Marine Debris Program 2009 - Submit Final Programmatic Report (Activities and Outcomes)
Grantee Organization: College of William and Mary, Virginia Institute of Marine Science
Project Title: Effects of Ghost Crab Pots in the Chesapeake (VA) – II

Project Period	04/01/2011 - 12/31/2011
Award Amount	$4,960.94
Matching Contributions	$2,232.00
Project Location Description (from Proposal)	Virginia portion of the Chesapeake Bay.
Project Summary (from Proposal)	Continue testing of biodegradable escape panel that would allow crabs to excape after a period of time on lost pots. Prior testing confirmed no loss of catch on active gear; this project will now test for a full season with commercial fishermen in the blue crab fishery.
Summary of Accomplishments	Our results suggest a panel made of a specific biodegradable polymer (a polyhydroxyalkanoate (PHA)) is the optimum panel material for its durability, environmental neutrality, minimal expense and ease of use. PHA is a plant-based biodegradable polymer certified by American Society for Testing and Materials (ASTM) to fully degrade in the marine environment.
Lessons Learned	Incorporating the panels in commercial fishing gear for testing and utilizing the commercial fishermen in the research helped with panel design enhancements.

Conservation Activities	Test time to failure of biodegradable panels in commercial operations
Progress Measures	Other (Time to failure)
Value at Grant Completion	months

Conservation Outcome(s)	PHA polymer lasted the required season time frame
Conservation Indicator Metric(s)	Other (Time to failure)
Baseline Metric Value	unknown
Metric Value at Grant Completion	10-12 months
Long-term Goal Metric Value	10-12 months
Year in which Long Term Metric Value is Anticipated	365

Effects of Ghost Crab Pots in the Chesapeake (VA)-II
#19042

Final Programmatic Report Narrative

Instructions: Save this document on your computer and complete the narrative in the format provided. The final narrative should not exceed ten (10) pages; do not delete the text provided below. Once complete, upload this document into the on-line final programmatic report task as instructed.

1. Summary of Accomplishments

In four to five sentences, provide a brief summary of the project's key accomplishments and outcomes that were observed or measured

Our results suggest a panel made of a specific biodegradable polymer (a polyhydroxyalkanoate (PHA)) is the optimum panel material for its durability, environmental neutrality, minimal expense and ease of use. PHA is a plant-based biodegradable polymer certified by American Society for Testing and Materials (ASTM) to fully degrade in the marine environment.

2. Project Activities & Outcomes

Activities

- *Describe and quantify (using the approved metrics referenced in your grant agreement) the primary activities conducted during this grant.*
- *Briefly explain discrepancies between the activities conducted during the grant and the activities agreed upon in your grant agreement.*

Lost or abandoned (derelict) fishing gear, including crab and lobster pots, can present safety, nuisance, and environmental impacts in estuarine and marine waters. Typically pots become lost when buoy lines are severed by vessel propellers, lines break because of age, pots are abandoned or are vandalized, or storms roll the pots, pulling the floating buoy below the water surface. Derelict pots can continue to trap and kill animals, including commercially important finfish and shellfish, for years. Blue crabs, and various fish species that are entrapped and die in derelict pots, can act as an attractant to crabs ('ghost' fishing), resulting in a self-baiting effect.

Commercial operations in the Chesapeake Bay typically lose between 10% and 20% of the more than 500,000 pots deployed annually. In the Gulf of Mexico, pot loss is estimated at 25%, with 250,000 derelict blue crab pots added to the Gulf annually. Similar pot loss rates are reported for the lobster and Dungeness crab industry, which has over 3 million lobster pots deployed annually in Maine alone.

Ideally, crab and lobster pots would be designed or equipped such that lost pots would not continue to capture fish and other marine species. Some states have regulations in place to require some degradable component on pots to allow for escape of animals once the pot is lost. However, those requirements were generally put in place decades ago, and the technologies that were utilized (e.g., rot cord latches, springs, gapped openings) have been shown to be ineffective. For example, studies in Maine have demonstrated that escape mechanisms that rely on hinges or degradable attachment points fail due to encrustation of bio-fouling organisms such as barnacles and sponges which hold the hinge or non-degradable panel in place once the pot is lost. The only mechanism that truly allows for adequate escape of trapped animals is a panel that is fully biodegradable and does not rely on hinges or detachable components which become encrusted over time and fail to detach.

This project continued work on biodegradable panels for crab pots begun with funding, in part, from the National Fish and Wildlife Foundation. This project tested the design and biodegradable endurance of the panels for a complete crabbing season utilizing commercial fishermen. Seven commercial fishermen, selected from across a

geographic and salinity regime, incorporated the panels in their commercial crabbing operation. The fishermen monitored the panels throughout the crabbing season, reported any failure and returned the panels for analysis (weight loss) at the end of the season. In addition, VIMS scientists deployed a series of panels in different salinities and analyzed them at the end of the season.

Outcomes

- *Describe and quantify progress towards achieving the project outcomes described in your grant agreement. (Quantify using the approved metrics referenced in your grant agreement or by using more relevant metrics not included in the application.)*
- *Briefly explain discrepancies between what actually happened compared to what was anticipated to happen.*
- *Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results*

Our results suggest a panel made of a specific biodegradable polymer (polyhydroxyalkanoate (PHA)) is the optimum panel material for its durability (time frame for biodegradation), environmental neutrality, minimal expense and ease of use (Figure 1).

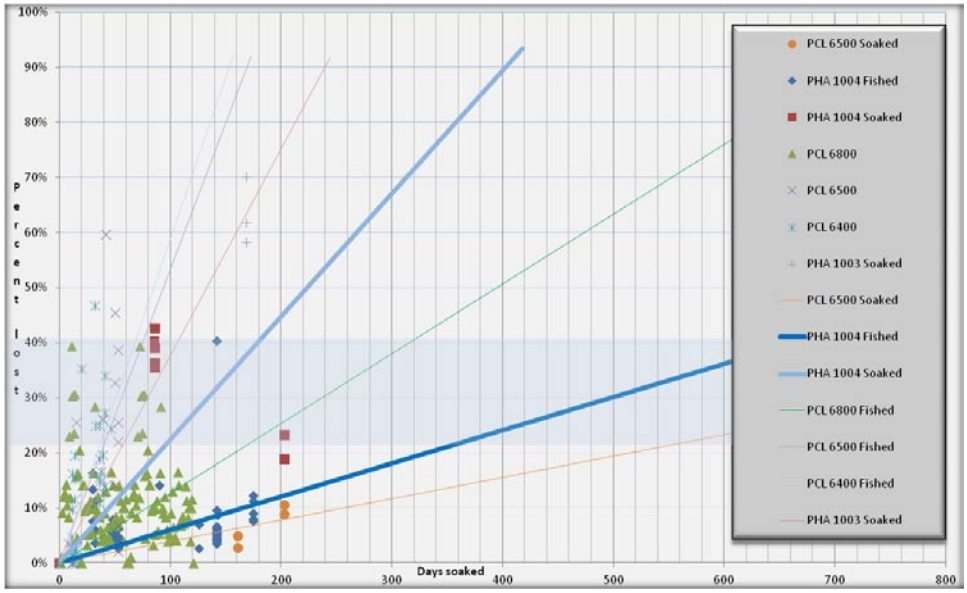


Figure 1. Graph of different biodegradable polymer materials and their durability (percent weight loss vs. days deployed). Blue shading depicts percent weight loss zone of likely panel failure.

PHA is a plant-based biodegradable polymer certified by American Society for Testing and Materials (ASTM) to fully degrade in the marine environment. This is an important component since most so-called 'degradable plastics' are not truly degradable and, in fact, simply fragment into smaller and smaller non-degradable components (micro-plastics). Micro-plastics have been identified as a potential serious threat to the base of the marine food web since they may be mistaken for food and consumed by zooplankton.

Importantly, the panels actually degraded faster once a pot was abandoned than while it was regularly fished. This beneficial feature may occur because the fishing process, which entails bringing the pot out of the water to remove the trapped crabs and exposes microbes that degrade PHA to deleterious light and oxygen, slowing the degradation process.

3. Lessons Learned

Describe the key lessons learned from this project, such as the least and most effective conservation practices or notable aspects of the project's methods, monitoring, or results. How could other conservation organizations adapt their projects to build upon some of these key lessons about what worked best and what did not?

Deploying the pots with the biodegradable panels as part of the commercial fisherman's regular pot line activity allowed valuable fisherman input into design components to enhance the panels. For example, the fishermen suggested more holes in the panels to prevent current and tidal flow pushing against a mostly solid panel and moving the pot along the bottom.

4. Dissemination

Briefly identify any dissemination of lessons learned or other project results to external audiences, such as the public or other conservation organizations.

Presentation to the New England lobster fishery community about the project as part of the National Fish and Wildlife Foundation NE State Managers Workshop on derelict fishing gear and the NOAA NE DGF Workshop.

Work on the biodegradable panels mentioned in the Washington Post article on 'ghost' crab pots:

Ghosts' haunt creatures on bay's bottom. By Darryl Fears, Washington Post article, published January 1, 2012.

http://www.washingtonpost.com/national/health-science/ghosts-haunt-creatures-on-bays-bottom/2011/12/12/gIQAjbexUP_story.html *Excerpt: "Virginia is trying to create a more animal-friendly pot. It would have a portal made of a plant-based polymer that dissolves if left in water for a year or more, allowing animals to escape forgotten pots. The loss of the Chesapeake Bay's most recognized seafood is detrimental to more than just the crab. Restaurants, retailers and customers pay more for crabs, and watermen, who rely on the creatures for income, suffer too."*

Article on testing biodegradable panels accepted for publication in Conservation Biology journal.

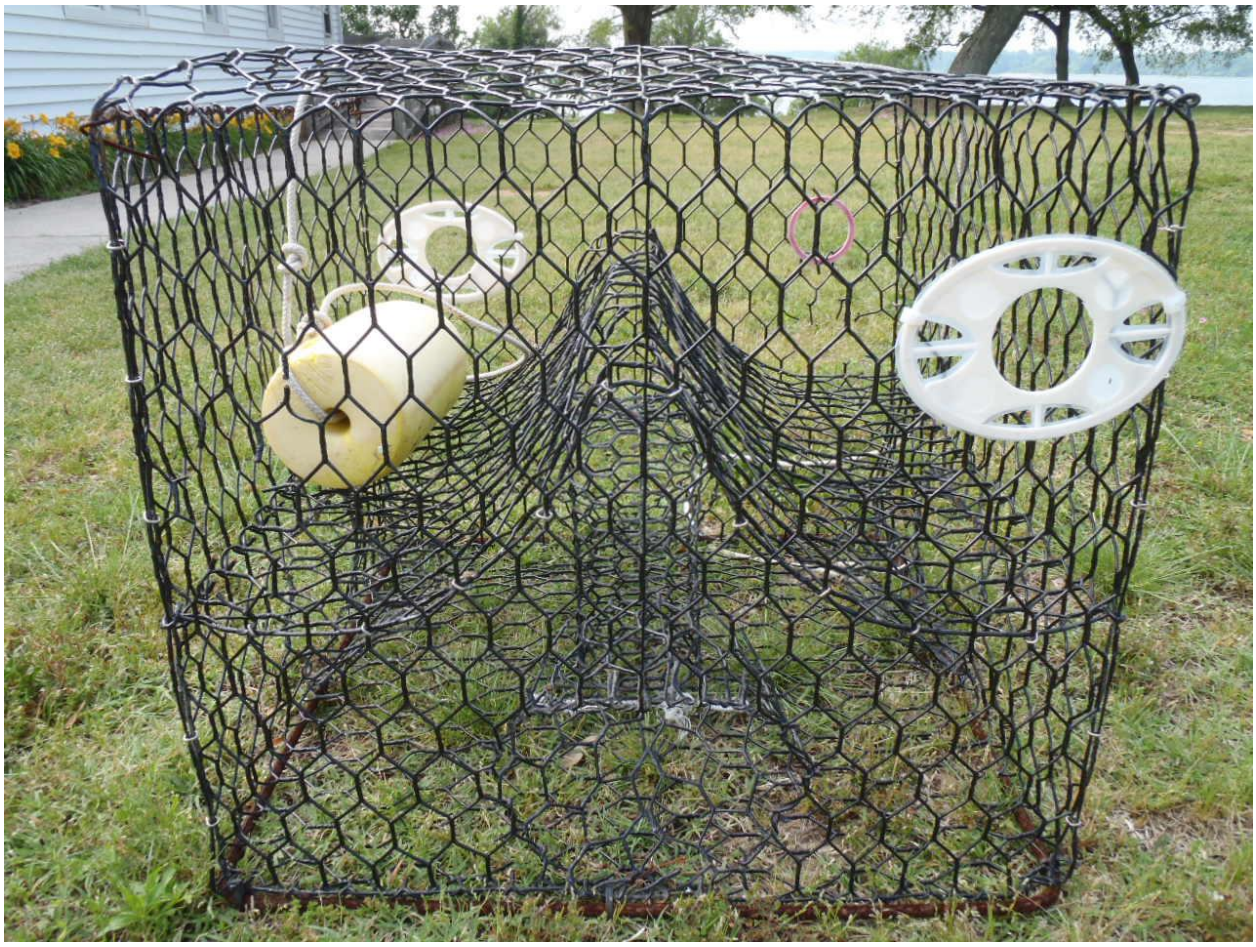
5. Project Documents

Include in your final programmatic report, via the Uploads section of this task, the following:

- *2-10 representative photos from the project. Photos need to have a minimum resolution of 300 dpi and must be accompanied with a legend or caption describing the file name and content of the photos;*
- *report publications, GIS data, brochures, videos, outreach tools, press releases, media coverage;*
- *any project deliverables per the terms of your grant agreement.*

Photos of biodegradable panel degradation time series included.

POSTING OF FINAL REPORT: *This report and attached project documents may be shared by the Foundation and any Funding Source for the Project via their respective websites. In the event that the Recipient intends to claim that its final report or project documents contains material that does not have to be posted on such websites because it is protected from disclosure by statutory or regulatory provisions, the Recipient shall clearly mark all such potentially protected materials as "PROTECTED" and provide an explanation and complete citation to the statutory or regulatory source for such protection.*



Time sequence of biodegradation of PHA panel (prior to use, six months, 12 months).