Project Number: 41-DVG-COOL

An Industry Haunted

Investigating the Phenomena of Ghost Gear and Marine Debris

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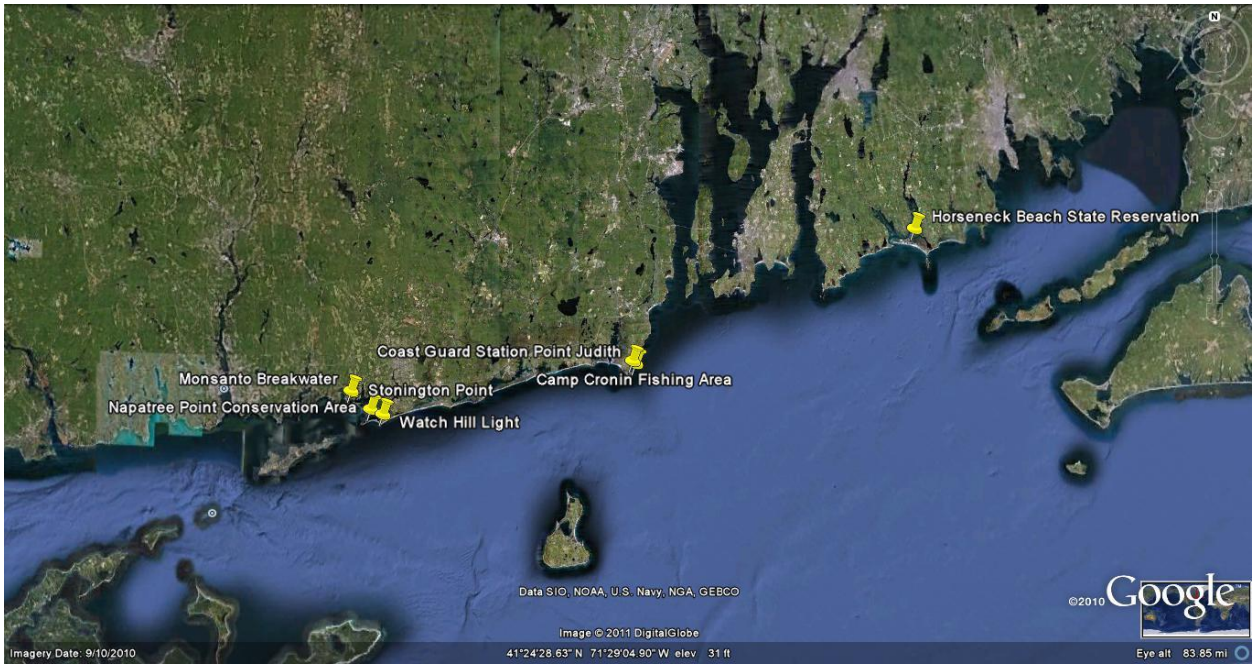
Abstract

For recreational and professional lobstermen alike, the loss of and disposal of lobster traps are continuing problems. They hinder conservation efforts, pollute the marine environment, impede navigation, and put the lives of mariners and the general public at risk. To prove this, a submarine survey, marine debris survey covering three states, and leaching experiment were conducted. Throughout the project, procedures were implemented to protect the environment such as releasing caught marine life and recycling found lobster traps.



IQP Survey Sites (Source: Google Earth)

INTRODUCTION

For recreational and professional lobstermen alike, the loss of and disposal of lobster traps are continuing problems. Unfortunately, this issue is widespread in the industry and it leads to the phenomenon of ghost gear (see Figure 1) and marine debris (see Figure 2). According to the Food and Agriculture Organization (FAO) of the United Nations, ghost gear is "lost or abandoned fishing gear that continues to catch fish."[1] While the National Oceanic and Atmospheric Administration (NOAA) defines marine debris as "any persistent solid material that is…intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes."[2] The loss and disposal of traditional lobstering gear is a problem because it hinders conservation efforts, pollutes the marine environment, impedes navigation, and puts the lives of mariners and the general public at risk.

BACKGROUND

The lobster trap originated in France approximately four hundred years ago. Known as a crille and made out of wood, it had its drawbacks. Fishermen in Britain, Ireland, and Scotland improved its design.[3] The first wire mesh lobster trap was created by Jim Knott around 1956. He did this because wooden traps weighed about one hundred pounds when wet and are very buoyant. A wire mesh trap is approximately one half the weight of a wooden trap and sinks. A wire mesh lobster trap has a service life of one to over ten years and according to Jim Knott, "If the trap is [left alone] the PVC can protect it indefinitely, but if it's used in a rocky place the PVC eventually gets scrubbed off. When that happens the zinc eventually goes and the wire will rust."[4] Also, "Knott estimates that 90% of all lobster traps used in the U.S. are made from wire."[5]

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[1] FAO. © 2005-2010. Fisheries Issues. Ghost fishing. Text by Andrew Smith. In: *FAO Fisheries and Aquaculture Department* [online]. Rome. Updated 27 May 2005. [Cited 8 April 2010]. http://www.fao.org/fishery/topic/14798/en

[2] "Marine Debris Program - Marine Debris Information." *NOAA Marine Debris Program - Welcome*. 17 Nov. 2010. Web. 21 Feb. 2011. <http://marinedebris.noaa.gov/info/welcome.html>.

[3] Pekar, P. M. *How to Build a Lobster Trap*. Nyack, NY: Rockcom Pub., 1986. 5-14. Print.

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[5] Marselli et al.

SUBMARINE SURVEY

As a recreational diver, I knew that there are untended lobster traps strewn across the seabed, but didn't know the extent of the problem. For this reason, I conducted a submarine survey using SCUBA in Stonington Harbor in the area between the Monsanto jetty and Stonington Commons' docks (see Figure 3) as part of my Interactive Qualifying Project (IQP). This site was chosen because it is a popular recreational lobstering area, prior surveys have found ghost traps, and a propeller fouling incident involving trap hauling tackle occurred there (see Figure 4).

Three separate dives were completed on the site covering a different area each time using underwater survey techniques. A total of ten traps were recovered, two on July 16, 2010, five on July 22, 2010, and three on September 6, 2010. All ten traps were fouled with algae and sessile invertebrates, but in addition, five of them contained living animals that are intentionally fished for: four *Homarus americanus* (American lobster) and one large unidentified fish (see Figure 5 & Figure 6). Some of the lobsters should have been able to escape the traps because they were small, but they were prevented from doing so by heavy fouling and malfunctioning escape vents. All the ghost-fished animals were released on site after photographing (see Figure 7).

According to the State of Connecticut in the Connecticut Law Journal section 26-157c-2, (b):

> All lobster pots and traps made of material other than wood used for the taking of lobsters shall be constructed so as to contain, on any side of the catch compartment (parlor) an escapement panel which, when open, will provide an unobstructed orifice not less than 3-3/4 inches by 3-3/4 inches…If constructed of material other than wood, said escapement panel may be hinged and shall be held in the closed position with uncoated, ferrous wire…

While all the traps recovered had the required escape vent, seven of the recovered traps had escape vents that were not intact. If this conservation method was working, no marine life should have been found in the traps (see Figure 8).

MARINE DEBRIS SURVEY

Lost and improperly disposed of lobster traps litter the ocean bottom, but they are a particular detriment to coastlines and shallow waters, especially where human traffic is heavy. On a hike around the Napatree Point Conservation Area on October 9, 2010, I found ten lobster traps in various stages of disintegration (see Figure 9). Two lobster claws next to the trap parts likely belonged to victims of the ghost trap phenomenon (see Figure 10 & Figure 11).

The Napatree Point Conservation Area was well-known as a site of trap accumulation; four other sites were also examined. One of those sites was Watch Hill Light's seawall which I surveyed on October 10, 2010. This survey revealed one lobster trap elevated on the seawall still attached to the snagged hauling tackle (see Figure 12). This find was minor compared to the sixteen traps found during an excursion on November 15, 2010 at the Horseneck Beach State Reservation in Westport, MA (see Figure 13). On November 19, 2010 a total of five traps were found at two sites in Point Judith, RI. Two traps were found at Coast Guard Station Point Judith and three were found at the Camp Cronin Fishing Area (see Figure 14). Obviously, lost and improperly disposed of lobster traps are not an isolated problem. I have been easily able to demonstrate that they litter the coastlines of three contiguous states.

LEACHING EXPERIMENT

Because lobster trap wire is protected with polyvinyl chloride (PVC) it can be assumed that Bisphenol A (BPA) leaching occurs. BPA is found in plastics and "hosts of studies show[] that it leaches from plastics and resins when they are exposed to hard use…"[6] This leaching is a problem because BPA is a carcinogen, it has estrogen-like effects on development, and has caused low sperm counts in rats. Also, Retha Newbold, an endocrinologist with the U.S. National Institute of Environmental Health Services, says

[6] Biello, David. "Plastic (Not) Fantastic: Food Containers Leach a Potentially Harmful Chemical: Scientific American." *Science News, Articles and Information | Scientific American*. 19 Feb. 2008. Web. 19 Feb. 2011. <http://www.scientificamerican.com/article.cfm?id=plastic-not-fantastic-with-bisphenol-a>.

"In animals, BPA can cause permanent effects after very short periods of exposure. It doesn't have to remain in the body to have an effect."[7]

To see if any visible leaching could be demonstrated, twelve pieces of wire trap mesh of varying gauge and color and three ferrous hog rings were submerged in seawater and allowed to leach. I used the technique known as Thin Layer Chromatography (TLC) (see Figure 15, Figure 16, Figure 17) to demonstrate proof of concept that seawater could be used as the solvent in TLC. The solvent fronts did not stop at a uniform height on the two substrates employed: filter paper and silica-gel-coated plastic membrane, which suggests that solutes travelling with the salt may have affected its deposition point. There were no other deposition lines below the "salting-out" front, but it is possible that analysis of the salt band could reveal the leachate. However, very sophisticated and expensive methods would have to be used. It is likely that the amount of bis-phenol could only be detected with High Pressure Liquid Chromatography or Gas Chromatography, methods beyond the means and scope of this study.

DISPOSAL

Throughout the project, a procedure of studying the found lobster trap material in situ and then properly disposing of it was followed. For example, during the Submarine Survey a line was attached to the trap which was then hauled to the surface by the dive tender where it was examined, emptied of marine life, and transported to the staging area. However, a more in-depth removal operation was conducted during the Marine Debris Survey at the Horseneck Beach State Reservation. While the traps were observed on November 15, 2010, their removal was not allowed until permission was granted by the Commonwealth of Massachusetts' Department of Conservation and Recreation (see Figure 18). Once permission was secured, the operation commenced on November 21, 2010 and I successfully removed an entire pickup truck full of lost and improperly disposed of lobster traps. Once they were removed from the Horseneck Beach State Reservation they were brought to the staging area to await proper

[7] Biello et al.

disposal. With the permission of the Town of Stonington's First Selectman and Solid Waste Manager, the traps were removed of their heads, ballast, and runners and brought to the Town of Stonington Solid Waste Transfer Station (see Figure 19).

CONCLUSIONS

The phenomenon of ghost fishing and marine debris are prevalent within the New England lobster fishery due to the loss and improper disposal of lobster traps. The submarine survey showed that conservation measures are not working, while the marine debris survey showed that the issue is not localized and lobster traps wreak havoc above the ocean's surface as well. This problem must be addressed because it defeats conservation efforts, is a large source of pollution, and is a danger to mariners and civilians (see Figure 20). While steps can be taken mitigate the problem the ultimate solution should be to develop an environmentally friendly lobster trap.

APPENDIX

Figure 1 (Ghost Lobster Trap)
Ghost lobster trap found during the Submarine Survey, pulled from a depth of approximately 10-15'. Notice the lobster caught in the trap despite measures taken to prevent this problem.

Figure 1a
Ghost lobster trap found during the Submarine Survey with heavy marine fouling.

Figure 2 (Traps Above the Tide Line)
Multiple lobster traps found above the tide line at Horseneck Beach State Reservation on November 15, 2010.

Figure 3 (Submarine Survey Site)
Outlined area is the site of the Submarine Survey. Monsanto jetty is to the Left and Stonington Commons' docks are to the Right.

Figure 4 (Prop Fouling)
Typical prop fouling which is a common occurrence for mariners. Submerged and semi submerged ghost fishing gear obviously makes this problem more frequent.

Figure 5 (Stuck Lobster)
American lobster stuck in a trap. Escape hatch is in upper left corner of the photograph. For scale, the wire trap mesh is 1.5” square.

Figure 6 (Unidentifiable Fish)
Large unidentifiable fish stuck in a trap.

Figure 7 (Stuck Baby Lobster Released)
Baby lobster stuck in trap being released; it should have been able to free itself, but either the escape vents did not work or the lobster's behavior makes them inappropriate.

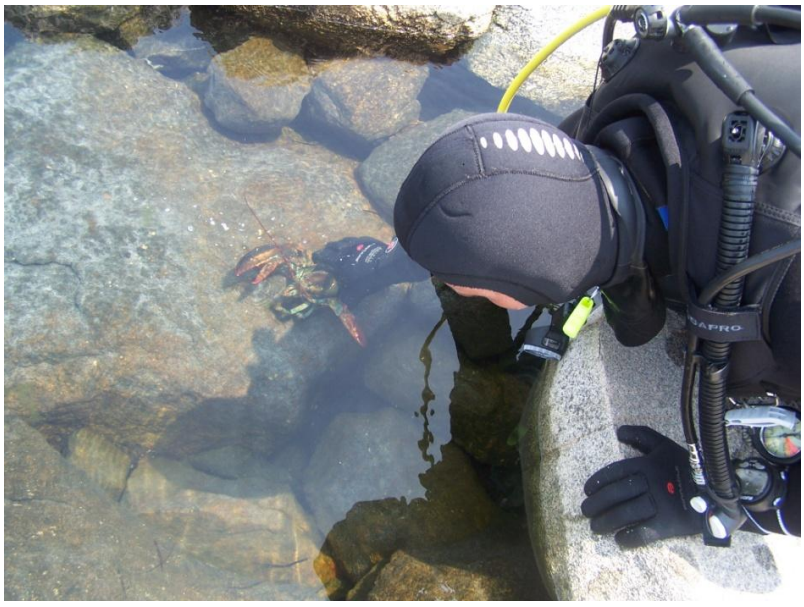

Figure 7a
Large lobster stuck in trap being released.

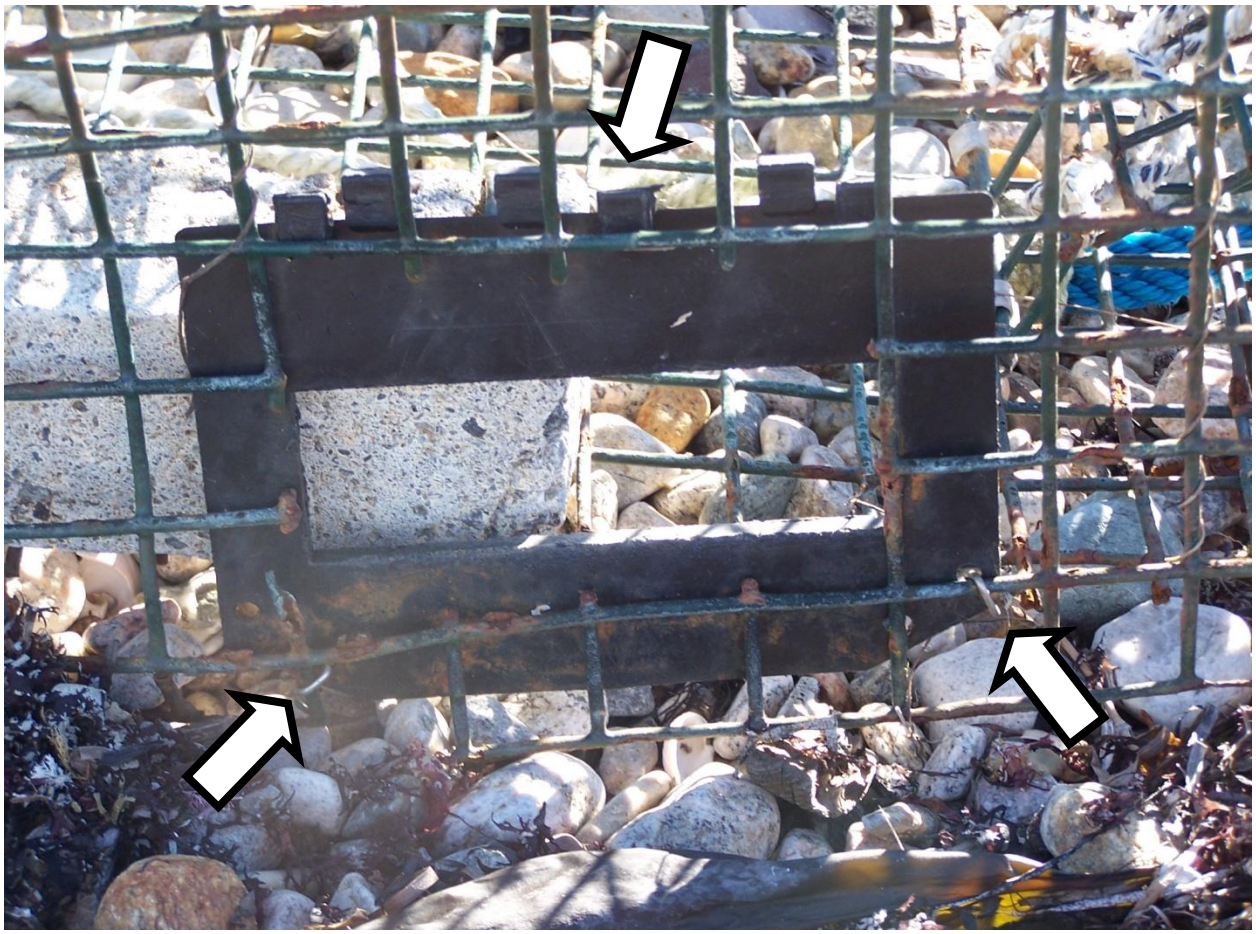

Figure 8 (Lobster Trap Escape Vent)
Typical lobster trap escape vent. Notice the noncompliant securing and hinge which is not intact. The design of typical lobster trap escape vents is flawed thus hindering escape of lobsters. Undersized lobsters as defined by regulations do not find their way out of the traps when door is intact and the mechanism for full hatch opening does not work because the door may be held in place by fouling organisms.

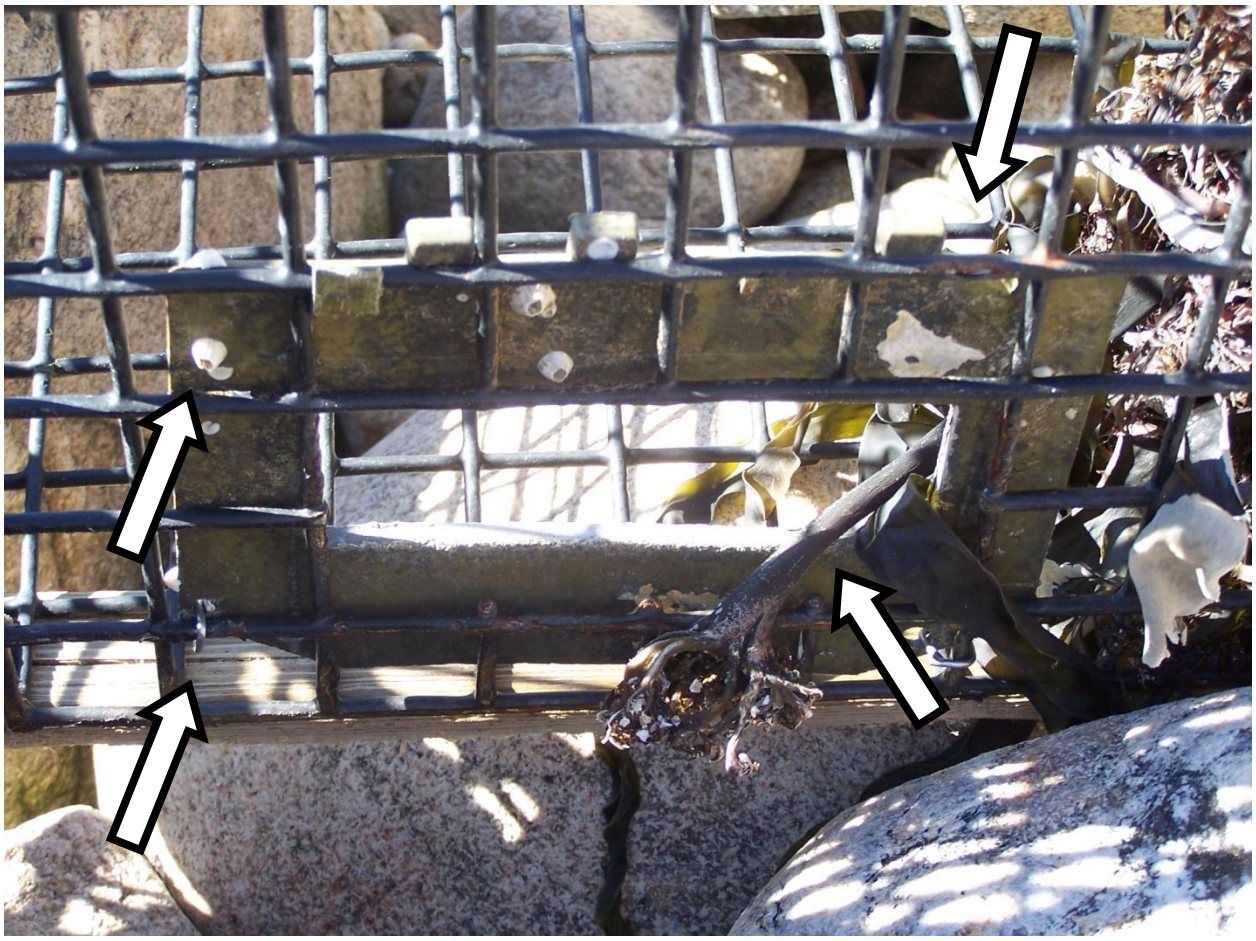

Figure 8a
Another typical lobster trap escape vent. Notice the noncompliant securing, hinge which is not intact and fouling organisms, in this case, macroalgae that could prevent release of the vent door.

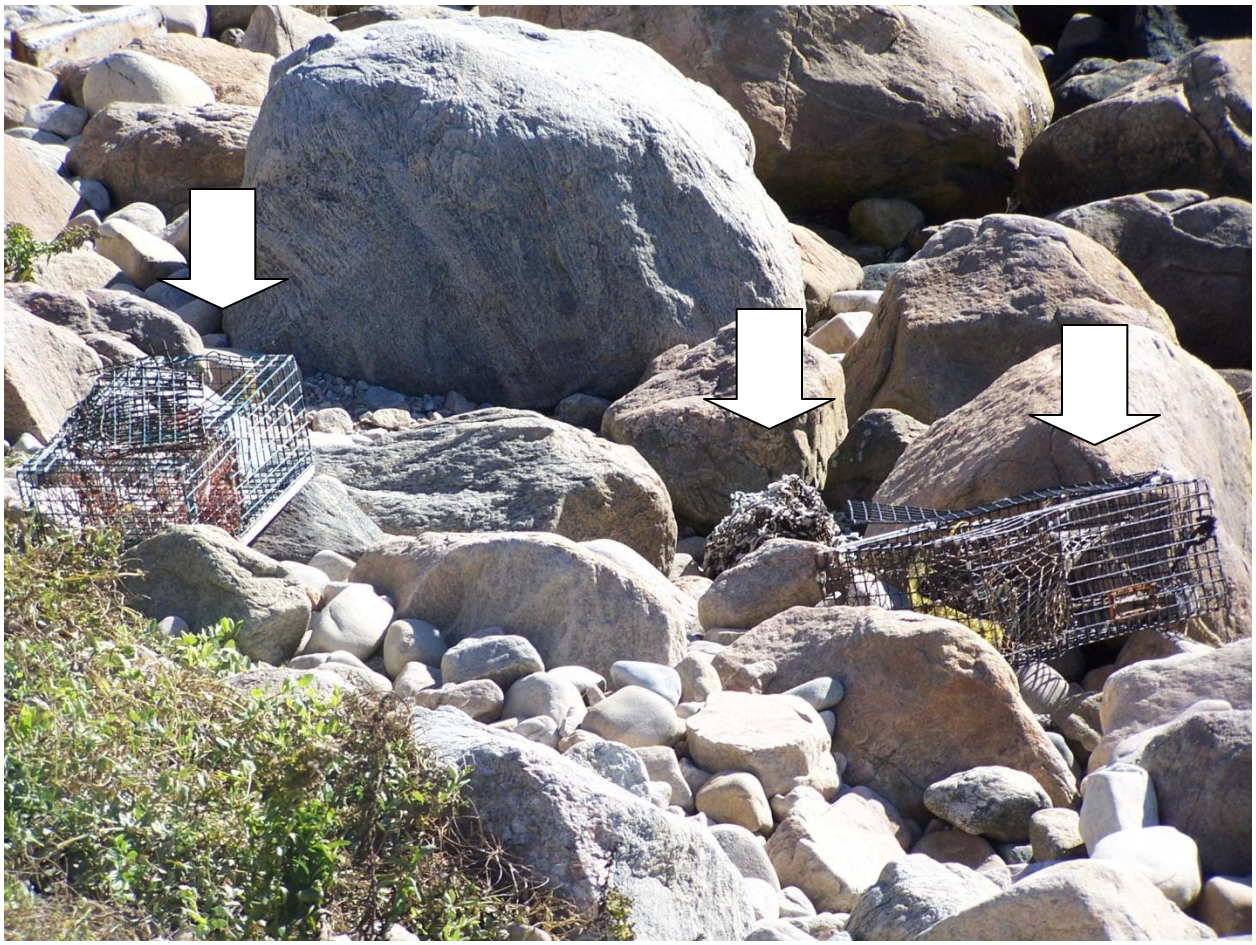

Figure 9 (Napatree Point Conservation Area)
Lobster traps washed ashore at Napatree Point Conservation Area. Other fishing gear washes ashore in this area as well. Note net at middle arrow. Nets can also ghost-fish.

Figure 10 (Trap With Claws)
Trap washed ashore at Napatree Point Conservation Area. Notice the claws on top of the trap.

Figure 11 (Bait Bag)
Plastic mesh lobster trap bait bag washed ashore at Napatree Point Conservation Area. Notice the claw next to the bait bag. See text for details.

Figure 12 (Watch Hill Light)
Lobster trap washed up onto Watch Hill Light's seawall.

Figure 12a
Watch Hill Light

Figure 13 (Communal Trap Dump)
Communal trap dump at Horseneck Beach State Reservation. Employees with the Commonwealth of Massachusetts' Department of Conservation and Recreation mentioned that this area must be cleaned up once a year due to the number of traps that are dumped there.

Figure 13a
Horseneck Beach State Reservation (Source: Town of Westport, MA GIS)

Figure 14 (Point Judith and Camp Cronin)
Lobster traps found at Coast Guard Station Point Judith and Camp Cronin Fishing Area (Bottom). Notice the mound of hauling tackle also found (Pickup).

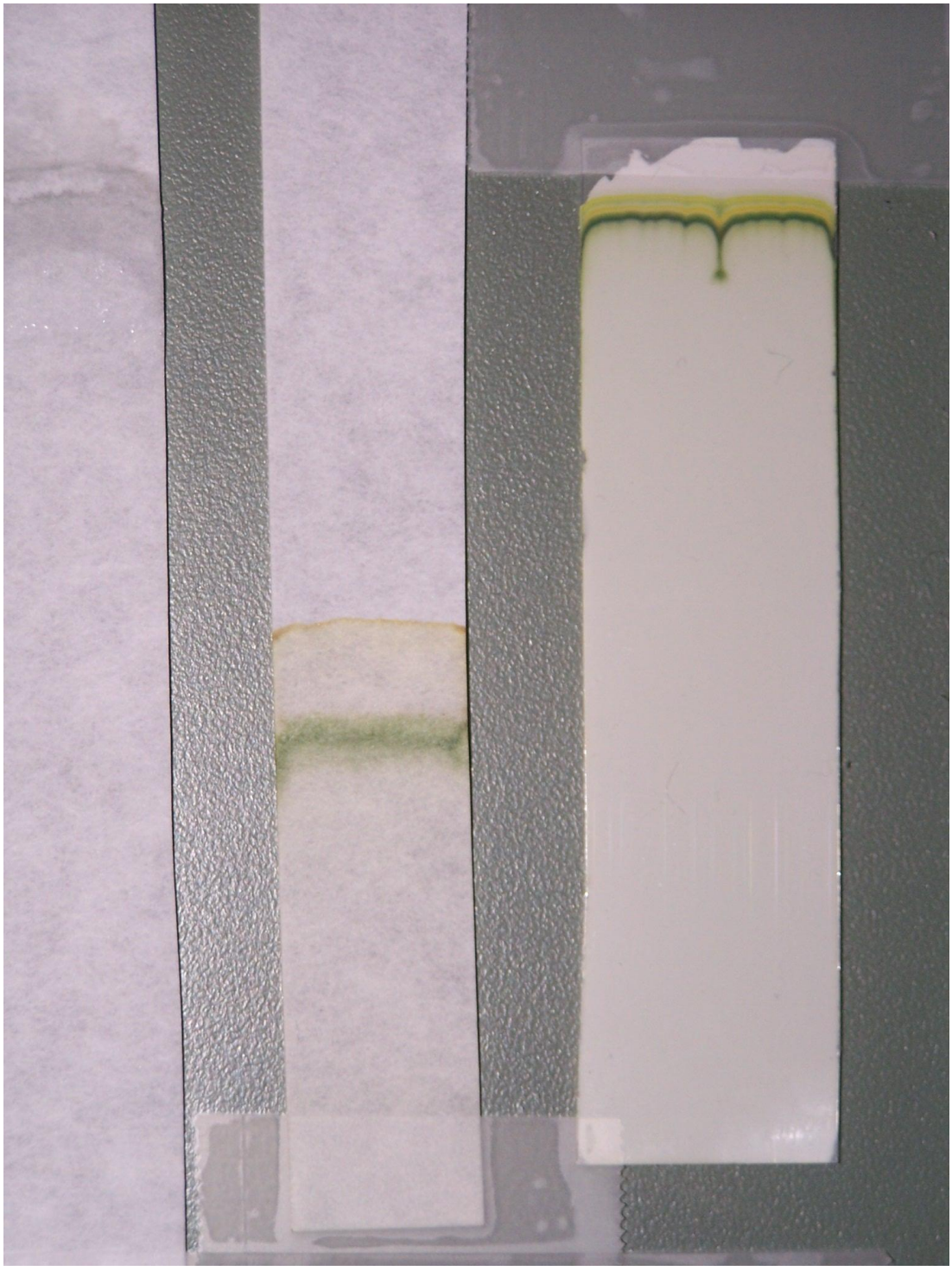

Figure 15 (Chlorophyll TLC)
Chlorophyll and other plant pigments migrate according to molecular weight and effinity for solvent up a silica gel coated membrane. We hoped to separate leachates from traps by this same method. Filter paper (Left), silica gel (Right). Filter paper seemed to work better for our purposes.

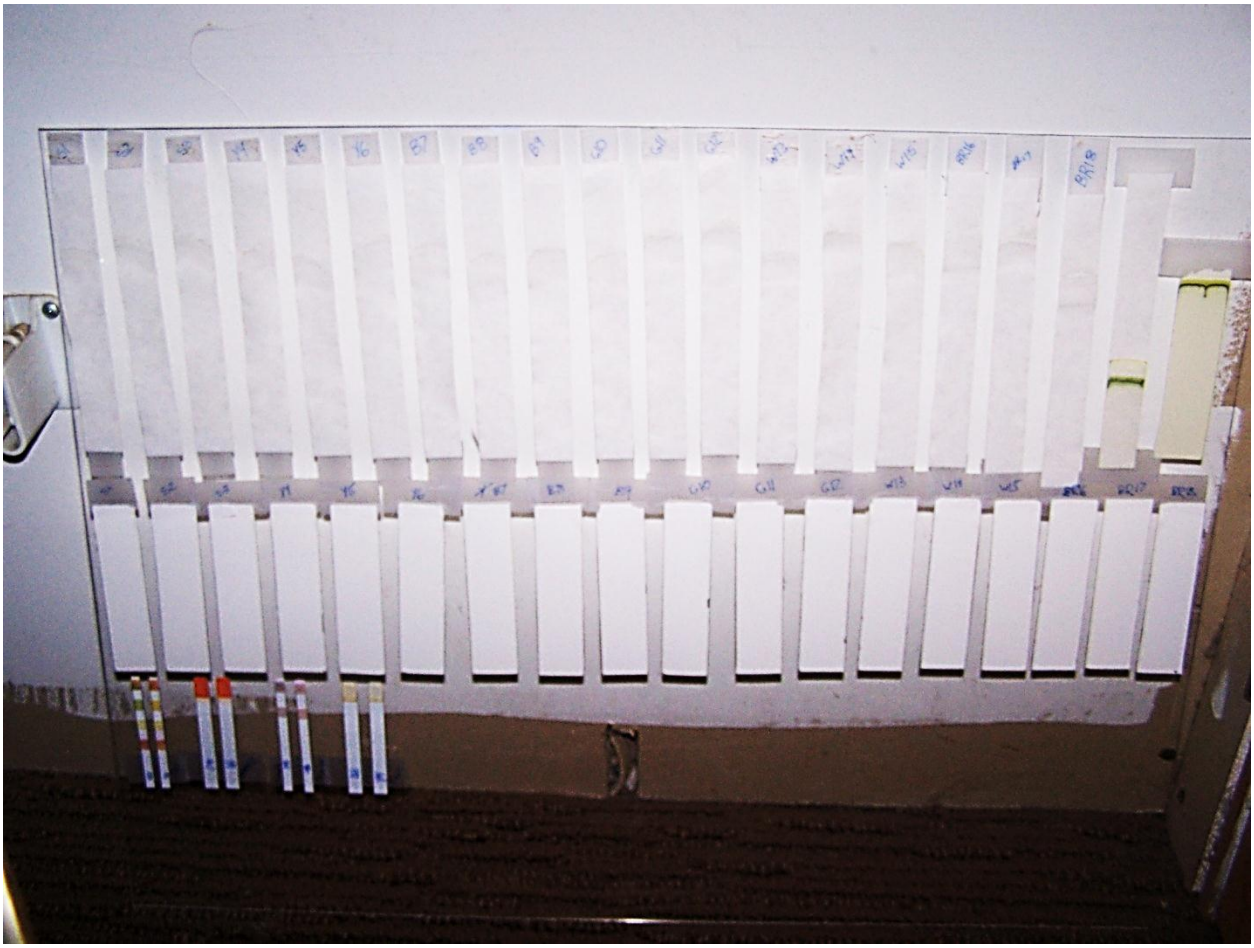

Figure 16 (TLC)
Results of leeching experiments: silica gel (Bottom row), filter paper (Top row). Seawater was used as solvent. Salt front precipitated at different levels although solvent was the same. This suggests comigration of solutes with salt, but without testing we can not be sure that salt bands also contain co-migrating leachate.

Figure 17 (TLC Ultraviolet Light)
Ultraviolet light was not helpful in examining the test strips.

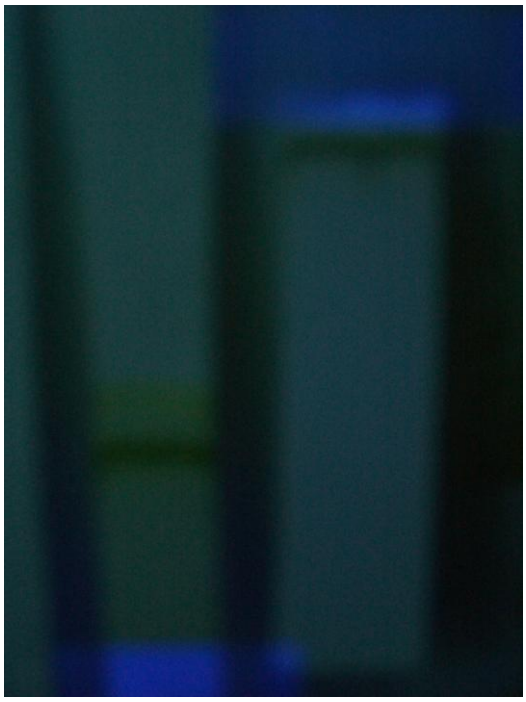

Figure 17a
Chlorophyll under ultraviolet light.

Department of Conservation and Recreation
OFFICE OF COMMUNITY RELATIONS

COMMUNITY CLEAN-UP REQUEST FORM

Please complete the form and return it to Ellen FitzPatrick, DCR Community Relations Coordinator at Ellen.FitzPatrick@state.ma.us Phone: 617-626-1412

NAME OF CONTACT PERSON: *Drew Domnarski* SUBMIT DATE: *11/29/10*

NAME OF ORGANIZATION: *Student Project*

ADDRESS: 126 Asher Ave.

CITY: *Pawcatuck* STATE: *CT* ZIP: *06379*

TELEPHONE: *(860)-884-5909* EMAIL ADDRESS: *drewd@wpi.edu*

DATE(S) REQUESTED: 11/21/2010

DURATION OF CLEAN UP AND TIME(S) REQUESTED: *0900-1200*

FACILITY OR AREA REQUESTED: *Horseneck Beach*

SIZE OF GROUP: *3* DO YOU NEED TO USE PUBLIC TRANSPORTATION? *NO*

MATERIALS REQUESTED: TRASH BAGS ___ GLOVES ___ STICKS ____ OTHER _____

****

(COMMUNITY RELATIONS USE)

DIRECTOR, COMMUNITY RELATIONS SIGNATURE _____

DCR COMMUNITY RELATIONS COORDINATOR: Ellen FitzPatrick PHONE: 617-626-1412

FORWARDING COPY TO:

URBAN PARKS: ( ) Harbor Region ( ) North Region ( ) South Region

STATE PARKS: ( ) Central Region ( ) Northeast Region ( ) Southeast Region ( ) West Region

CONFIRMED DATE, TIME AND LOCATION: _____

DCR STAFF CONTACT NAME: _____ PHONE:_____

POST-EVENT DATA: NUMBER OF VOLUNTEER: ____*3*____ HOURS WORKED:____*3*____

TRASH PICK-UP: *1 truckload of wire lobster traps*

Updated September 8, 2010

Figure 18 (*Community Clean-up Request Form*)
Permission to remove traps from the Horseneck Beach State Reservation requires participants to fill out and file a *Community Clean-up Request Form*.

Figure 19 (Load of Lobster Traps)
First load of lobster traps to be disposed. Prior to their disposal they must be sorted inorder to be accepted at the facility for recycling: hauling tackle (Left), wire cages (Center), miscellaneous wire (Right), ballast (Bottom Center). This process was very time compsuming and sometimes the components were impossible to separate which makes it impractical for commercial fishmen with a large number of traps to properly dipose of them on land. Most traps are dumped at sea as a matter of expediency.

Figure 19a
A lobster trap prior to sorting for dispoal. All traps recovered were cataloged and photographed prior to sorting/diposal inorder to record typical deformations as this information will be useful for future lobster trap technology development.

Figure 20 (Injury)
Well-intentioned recyclers should be careful in collecting ghost traps: injuries like this are inevitable without heavy gloves and other protective gear.

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