if the pot is lost it will no longer capture crabs, fish, and other animals?

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