National Fish and Wildlife Foundation
Final Programmatic Report

Project Name and Number: Affects of Ghost Crab Pots in the Chesapeake (VA) (2006-0001-010)

Recipient Organization/Agency: Virginia Institute of Marine Science, Center for Coastal Resources Management

Recipient Web Address: http://ccrm.vims.edu/

1) Summary

The project resulted in an assessment of derelict blue crab trap catch efficiency and mortality rates. Traps in high salinity areas become less efficient in trapping organisms after 2 years. Traps in brackish areas remain efficient in trapping organisms beyond two years. Once crabs enter the top chamber of a trap, escape rates drop significantly and mortality over time is high.

2) Introduction

Derelict "ghost" crab pots are those blue crab pots lost either through accident (cutting of the buoy float line by boat propellers), storm events, or abandoned. These pots continue to capture blue crabs as well as other marine organisms. The continued fishing of these pots can have a significant impact on the recreational and commercial blue crab fishery and the economy of local communities. For example, the Gulf States Marine Fisheries Commission has estimated blue crab ghost fishery losses as high as 4 to 10 million crabs a year in Louisiana.

Preliminary results of pilot surveys funded by the Marine Debris Program in 2005 successfully demonstrated the feasibility of using side scan sonar and bathymetric surveys to identify and geospatially position derelict crab pots in the Maryland and Virginia portions of the Bay. Preliminary estimates of derelict trap densities for the surveyed portions of the York River, Va. range from 20 to 30 traps/km^2 and near the South River of Maryland pot density exceeds 120 traps/km^2.

This project will investigate blue crab escape percentages and mortality rates associated with ghost pots in the Chesapeake Bay including the 'self-baiting' phenomenon of derelict traps.

Objectives

1. Quantify the biological impacts of marine debris (ghost crab pots) on marine species.
2. Educate local communities on the detriments associated with abandoned or lost crab pots.
3. Demonstrate the transferability of the project methodology to other coastal communities.

3) Methods

The use of side scan sonar surveys has been shown to be a reliable methodology for locating and identifying derelict crab traps. This project used side scan sonar to survey for derelict traps in the York River, Virginia. A subset of identified derelict traps was removed, aged, and the contents cataloged. In a field investigation, sites were established to test blue crab escape efficiency from traps of different ages: 0.5 year old and 1 year old derelict traps in September and October for a total of 14 traps per test. Crabs were removed from traps, measured, tagged, returned to the same location (upper or lower chamber) in the trap and monitored over time. In addition, a sub-sample of traps was identified and an underwater camera lowered to survey the traps contents. A laboratory experiment investigated blue crab escape potential from traps of various ages. Three traps of four categories (new (control), 1 year old, 2 year old, complete derelict) were seeded with 6 crabs each (three female and three male) in the lower chamber. "Complete derelict" traps were defined as high salinity, highly encrusted traps of over 2 years of age. Crabs were tagged and tracked daily to determine escape efficiency and mortality rates. To test the self-baiting phenomenon we compared catch rates between un-baited and baited traps. Fourteen traps were deployed in two locations for September and October. Seven traps at each site were baited by placing a dead Atlantic croaker in the upper chamber to simulate the capture of a fish by a derelict trap while the other seven traps were left un-baited. After 5 days all traps were checked and the entrapped organisms identified, measured, and released.

4) Results

A subset of derelict traps was identified and removed in August 2007. Species composition is listed in Table 1 and is similar to an earlier study in the region (Havens et al. in press). Of the 11 derelict traps removed, 8 had cut ropes (effectively removing the marker float), and 10 were effectively capturing animals. The average catch of blue crabs per derelict trap retrieved in field was 3.5. It is not known how long the crabs were in the trap prior to sampling. Accordingly, it most likely represents the upper end of potential catch rates. A previous study in the area found an average catch of blue crabs per derelict trap retrieved in field of 0.65 and a seasonal average catch of 0.24 crabs·trap day^{-1} (Havens et al. in press).

Table 1. List of species identified in derelict blue crab traps.

Species	Count
Blue crab – Male (*Callinectes Sapidus*)	24
Blue crab – Female (*Callinectes Sapidus*)	5
Oyster Toadfish (*Opsanus tau*)	6

Atlantic Croaker (*Micropogonias undulates*)	3
Spot (*Leiostomus xanthurus*)	2
Summer Flounder (*Paralichthys dentatus*)	1
Sheepshead (*Archosargus probatocephalus*)	1

As was expected, in both the laboratory and field experiment, higher percentages of crabs escaped from the lower chamber than from the upper chamber (Table 2). In the field experiment crabs in the upper chamber were less likely to escape ($p = 0.001$) and as crab size increased the probability of escape decreased ($p = 0.032$). In a comparison of traps of different derelict ages, the older traps (2 years) had more escapes ($p = 0.010$) while there was no significant difference in escapes between 0.5 year and 1 year old derelict traps. In the laboratory and field experiments, the high salinity, highly encrusted derelict traps were no longer effectively entrapping crabs.

Table 2. Blue crab escape percentages from the lower and upper chambers of different aged derelict traps.

Trap Age	Lower Chamber (Average Percent Escape)	Upper Chamber (Average Percent Escape)	Trap (Average Percent Escape from Trap)
New (Lab)	22.3	5.5	16.7
1 year (Lab)	55.5	13.7	41.8
2 year (Lab)	47.2	29.3	40.7
Complete derelict (Lab)	92.1	NA	92.1
0.5 year (Field	68.8	18.0	16.7
1 year (Field)	83.3	14.7	12.5

In the laboratory mortality experiments over 80% of the crabs were dead after 168 hrs (approximately 7 days). In the field experiment approximately 40% were dead after 192 hrs (approximately 8 days) (Table 3). It is important to note that the laboratory crabs were obtained from a commercial crabbing operation and, while they were harvested the morning of the experiment, they had been handled prior to the start of the experiment at noon the same day.

Table 3. Time to mortality of blue crabs in derelict traps in the laboratory and field.

Experiment	N (alive)	Time (hrs)	N (dead)	Percent
Laboratory 1	72	168	58	80.6
Laboratory 2	72	168	61	84.8
Field	18	192	7	38.9

Baited and un-baited traps had varying catch rates (One-way ANOVA, $p = 0.016$, $df = 42$), with the traps simulating 'self-baiting' capturing slightly more than double the un-baited traps (mean catch rate 0.79 and 0.39 crabs·trap day^{-1}, respectively).

a) Outputs

Fig. 1: Logic framework table with indicators. *For additional guidance and examples, see http://www.nfwf.org/evaluation/ .*

Activities	Short-Term Outputs	Long-Term Outcomes	Indicator	Baseline Value	Predicted Value of Project Output	Actual Value of Project Output
Scan, identify, and locate a sample population of ghost traps. Remove traps, catalog contents, return subsample of traps to site for continued study.	Quantify mortality rate.	Inform resource managers.	# crabs/ traps/season	Unknown	To be determined	0.24 crabs/trap day 0.65 – 3.5 crabs/ trap retrieved in field
Scan, identify, and locate a series of ghost traps of different ages. Observe contents over a time series with minimal disturbance in both the field and laboratory.	Quantify/refine mortality rates by limiting trap disturbance	Inform resource managers.	%/trap age/time	Unknown	To be determined	Field 38.9% after 192 hrs. Laboratory 82.7% after 168 hrs
Scan, identify, locate, and retrieve a sample of different aged ghost traps and relocate to laboratory. Seed traps with live crabs and observe escape rates.	Determine blue crab ghost trap escape rates relative to aged traps. Refine mortality rates using escape rate data.	Inform resource managers.	%/trap/time	Unknown	To be determined	Escape percent from lower chamber: New = 22.3 1 yr = 55.5 2 yr = 47.2 Escape percent from upper chamber: New = 5.5 1 yr = 13.7 2 yr = 29.3

b) Post-project Outcomes

Significant post-project outcomes involve presentations of the data to various groups, including a report to the Virginia General Assembly. A second project (gear modifications to blue crab traps) funded through NFWF will provide opportunities to enhance outcomes from this project.

5) Discussion & Adaptive Management

a) Lessons Learned and Transferability

The key lessons learned from this project are listed below:
1. Underwater cameras are of limited use in observing animals in derelict traps in the southern Chesapeake Bay due to turbidity. The issue was resolved by removing the crabs from the traps, tagging them and returning them to the same location in the trap.
2. Derelict blue crab traps continue to effectively capture marine species for up to two years; particularly traps in brackish or tributary waters.
3. Crab escape rates vary by trap chamber position and gear modifications should be concentrated on the upper chamber of traps.
4. Mortality rates for crabs in the traps upper chamber are high after 7 days.
5. Highly encrusted derelict traps (generally from high salinity, main stem areas of the southern Chesapeake Bay) lose trap effectiveness after two years.

The next step involves design of gear modifications that reduce derelict trap capture efficiency while minimizing economic hardship to commercial watermen.

b) Dissemination

Information from this project has been provided to the Virginia General Assembly in a report to address House/Senate Joint Resolution 650 (see Appendix A). The results will be submitted for peer-review publication in an appropriate scientific journal. Some of the results have been accepted for 2008 publication in the North American Journal of Fisheries Management (see Appendix B). A presentation has been scheduled for the NOAA Marine Debris Information Forum to be held April 1-3, 2008 in Bethesda, MD. Recent press coverage is listed in Appendix C. Presentations to regulatory personnel are anticipated. The report will be posted on the Virginia Institute of Marine Science, Center for Coastal Resources Management website (hit rate 120,000/yr)

6) References

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Appendix A. Report to the Virginia General Assembly regarding HJ Resolution 650.

http://leg2.state.va.us/dls/h&sdocs.nsf/By+Year/HD72008/$file/HD7.pdf

Appendix B. Publication in peer-review journal.

December 17, 2007

Dr. Kirk J. Havens
Virginia Institute of Marine Science
Gloucester Point, Virginia

Dear Dr. Havens: Re: M07-014

"The effects of derelict blue crab traps on marine organisms in the lower York River, Virginia".

Congratulations. I am pleased to inform you that your manuscript has been accepted for publication in North American Journal of Fisheries Management as an article.

I look forward to working with you again before too long.

Sincerely,

Carolyn Griswold
National Marine Fisheries Service
Northeast Fisheries Science Center
28 Tarzwell Drive
Narragansett, RI 02882
United States of America

Appendix C. Recent press coverage in the Bay Journal.

http://www.bayjournal.com/article.cfm?article=3237