Massachusetts Division of Marine Fisheries
Protected Species Program

Projects and Accomplishments for Grant #2006-0093-001

Submitted to:

National Fish and Wildlife Foundation

Photo by Erin Burke (DMF)

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EXECUTIVE SUMMARY

The Massachusetts Division of Marine Fisheries (*MarineFisheries*) has conducted the Right Whale Conservation Program each year since 1996. The purpose of the program is to protect right whales in Massachusetts state waters through research, management, and outreach efforts. We carried out a range of cooperative projects related to right whale conservation, including aerial surveillance, habitat monitoring, acoustic monitoring, fixed fishing gear research, ghost gear removal, gear compliance analysis, and outreach.

However, the Commonwealth's protected species work extends beyond right whales. Many of the projects conducted for the benefit of right whales have conservation value for other large whale species too, such as humpback and fin whales. In addition, *MarineFisheries* is involved with all issues related to protected species in Massachusetts state waters. Currently this work focuses on reducing leatherback sea turtle and harbor porpoise entanglements in fishing gear.

During winter and early spring of 2007, *MarineFisheries* and the Provincetown Center for Coastal Studies completed the tenth season of the Right Whale Surveillance and Habitat Monitoring Program in Cape Cod Bay. Information collected through this program revealed seasonal trends in right whale population demographics, habitat use, and distribution and abundance patterns.

In 2007, *MarineFisheries* continued to collaborate with Cornell University and Woods Hole Oceanographic Institution to establish a near real-time acoustic monitoring system for right whales in Cape Cod Bay. These listening buoys will allow managers to more efficiently monitor and address threats to right whales by following their movement patterns, regardless of weather conditions or time of day.

Another important project, conducted jointly with the Atlantic Offshore Lobstermen's Association (AOLA), focused on identifying the factors affecting the durability of sinking groundline. *MarineFisheries* and AOLA continued to work with Tension Technology International to microscopically evaluate the causes of groundline damage. In addition, DMF and AOLA initiated a study in 2007 to investigate the impact of the lobster gear hauling system on groundline damage.

The Commonwealth also established new fixed gear rules in 2007 to further reduce the risk of large whale entanglement. Effective January 1, 2007, the use of floating groundline is prohibited in state waters in both the pot and gillnet fisheries. *MarineFisheries* and the Massachusetts Environmental Police initiated a compliance study using sonar in response to this broad-scale gear restriction.

Research, management, and outreach efforts accomplished by the Commonwealth of Massachusetts are aimed at reducing human-induced mortality and injury of right whales. The ultimate goal is the co-existence between endangered marine mammals and maritime industries. *MarineFisheries* will continue to conserve and protect right whales in state waters, through further progress on the acoustic monitoring system and identifying the causes of groundline wear.

INTRODUCTION

This report summarizes the activities of the Massachusetts Division of Marine Fisheries' (*MarineFisheries*) Protected Species Program, under NFWF grant #2006-0093-001. This work related primarily to the North Atlantic right whale and other large whale conservation issues. Though the Right Whale Conservation Program is the cornerstone of the protected species work done by *MarineFisheries*, in recent years we have expanded our focus to address impacts to other species such as sea turtles, harbor porpoise, and other large whales. The Commonwealth is building a comprehensive and cooperative protected species program, supported by several funding sources, that is integrated with other programs with similar goals.

FUNDING SOURCES

National Fish and Wildlife Foundation (NFWF)

The NFWF provided $170,605 to support the Commonwealth's Right Whale Conservation Program (# 2006-0093-001). This included support for a collaborative effort with Cornell University to provide near real-time acoustic monitoring of right whales in Cape Cod Bay; support for groundline durability research; funding for a Protected Species Specialist to oversee all program activities; groundline compliance analysis; and outreach.

In addition, the Protected Species Specialist position supported by the NFWF grant worked on all project related to right whales and protected species work for the Commonwealth of Massachusetts. This included the following projects funded by the National Marine Fisheries Service.

National Marine Fisheries Service (NMFS)

1) $420,000 to fund the 2007 season of the Right Whale Surveillance and Monitoring Program in Cape Cod Bay (CCB).

2) $44,700 to evaluate how adjustments to the lobster gear hauling equipment can improve the durability of sinking groundline.

PROJECTS AND ACCOMPLISHMENTS

During the period December 1, 2006 though September 30, 2008 *MarineFisheries* completed the following activities in implementation of the Massachusetts Protected Species Program:

RIGHT WHALE CONSERVATION PROGRAM

CAPE COD BAY RIGHT WHALE SURVEILLANCE AND HABITAT MONITORING PROGRAM 2007

For the tenth consecutive year, *MarineFisheries* conducted a surveillance and habitat monitoring program for right whales in Cape Cod Bay and adjacent waters from January 1 - May 15. This program is accomplished through a contract with the Provincetown Center for Coastal Studies (PCCS) and involves aerial surveillance of right whales, vessel-based habitat monitoring of right whale food resources, and investigations of whale behavior associated with vocalizations. All marine mammal sightings were communicated to the NMFS Sightings Advisory System and the University of Rhode Island, home of the right whale distribution database[1]. Photo documentation of right whales was sent to the New England Aquarium (NEAq), curators of the right whale photo-identification catalog. See Jaquet *et al* 2007 for a full report on the surveillance season. http://www.mass.gov/dfwele/dmf/programsandprojects/ritwhale.htm#right

Aerial Surveillance

During the 2007 season, PCCS completed 31 aerial surveys, totaling 157.4 hours of flight time over Cape Cod Bay and adjacent waters. Right whales were observed in Cape Cod Bay and adjacent waters for 92 days in 2007, between February 11 and May 13. This period of occupation is similar to previous years. In 2007, right whale sightings began to increase in late February and continued to increase throughout March. Prior to the northeaster' on April 19, there had been strong concentration of right whales around Race Point. The violent storm temporarily dispersed the right whale concentration and sightings were low directly following the gale, with only six whales sighted on April 21. However right whale sightings quickly began to increase again, causing another peak in abundance around Race Point in late April, similar to that seen in 2006 (Jaquet et al. 2007).

A much larger number of individuals were seen in 2007 than in any previous year of this study. A total of 161 individual right whales visited CCB and adjacent waters, representing 45% of the population known to be alive in 2007. This is twice the yearly average between 1998 and 2006. There was an average of 18.4 days between the first and last sighting of individual right whale. This is substantially longer than 2006 (average of 7.4 days) and 2005 (average of 13.2 days),

[1] All marine mammal sightings are communicated to the sightings database at the University of Rhode Island.

suggesting that not only more whales than usual visited CCB and adjacent water in 2007, but their residency time was also longer than in recent years (Jaquet et al. 2007).

The aerial team spotted 3 mother and calf pairs in 2007, with 2 of those mothers bringing calves to CCB for the first time. In addition, 34 new individuals were seen in CCB that have never been observed in the previous nine year of the project. The largest number of Surface Active Groups (SAGs) was also observed in 2007. Between 1998 and 2006, a yearly average of 9.2 SAGs (SD=4.89, range = 1 to 15) had been reported. In 2007, 30 SAGs were observed while no changes in the methodology of the survey had been made (Jaquet et al. 2007).

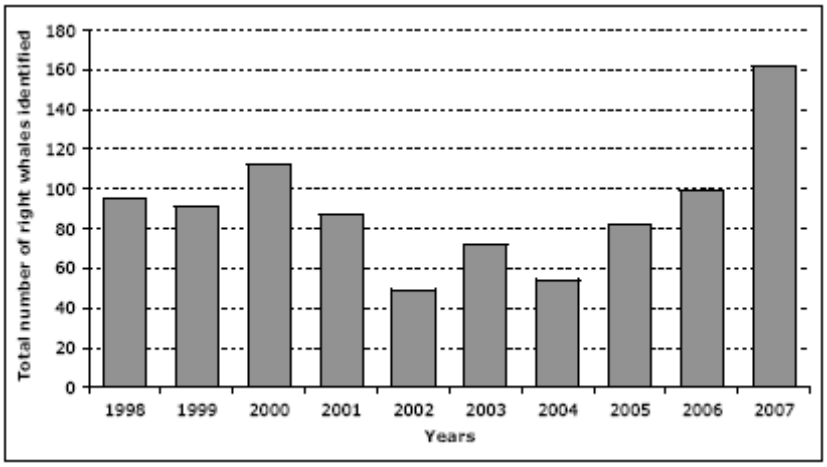

Figure 1. Total number of individual right whales identified in both CCB and adjacent waters by all platforms (1998-2007) (PCCS data).

In both 2006 and 2007, large aggregations of right whales were observed off Race Point in April. The 2007 season also witnessed the most Surface Active Groups (SAG) ever observed in CCB. Between 1998 and 2006, a yearly average of 9.2 SAGs were observed, but in 2007, 30 SAGs were documented, despite no changes in survey methodology (Jaquet et al. 2007).

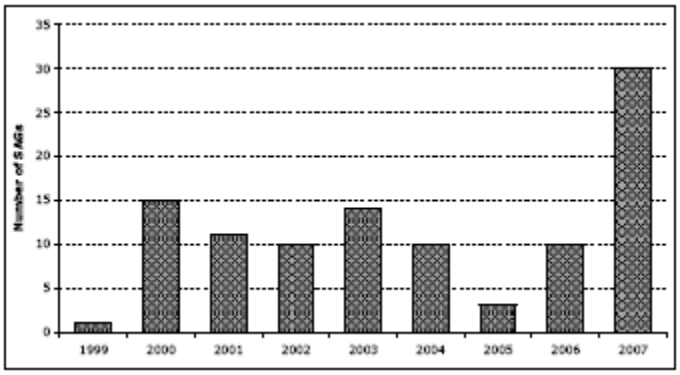

Figure 2. Number of SAG's observed in both CCB and adjacent waters by all platforms (1998-2007) (PCCS data).

The results of the 2007 field season continue to support the view that CCB is an important habitat for right whales during winter and early spring as up to 45% of the entire right whale population can be observed in this area. Furthermore, this habitat is especially important for adult females and for mother/calf pairs as their residency time in CCB is significantly longer than for males (Jaquet et al. 2007).

Habitat Monitoring

In addition to aerial surveys, *MarineFisheries* contracts PCCS to conduct habitat monitoring in Cape Cod Bay from January through mid May to explore the association between the spatial-temporal distribution of right whales and their zooplankton prey. It also examines the biotic and abiotic habitat variables that affect zooplankton density, useful for developing a predictive model of right whale movements based on prey resources. Post-cruise analysis and reporting are completed as rapidly as possible with the goal of delivering to *MarineFisheries* time-critical information that can assist in managing Cape Cod Bay Critical Habitat. Managers are provided with a better understanding of whale location and the potential overlap with human activities such as fishing and shipping.

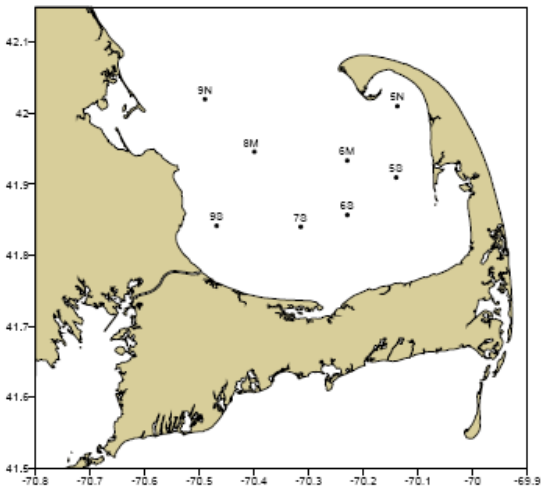

Figure 3. Map of zooplankton sampling stations in Cape Cod Bay (DMF)

During the 2007 field season, 19 cruises were undertaken, collecting 345 zooplankton samples to characterize the zooplankton food resources which control the distribution of right whales within Cape Cod Bay. Collections were principally taken by surface and oblique net tows at eight regular stations throughout the bay. "Habitat Assessment" reports are circulated within several days of completing a cruise, but near real-time reports are provided to *MarineFisheries* immediately after each cruise. The near real-time "Preliminary Assessment and Alert of Right Whale Risk" reports relate information about High Risk Areas based on the proximity of aggregations right whales and zooplankton to areas of high ship traffic. *MarineFisheries* uses these near real-time assessments to issue advisories to vessel operators that recommend maintaining slow speeds in these High Risk areas where right whale aggregations will likely remain due to food availability. This real-time reporting strategy has proven very successful,

with *MarineFisheries* issuing two advisories in 2007. These advisories can be found in Appendix B of this document (Jaquet et al. 2007).

Generally the 2007 zooplankton resource followed previously documented patterns of enrichment and impoverishment with the primary food resources being the three dominant calanoid copepod taxa: *Centropages* ssp., *Pseudocalanus* ssp., and *Calanus finmarchicus*. As in previous years, the 2007 season followed the pattern of fairly steady and increasing zooplankton abundance resource from January through May. *Centropages* increased in early winter, likely the remains of the late summer and fall stock. Enrichment by *Pseudocalanus* peaked during March, which is typical, although the strength of the *Pseudocalanus* was somewhat reduced in 2007 as compared to previous years. Typical of other years, the *Calanus* resource increased from very low densities prior to late February to relatively high concentrations in April (Jaquet et al. 2007).

The 2007 season, however, was unusual because right whale densities did not follow the steady increase in total zooplankton concentration. In addition, right whales left Cape Cod Bay in 2007 during a time in May when zooplankton, mainly *Calanus*, remained broadly available and at densities exceeding the feeding threshold of right whales throughout large portions of the bay. However, the departure from habitat that appears acceptable has been observed in previous years and we believe may be explained by the "competition between habitats". In early May, other nearby habitats (e.g. Great South Channel) become enriched with a strong, stable food resource. While the *Calanus* abundance in Cape Cod Bay at this time is still above feeding threshold in some areas, it is less stable and pervasive, likely leading to departure of right whales from the area (Jaquet et al. 2007).

Acoustic Monitoring Buoys

Passive acoustic monitoring is increasingly being used as a tool in right whale research and management. Acoustic monitoring is not subject to the same weather and daylight constraints that limit aerial and vessel surveillance. Acoustic monitoring buoys can detect the presence of right whales over long periods of time, regardless of time of day or weather conditions. The continuous coverage provided by acoustic buoys greatly expands the surveillance capabilities.

Since 2003, *MarineFisheries*, Cornell University, and Woods Hole Oceanographic Institution have partnered in the development of this real-time acoustic monitoring technology for right whales. A great deal of research and development has gone into improving the design and performance of the buoys. There have been many challenges related to battery power, false detections, and up-link of calls via cell phone. However, incredible progress has been made over the years to address these issues and make the buoys as functional and reliable as possible.

One major problem that needed to be addressed was the hydrophone cable. The current chain-link design was creating too much noise. So on March 21, 2007, we tested a new hydrophone tether off Sandwich, Massachusetts. This was our first buoy equipped with a new elastic hydrophone tether called a “Gumby hose”, designed to address the problem of false detections,

reduce self-noise, and improve data quality, as compared to the previous chain-link model. The Gumby buoy performed exceptionally well, detecting right whales calls until May 27, 2007, after which the whales left the area. In this time period, we averaged 7 right whale call detections per day, with a peak of 40 detections on March 28, 2007. During the Nor'easter on April 16, the buoy continued to pick up right whale calls, revealing that the whales rode out the storm in the bay. A total of 470 right whale up-calls were detected in 2007. The flexible hydrophone hose/anchoring system proved to be successful at reducing the amount of self-noise that had plagued the detection system in previous years. Even though this was only a single buoy, this was a very useful year for confirming that the quiet Gumby system was the step forward that we needed for future monitoring efforts

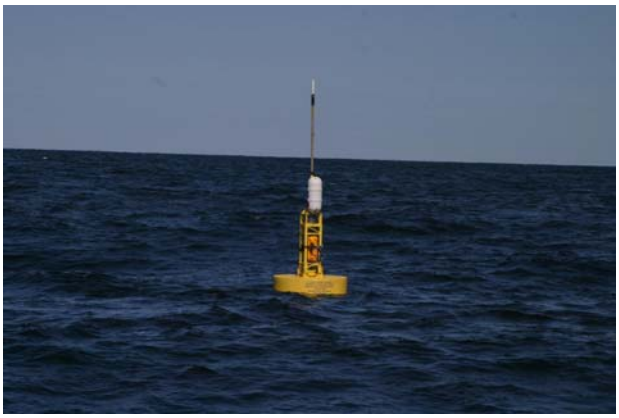

Figure 4. Acoustic buoy in Cape Cod Bay – March 2007 (DMF photo).

In 2008 we will deploy 3 buoys equipped with Gumby hoses in Cape Cod Bay. Additionally, we are planning to convert the surface system of our buoys over to the latest design. WHOI had recently devised a new surface buoy system to remedy the exposed connection wires used in the old system. This new system is also being utilized by the liquid natural gas companies on their right whale monitoring buoys in the Traffic Separation Scheme. New canisters containing the hardware and batteries were designed to fit inside the surface system and not have exposed wiring, causing less connection problems.

Since 2003, NFWF has provided tremendous support toward the development of this important acoustic technology. Beginning on January 1, 2008, the Commonwealth of Massachusetts will be using mitigation funds to continue the acoustic monitoring program in Cape Cod Bay.

REDUCING DAMAGE TO SINKING GROUNDLINE

Under the federal Large Whale Take Reduction Plan, the use of sinking groundline in the pot and gillnet fishery expanded in October 2008 and April 2009, respectively. Sinking groundline will be required year-round in most of the Gulf of Maine, including many areas where this type of rope has not previously been used. In Massachusetts, sinking groundline had been a year-round requirement in Cape Cod Bay Critical Habitat since 2004 and a year-round requirement in all

Massachusetts state waters since January 1, 2007.

The use of sinking groundline reduces the profile of line in the water column and thus reduces the risk of entanglement for large whales. Entanglement in fixed gear is a major cause of human-induced injury and mortality for endangered whales. However, while sinking groundline provides conservation benefits to whales, it has drawbacks for fishermen, who report that it causes more hang-downs, chafes on the bottom, and tends to wear out faster than floating line. The offshore lobster fishery is particularly concerned about longevity problems associated with sinking line. *MarineFisheries* and the Atlantic Offshore Lobstermen's Association have worked since 2003 to increase the lifespan of sinking groundline and reduce the potential for lost gear by improving durability.

The scope of our groundline investigations have grown considerably since the start of the project. In the beginning, we focused on the rope itself, examining which brand performed best in response to contact with sediment, since fishermen had reported that sediment intrusion was the main cause of rope damage. However, our investigations have revealed that sediment is not the main cause of rope degradation, rather that mechanical damage from the hauling system is also a significant contributor to rope failure.

Offshore Field-testing of Sinking Groundlines

Field-testing of promising groundlines continued during 2007. Those brands of sinking groundlines that performed well on the machine were first put in the field in early 2006, with five offshore lobster boats participating in this part of the study. Each fisherman is testing five different brands of 5/8-inch sinking groundline. Lobster trap trawls in the offshore fishery are generally 40 traps in length. Some of the trawls will be rigged with only one brand, while others will be multi-brand trawls. Samples of line from the test trawls will periodically be brought in to evaluate the change in breaking strength and the patterns of wear.

In 2007, sinking groundline samples that were field-tested by two different fishermen where sent to Southwest Ocean Services in Houston, TX for break testing. Each sample was broken twice and the average is reported in the table below. These results are based on a small sample, which prevents us from drawing any definitive conclusions about ropes whose breaking strengths are close. However statistical tests do provide evidence that the difference in strength between the highest ranked rope and the others is probably not due to chance. It is interesting to note that the ranking of breaking strengths after two years were the same for both users, despite the difference in fishing grounds.

Brand	Br. Strength - New	Av. Br. Strength - Used	% Br. Strength Retained
Everson 4-strand	9170	7465	81.41
Everson 3-strand	8857	6647	75.05
Polysteel Esterpro	8638	6465	74.84
Anacko	8197	5902	72
Orion Orco	8658	5426	62.67
Polysteel Hydropro	10297	6199	60.2

Figure 5. Comparison of the breaking strength of new ropes and the average strength after approximately two years of field-testing (Southwest Ocean Services data).

Additionally, in January 2007, rope samples from the 5 offshore field-testing users were collected and sent to Tension Technology International (TTI) for analysis of wear patterns. TTI, a rope engineering and testing firm, performed microscopic and visual examinations on our field-tested ropes to determine the source of damage and wear. These results of that analysis are discussed in the next section of this report.

Visual and Microscopic Analysis of Rope Damage (NFWF grant # 2006-0093-001)

MarineFisheries and AOLA have partnered with Tension Technology International (TTI) since 2005 to identify the causes of rope degradation and failure. The analysts at Tension Technology's laboratory in Scotland use microscopic and visual techniques to examine ropes and identify the causes of wear. Analysts conducted breaking strength tests, analyzed rope construction, evaluated the type of wear seen, and quantified the presence of sediment. In early 2007, we sent rope samples to TTI that had been fished in the offshore lobster fishery for one year. The analysis showed that external abrasion, not sediment intrusion, was the dominant fatigue mechanism (TTI, 2007). This finding conflicts with reports by fishermen that sinking groundlines are being damaged from the inside out by sediment intrusion. This does however corroborate previous tests by TTI on both machine-tested and used ropes from the field.

In the current samples, they found that while internal abrasion and damage from sediment intrusion *were* observed in the rope samples, the effect was very small when compared to the external abrasion. It was concluded that the primary cause of the external abrasion damage was from the mechanics of the rope-hauling system. Damage to the inner structure of the rope strands, due to the abrasive effect of sediment was not a major contributor to damage (TTI, 2007).

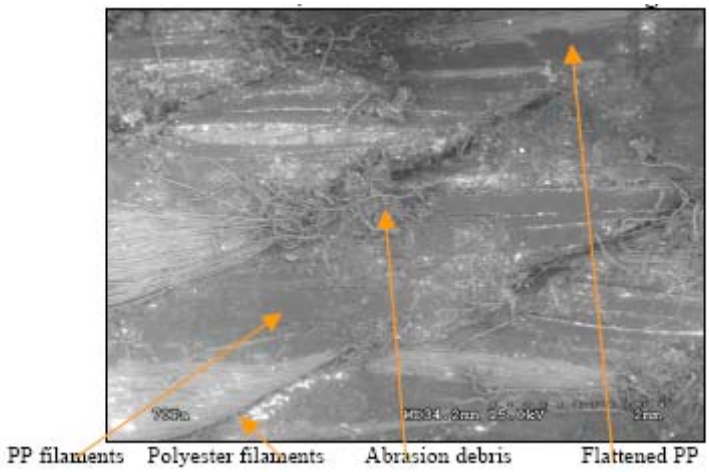

Figure 6. Scanning electron microscope view of outer rope strand
(PP is the abbreviation for polypropylene)

Other results from this analysis relate to the specifications and construction of the ropes. TTI found that the best performing ropes were those where the outer layers of a rope strand were made from a blend of coarse polypropylene (floating) filaments and finer polyester (sinking) filaments. Ropes constructed with polypropylene and polyester filaments blended in the surface layer of rope strands have good resistance to external and internal abrasion. The Everson 3 and 4 strand ropes were constructed in this way. Ropes with only polypropylene filaments in the outer layer, such as Anacko brand, suffered high levels of mechanical damage (TTI, 2007).

The results for the two ropes where polyester filaments dominate the outer face were mixed. The Orion Orco suffered from the effects of abrasion and pressure to a greater extent than did the Polysteel Ester Pro and also displayed a greater degree of filament abrasion damage due to particle penetration. In general, the Ester Pro compared well with the two Everson specifications, where the outer face is a blend of polypropylene and polyester filaments.

While it cannot be stated that sediment plays no role in damaging ropes, the finding about mechanical damage demonstrate the potential for improving rope performance by making adjustments to the lobster trap hauling system. The full report from Tension Technology on this analysis can be found at the *MarineFisheries* website, titled "□ HYPERLINK "http://www.mass.gov/dfwele/dmf/programsandprojects/tti_report_2007.pdf" □Visual and scanning electron microscopy investigation and tensile testing to estimate residual tensile strength of a selection of lobster lines.□" □ HYPERLINK "http://www.mass.gov/dfwele/dmf/programsandprojects/ritwhale.htm" \l "right"□http://www.mass.gov/dfwele/dmf/programsandprojects/ritwhale.htm#right□

Use of a Rope-Hauling Simulator to Test the Durability of Sinking Groundlines

In early 2007, while TTI was processing our field-tested ropes, *MarineFisheries* and the Atlantic Offshore Fishing Association (AOLA) began more runs on the rope-hauling simulator. Our goal was first to test a rope specially-designed for us by Anacko Cordage, based on specifications for a high durability. *MarineFisheries*, AOLA, and Tension Technology contracted Anacko Cordage Company of Narragansett, Rhode Island to build a rope that would meet TTI's design specifications for durability. We were looking to build an "ideal" rope that would have sufficient strength, be resistant to the ingress of sediment, and resistant to external and internal abrasion. Next we planned to conduct basic runs on the machine without sediment in the tank, in order to

evaluate the role of sediment in rope damage.

Before beginning, we made repairs to the machine and adjusted certain components to ensure they weren't causing phantom wear on the ropes. We had the tensioning helix device, which simulates the weight of the traps, lined with polyurethane to eliminate wear-and-tear from that source. The old version was constructed only of steel that had grooves worn into it from the ropes. We also added a load cell to the splitter (the knife-like device that removes the rope from between the sheaves) in order to measure the force exerted on the rope by that component. This will help shed light on the role of the splitter in causing rope damage.

Unfortunately, Anacko was unable to make the rope exactly to our specifications, due to constraints in their rope-making machinery. Tension Technology had recommended the following construction:

- Combination of polyester (sinking) and polypropylene (floating) fibers
- Use high tenacity (i.e. strength) polyester
- Polyester coated in marine finish to improve resistance to internal and external damage
- Three strand laid construction with rope angle within 30 to 40 degrees
- Strand construction with polyester wrapped fully around polypropylene
- No polypropylene should be visible through the polyester outer wrapping

While Anacko did match most of the specifications, they were unable to meet all the requirements of rope construction and fiber placement. The Anacko machinery could not produce a rope with polyester fully covering the outside of each strand. The outside of each strand was a blend of polyester and polypropylene. The purpose of the recommended construction was to limit the ingress of sediment into the rope and encourage sediment to fall off the surface of the rope during hauling. Polyester fibers are much finer than polypropylene and can form a tighter outer layer. In addition, the polyester fibers were the coated in the protective marine finish, so the outer coverage of those fibers on the rope is important for abrasion-resistance.

The runs with the specially-designed Anacko rope did not yield very positive results. The rope did not perform well under the rigors of the machine-testing, often parting before the end of a full cycle. Visually the rope also appeared to suffer a great deal of abrasion. These overall results could be related to the fact that the rope construction did not meet all of the design requirements; however it is difficult to determine the exact cause of the poor performance. It should also be noted that TTI developed these "ideal" rope specifications in the summer 2006, prior to conducting the analysis of the field-tested ropes in January 2007. It was during that analysis that they found that ropes with polyester and polypropylene blended in the outer surface, like the Anacko made for us, performed well.

Before proceeding with the "no sediment" tests, we made an additional audit of the machine. With the help of Dick Allen, our machine consultant and a former offshore lobsterman, we made seemingly minor changes in the adjustment of the hauler components, intended to bring the testing conditions closer to the hauler configuration used by the fleet. These changes involved small adjustments to the relationship of the hauling sheaves to the rope. However, once we

began running ropes again, we found that these changes were not so minor. The machine was now damaging the ropes to a degree never seen before - though all we did was make the sheaves more closely match the profile used in the field. While individual hauling systems and their adjustment vary among the boats in the fleet, our results indicate that some meaningful portion of rope wear may come from the hauling system.

In all of our previous groundline investigations, including the Anacko project, we were approaching the problem of groundline durability from the perspective of the rope. The idea that some perfect combination of design principles was the key to solving the problem. Not to say that these factors don't play a role in rope durability. The quality and construction of a rope has a tremendous impact on its strength, longevity, and resistance to wear. But the rope itself isn't the only cause of rope degradation.

Around the time we made the adjustments to the hauling system, we also received the results from TTI's visual and microscopic evaluation, which further confirmed what we were seeing on the machine. It became obvious that the potential existed to improve the serviceability of sinking groundlines through small changes in the hauling system. As mentioned, our research up until that point had focused on the rope itself as the main determinant of durability. In contrast, these recent investigations suggested that small changes to the hauling system may make substantial differences in rope longevity. Previous discussions with Tension Technology had shown that the components of the hauling system can cause both internal and external damage to ropes. Internal damage is caused by bending around the hauling block and fairlead sheave, and external damage is caused by abrasion over all the components of the hauling system (Tension Technology, 2006). The 2007 analysis of the field-tested ropes showed that this was likely happening.

Adjusting the Hauling System to Reduce Sinking Groundline Damage

Based on the results from our rope and machine investigations under the NFWF grant, *MarineFisheries* and AOLA applied for a grant from NOAA to evaluate how minor changes to lobster gear hauling equipment will affect the service life of sinking groundline. We received this grant in October 2007.

Our goal was to investigate how the following factors affected rope wear:

1. The angle between the hauler sheaves
2. The depth at which the rope rides in the hauler
3. The shape of the knife or splitter
4. The profile of the working surface of the hauler sheaves
5. The material from which the sheaves and knife are made

The results of our study have the potential to make significant improvements in rope longevity through minor changes in the design of the hauling system. The hydraulic hauling system has

not changed significantly since its introduction in the 1960s. The hauling system has never been subjected to any rigorous testing to determine the optimum adjustment of hauler components to minimize rope wear or the effects of changes to the hauler. Unless the rope wear caused by the hauler is extreme, it could easily go unnoticed or be attributed to other causes, such as sediment abrasion or chafing. A systematic testing program is necessary to determine how, where and why rope wear occurs in the hauling system and how it can be reduced.

The results from this study can be found at the *MarineFisheries* website: HYPERLINK "http://www.mass.gov/dfwele/dmf/programsandprojects/ritwhale.htm" \l "right" http://www.mass.gov/dfwele/dmf/programsandprojects/ritwhale.htm#right

Testing of Polyurethane Sheave in the Field

As reported, a significant portion of the wear seen in groundlines is the result of mechanical damage from the lobster trap hauling system. In order to pull a trawl of lobster traps off the seafloor and onto the boat, the buoylines and groundlines are run through a series of steel components that provide guidance and power. The rope is pulled under tension between two hauling sheaves, which rotate and draw the rope along. A hanging block provides vertical clearance for the trap to be swung on-board, while the fairlead sheave guides the rope into the hauling sheaves. The knife is wedged between the hauling sheaves to eject the rope from the rotating plates. The rope then drops to the deck of the boat. See diagram below for a representation of the hauling system.

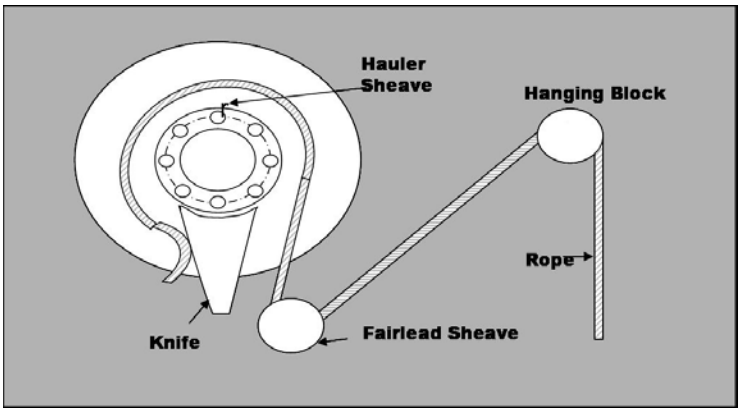

Figure 7. Schematic of lobster trap hauling system

All of these steel components cause both internal and external damage to ropes. Internal damage is caused by bending around the hauling block and fairlead sheave, and external damage is caused by abrasion over all the components of the hauling system (Tension Technology, 2006). External damage to ropes from the hauling system is caused by the hauling sheaves, knife, and pulleys. This damage is further worsened as the rope wears grooves into the steel, creating sharp edges that cut the rope fibers. Many industries coat their steel components with plastic polymers, such as polyurethane, to make the steel more durable. (Polyurethane is more abrasion-resistant than steel).

In 2006, *MarineFisheries*, AOLA, and Tension Technology began working with Corrosion

Control Resources in Texas to make polyurethane components for the hauling system. Corrosion Control made polyurethane hauling sheaves and polyurethane knives in various durometers (i.e. the hardness) for us, so we could evaluate the damage caused to ropes in comparison to the standard steel components. In 2007 we received funding from NFWF to test these materials on hauling equipment in the inshore and offshore lobster fishery. First, we ordered polyurethane sheaves and knives from Corrosion Control to be tested on the simulator. We would test for general operability of these materials and also determine the proper hardness or durometer for the materials, before ordering more sheaves for the field-testing component. We partnered with the International Fund for Animal Welfare (IFAW) on this project – they provided matching funds to purchase the final sets of sheaves for the inshore field-testing portion.

Figure 8. Polyurethane sheave liner and polyurethane knife made by Corrosion Control Resources.

The development and testing of the sheaves required quite a bit of trial and error before we found a sheave design that was suitable. It proved difficult to find a material that was hard enough to withstand the rigors of the hauling process. During summer 2008, we also did preliminary field-tests of polyurethane sheaves for the inshore pot fishery. The sheaves performed well and by September 2008 we had ordered 4 sets of polyurethane sheaves to test in the inshore fishery. Due to unexpected extra costs incurred during research and development, we were unable to order as many sheaves as we had planned. In addition, we are working to find a polyurethane material that is hard enough to use in the offshore lobster fishery. All test versions to this point have proven unsuitable.

The inshore polyurethane sheaves have been distributed to participating fishermen for field-testing; however, it will take some time for results to be received. We will report to NFWF in the near future on the final results from this project.

Inshore Groundline Durability in Rocky Habitat

In certain areas of Massachusetts waters, lobstermen have fished with sinking groundline for many years. In the Boston Harbor area, sinking groundline is traditionally used in their 20-25 pot trawls, due to space constraints. And Cape Cod Bay fishermen have been required to use sinking groundline seasonally since 1997 and year-round since 2003. However, in other areas

such as the North Shore and Buzzards Bay, floating groundline is the rope of choice. When the year-round ban on floating groundline went into effect state-wide in January 2007, there was some resistance to this rule from fishermen in these areas, particularly the rocky habitats off the North Shore. They claimed that the rope would wear out too fast and get hung-down on the rocks.

To address some of their concerns with the shortened service life of sinking groundline, we initiated a project in summer 2007 to test the performance of various brands of groundline in these rocky areas. We partnered with a group of lobstermen who have had a fair amount of success fishing sinking groundline in these habitats, but have had issues with the longevity of the lines. In July 2007 we distributed 5 brands of groundline to 5 different North Shore lobstermen – enough for one trawl for each brand. Currently the fishermen report that much of the rope is still being fished and performing well, plus the samples have helped the fishermen in making future groundline purchase decisions.

Outreach to fishing industry on the results of groundline investigations

Since the start of our groundline investigations in 2003, *MarineFisheries* and AOLA have learned a tremendous amount about the factors affecting the service life of rope. The ultimate goal of our work is to distribute this information to fishermen in order to guide them in purchasing durable and cost-effective whale-friendly rope. We have presented our results to date to the Maine Fishermen's Forum, the Massachusetts Lobstermen's Association, the Large Whale Take Reduction Team, the Right Whale Consortium, and published it in various newsletters. However, as we learn more about the hauling system and continue our investigations, we realize the need for interactive, multi-media links to fishermen. It is our plan to produce pamphlets and videos that demonstrate to fishermen how rope construction, rope materials, and changes to the hauling system can increase the service life of their sinking groundline.

REDUCING LARGE WHALE ENTANGLEMENTS IN FISHING GEAR

Fixed-gear regulations in Massachusetts state waters

The Commonwealth continues to establish regulations for fixed-gear fisheries in state waters to reduce the risk of entanglement of protected species. To date, the majority of our protected species regulations pertained to endangered large whales, however, we have recently expanded our focus to include other species such as sea turtles and harbor porpoise.

In 2007, *MarineFisheries* broadened the use of non-buoyant groundlines in the fixed gear fishery throughout state waters. Effective January 1, 2007, it became unlawful for any person to fish, store, or abandon any fixed gear in waters under jurisdiction of the Commonwealth with buoyant

(floating) groundline. *MarineFisheries* is also in the process of amending our state regulations to mirror new rules put forth by NMFS under the Atlantic Large Whale Take Reduction Team. These federal rules, which extend into state waters, went into effect in October 2008 and require vertical line modifications, including universal weak links and color-coded markers on all buoylines. The purpose of mirroring the laws in the state Code of Regulations is to give the Massachusetts Environmental Police the ability to enforce these rules and pursue cases against offenders.

In addition, *MarineFisheries* is in the process of mirroring federal rules regarding the gillnet fishery and harbor porpoise incidental takes. These rules, which cover Massachusetts state waters in some areas, were promulgated under the Harbor Porpoise Take Reduction Team and regulate the use of acoustic deterrent devices and closed areas to reduce takes. Mirroring the rules allows the Commonwealth to take a stronger role in enforcement and outreach.

More details on Massachusetts protected species regulations can be found within the Code of Massachusetts Regulations (322 CMR 12:00).
http://www.mass.gov/dfwele/dmf/commercialfishing/cmr.htm

Sinking Groundline Compliance Study (NFWF grant # 2005-0326-004)

** This project was initially reported on in our 2006 Annual Report*

MarineFisheries initiated a pilot study in spring 2007 to use sonar to evaluate compliance with the floating groundline ban which took effect on January 1, 2007. This study was meant to assist the Massachusetts Environmental Police in enforcing whale-safe gear regulations. Single-beam sonar is used in standard fish-finders and depth-sounders on most small vessels. Fishermen have also used it to visualize the acoustic signal of their floating groundline underwater, in the event that a trawl is lost. Enforcement officers also have single-beam sonar on their patrol vessels, making it possible for them to use the same tool to locate floating groundline in Massachusetts and enforce the ban on its use.

MarineFisheries designed a controlled field experiment to examine the acoustic signal produced by sinking and floating groundline, using both single-beam and multi-beam sonar. Trawls equipped with sinking and floating groundline were viewed with both sonar types to compare the effectiveness of each tool. We were particularly interested in how well the single-beam sonar could detect floating groundline in the water column, since these units are readily available, easy to use, and found on most vessels. Using multi-beam sonar for enforcement is not very practical, but we were curious to see how it would perform in comparison to the single-beam.
After approximately 3 hours of viewing both trawls with the two types of sonar, it was clear that the single-beam sonar was more than capable of visualizing floating groundline in the water column. A strong visual of the floating line was observed as the acoustic pings scrolled across the display screen. See the figure below.

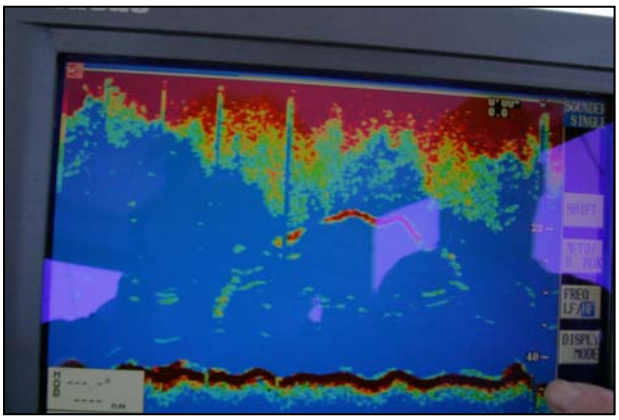

Figure 9. Single-beam sonar image of floating groundline at slack tide.

The multi-beam sonar could work for this same purpose; however, it is an impractical real-time enforcement tool due to the complexity of the system, the potential technical difficulties associated with its operation, the high cost of the equipment, and technical expertise required. Another confounding factor was that fact that *MarineFisheries* did not have the real-time software necessary to process the water column data into a ping history. Without the ping history, the signature of the line was indistinguishable from other targets in the water column. In contrast, single-beam sonar was easy to use, and it did an excellent job of visualizing the groundlines and traps. We were even able to tell the difference between the height of the floating groundline at slack and running tides. However, using single-beam sonar to identify floating groundline is not without constraints. Vessel operators must understand the orientation of the gear, the currents, and the swath limitations of the transducer.

After successfully completing our controlled test trial, *MarineFisheries* arranged for further field testing on commercial fishing gear while on patrol with the Massachusetts Environmental Police. In summer 2007, we conducted 5 compliance trips, using the single-beam sonar aboard the patrol vessels to search for floating groundline. One of our goals was to target areas where fishermen's resistance to the sinking groundline rule might be high, such as the North Shore, an area where floating groundline is traditionally used. In contrast, sinking groundline was traditionally used in the Boston Harbor area, due to space constraints, despite never being mandated before.

Our first trip to survey the Gloucester area using sonar proved very successful. We observed the sonar over a variety of trawls, getting accustomed to how the traps and bottom type looked on the screen, as well as searching for the signal of floating groundline in the water column. After a couple hours of not seeing much except traps and marine growth on the hard bottom, we came across some non-compliant gear.

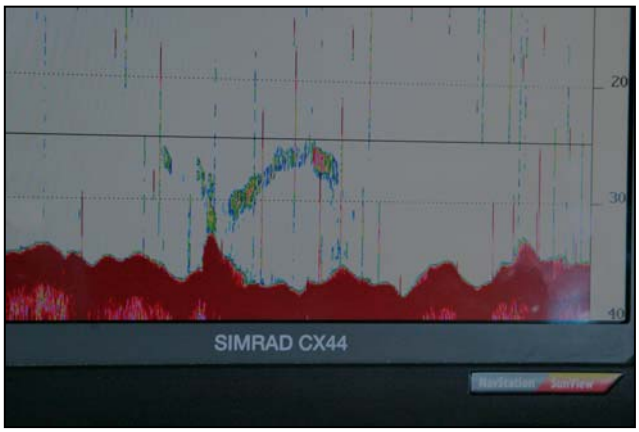

Figure 10. Non-compliant (floating) groundline seen with single-beam sonar on Massachusetts Environmental Police patrol vessel.

The acoustic signal of floating groundline was unmistakable. The Environmental Police patrol vessels are not equipped with a hauler, so in order to physically confirm what we saw; we hauled up the first couple traps by hand. We found that the groundline was indeed composed of floating rope. In bringing the boat around for another pass over the gear, the sonar visualized another person's trawl nearby that also showed floating groundline. Both of these individuals had multiple trawls in the area. We documented the location, their permit numbers and buoy colors, and came back on another day in a vessel equipped with a hauler to retrieve the gear. The other 4 sonar patrols conducted in summer 2007 occurred off Scituate, Boston, New Bedford, and Gloucester again. We did not find any other groundline violations.

Our study found that the use of sonar to detect floating groundline is a viable enforcement tool, including low-tech sonar like single-beam. The use of more advanced types of sonar, such as multi-beam or side-scan, would likely expand the range and capabilities of this tool. User groups familiar with the use of these more advanced sonar types could evaluate compliance on a broader scale and in deeper water.

Cape Cod Bay Ghost Gear Removal Program

Ghost gear removal efforts in Cape Cod Bay Critical Habitat date back to 2000 when *MarineFisheries* teamed up with the International Fund for Animal Welfare (IFAW), Massachusetts Lobstermen's Association, and the Massachusetts Environmental Police to clear the bay of abandoned and non-compliant lobster gear. These efforts took place during the winter months when right whales are present. Cape Cod Bay is relatively gear-free during winter and spring, when the total number of lobster pots drops to a few thousand, in contrast to the 80,000 traps present in the summer months. "Ghost gear" is untended or lost fishing gear that continues to fish. Passive gears such as gillnets and lobster traps will capture fish and crustaceans as long as the gear remains intact. Ghost gear can entangle whales, and many fishermen fear closures or additional restrictions if a whale ever suffered serious injury or mortality in lost or abandoned gear. Gillnets and single lobster pots are prohibited from in Cape Cod Bay Critical Habitat from January 1 – May 15, but lobster pot trawls are allowed, so long as the buoy lines are rigged with a 500-lb (or weaker) breakaway, sinking groundline is used between pots, and twin-orange markers are placed on buoys.

MarineFisheries received funding for ghost gear removal in the interim years from the National Fish and Wildlife Foundation and in 2007 we received a grant from NOAA's Marine Debris Program. (The final report on the 2007 ghost gear removal efforts can be found at http://www.mass.gov/dfwele/dmf/programsandprojects/ritwhale.htm#right

Figure 11. Environmental Police hauling ghost gear in 2007. Notice the marine growth on the buoyline.

Massachusetts Lobster Labeling and Marketing Program

Massachusetts lobstermen have learned to co-exist with whales by adopting gear modifications that reduce the risk of entanglement. The cost of these conservation efforts to the lobster industry has been significant. Along with dramatic increases in costs for fuel and bait, whale-safe lines are another factor that is making commercial lobster fishing more economically challenging in the current economic climate. Massachusetts is the first and only state to require sinking groundline year-round in all state waters. The use of sinking groundline removes that line from the water column and reduces the risk of entanglement for large whales, including the North Atlantic right whale.

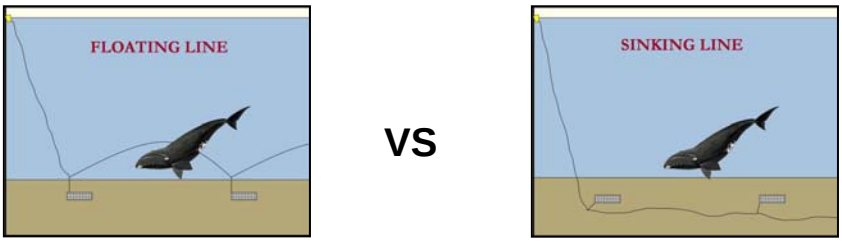

Figure 12. Diagrams of floating and sinking groundline

At the urging of conservation groups and some consumers, we developed a promotional campaign to highlight the accomplishments and ongoing conservation burden born by Massachusetts lobstermen. In July 2008, a new lobster promotion campaign was introduced to

educate consumers about what Massachusetts lobstermen are doing to protect endangered whales. The Division of Marine Fisheries has partnered with the Massachusetts Lobstermen's Association, the Whale and Dolphin Conservation Society, and The Ocean Conservancy on a campaign called "*Massachusetts Lobster Fishing – The Right Way*." This marketing campaign uses labeled lobster bands and informational materials to promote lobsters caught by Massachusetts lobstermen using gear that reduces the risk of whale entanglements. Buying local lobsters helps support Massachusetts lobstermen who are putting a significant financial investment into whale protection at a time of rising bait and fuel costs.

A key component of the program is signature green lobster bands, which feature the word "Massachusetts" and a whale's tail to identify lobster caught using our unique gear modifications.

Figure 13. Labeled lobster bands

Massachusetts is the first and only state to require sinking groundline year-round in all state waters. The use of sinking groundline removes those arcs of line from the water column and reduces the risk of entanglement for large whales, including the North Atlantic right whale. In addition, Massachusetts lobstermen have other rules to protect whales, including break-away links on all buoylines and seasonal gear restrictions in Cape Cod Bay Critical Habitat. The program partners also distributed colorful brochures to fish markets, restaurants, seafood dealers, and whale watch boats describing the program.

The lobster promotion campaign even caught the eye of world-renowned chef (and Massachusetts native) Emeril Lagasse. His show, *Emeril Green*, on the Discovery Channel's Planet Green television network features sustainable, local, and organic foods. Massachusetts was highlighted in an episode because of the more sustainable approach to lobster fishing used in the state. Massachusetts lobsterman, Dave Casoni, was featured in the episode alongside host Emeril Lagasse to explore lobster recipes and explain how Massachusetts lobster is caught in ways that are safer for endangered whales. The episode aired November 4 at 8:00 p.m. "Being a part of this show was a great experience. It is important for people to know that there is a more sustainable choice when it comes to buying lobster, and this will help get out the word," said Casoni. "Along with our partners, we will continue to tell the story about Massachusetts lobster

and how buying local is the best choice for whales and for our local economy."

The goals of the program are as follows:

1. Raise public awareness about the efforts of Massachusetts lobstermen and fishery managers to protect endangered whales.
2. Provide the general public and tourists a thumbnail sketch about the lobster fishery and industry;
3. Provide an attractive marketing technique for local-caught seafood product to local consumers.
4. Enhance local consumer demand of locally caught lobsters during the months that MA-caught lobsters are readily available: July through November.
5. Promote the Massachusetts-caught American Lobster to conservation-minded consumers and servers (chefs).
6. Create a preferred brand "Massachusetts-caught American Lobster" that could compete favorably against lobsters from other jurisdictions, especially those without comparable conservation measures.

In 2009, the Massachusetts Lobster program will continue to highlight the efforts of Massachusetts lobstermen using media and outreach to consumers.

Support of the Atlantic Large Whale Disentanglement Network

MarineFisheries continues to support the efforts of the Disentanglement Network. Erin Burke, Protected Species Specialist, was trained in July 2007 as a Level 3 Disentanglement Network member. The training includes on-water disentanglement simulations using tools such as a flying grapple to attach telemetry and fixed knife buoys to cut lines. In addition, the Massachusetts Environmental Police (MEP) has offered to assist disentanglement efforts by providing on-the-water support to respond to reports of entangled whales and transport rescue team members. On March 21, 2007, the MEP, along with Erin Burke, assisted in disentanglement efforts in Cape Cod Bay on right whale #2029.

OUTREACH, PUBLIC EDUCATION, AND TRAINING

Throughout 2007 *MarineFisheries'* staff continued public education efforts regarding the Right Whale Conservation Program and other protected species issues by meeting with industry groups, fielding calls, and lecturing in public forums. Dan McKiernan (Deputy Director) and Erin Burke (Protected Species Specialist) attended various meetings and trade shows related to large whale and other protected species conservation and fishing interactions. Formal presentations were given at many of these meeting. In 2007, Erin Burke made public

presentations about the efforts of the Protected Species Program at the Massachusetts Lobstermen's Association Trade Show, the Right Whale Consortium annual meeting, and various other meeting related to rope work. Dan McKiernan serves as a member of the Atlantic Large Whale Take Reduction Team and the Atlantic Trawl Gear Take Reduction Team. Erin Burke serves as a member of the Harbor Porpoise Take Reduction Team. Details about outreach efforts can be found in Attachment C.

References

Jaquet et al. 2007. Surveillance, Monitoring and Management of North Atlantic Right Whales in Cape Cod Bay and Adjacent Waters in 2007. Final report submitted to the Division of Marine Fisheries, Commonwealth of Massachusetts, Boston, MA. November 2007.

Visual and Scanning Electron Microscopy Investigation and Tensile Testing to Estimate Residual Tensile Strength of a Selection of Lobster Lines. Tension Technology International, Weston, Massachusetts. June 2007.

List of Attachments

Attachment A	**Code of Massachusetts Regulations (322 CMR 12.00) -- fishing gear regulations related to right whales.**
Attachment B	**Advisories and notices posted by Commonwealth regarding right whales.**
Attachment C	**Outline of outreach efforts**

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ATTACHMENT A

Code of Massachusetts Regulations – fishing gear regulations related to right whales. State-wide prohibition on floating groundline included (section 12.03).

12.01 Purpose

The Division of Marine Fisheries works to protect marine protected species such as endangered turtles, harbor porpoise and large whales. The Division's efforts dovetail with federal regulation of marine mammals, including, the northern right whale is the rarest of the world's great whales. Despite international protection by the International Whaling Commission established pursuant to the 1946 International Convention for the Regulation of Whaling and national protection afforded by the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, the northern right whale is listed as endangered and its population remains dangerously low in the Atlantic.

In response to this threat the Massachusetts Legislature passed a Resolve in 1985 requesting the Department of Fisheries, Wildlife and Environmental Law Enforcement to study the right whale in Massachusetts waters and make recommendations for its conservation. That study recommended, among other measures, a 500 yard buffer zone between right whales and vessels within Massachusetts waters.

The purpose of 322 CMR 12.00 is to:

(1) implement a 500 yard buffer zone and, in addition, prohibit activities of vessels that affect large whales, including right whales within waters under the jurisdiction of the Commonwealth. 322 CMR 12.00 exempts vessels with federal or state Right Whale scientific study permits and commercial fishing vessels in the act of hauling back or towing gear. In addition, 322 CMR 12.00 applies to both commercial and recreational fishermen, but only to waters under the jurisdiction of the Commonwealth.

(2) minimize the risk of large whale entanglements, including right whales, in waters under the jurisdiction of the Commonwealth.

(3) reduce interactions between harbor porpoise and commercial gillnet gear in waters under the jurisdiction of the Commonwealth.

12.00 ▲

12.02 Definitions

For the purposes of 322 CMR 12.00:

(1) Bottom or Sink Gillnet means a gillnet, anchored or otherwise, that is designed to be, capable of being, or is fished on or near the bottom in the lower third of the water column.

(2) Buffer Zone means an area outward from a right whale a distance of 500 yards in all directions.

(3) Cape Cod Bay means the area that encompasses the state waters portion of the Cape Cod Bay Critical Habitat plus an additional area to the west of the Critical Habitat south of a line that runs east and west at 42 [degrees] 05' and that terminates at the Brant Rock shoreline in the town of Marshfield.

(4) Critical Habitat means those waters in Cape Cod Bay under the jurisdiction of the Commonwealth that fall within the federally designated Right Whale Cape Cod Bay Critical Habitat area listed in the federal Right Whale Recovery Plan and found in 322 CMR 12.11.

(5) Double means a two pot string with a single line attached.

(6) Fixed Fishing Gear means any bottom or sink gillnets or pots that are set on the ocean bottom or in the water column and are usually connected to lines that extend to the water's surface.

(7) Gillnet means anchored, or surface or drifting vertical walls of webbing, buoyed on top and weighted at the bottom, designed to capture fish by entanglement, gilling, or wedging.

(8) Groundlines means the lines connecting pots on a pot trawl and lines connecting gillnets to anchors.

(9) Harass means to approach, pursue, chase, follow, interfere with, observe, threaten, harm in any fashion, turn in any manner to intercept or attempt to engage in any such conduct.

(10) Negatively Buoyant Line means line that has a specific gravity equal to or greater than that of seawater, 1.03, and does not float up in the water column.

(11) Positively Buoyant Line means line that has a specific gravity less than that of seawater, 1.03, and floats up in the water column.

(12) Pot means any lobster or fish trap placed on the ocean bottom.

(13) Pot Trawls or Strings means single pots tied together in a series and buoyed at both ends.

(14) Right Whale means that species of marine mammal known as *Eubalaena (Balaena) glacialis*.

(15) Single Pots means individual pots buoyed at the surface.

(16) To Abandon means to leave fixed gear in the water without hauling it at least every 30 days or in prohibited areas during prohibited periods.

(17) To Fish means to use, set, maintain, leave in the water or haul gillnets or pots to harvest, catch, or take any species of fish or lobster.

(18) Vessel means any waterborn craft.

(19) Weak Link means a breakable section or device that will part when subjected to specified poundage of pull pressure and after parting, will result in a knot-less end, no thicker than the diameter of the line, the so-called "bitter end" to prevent lodging in whale baleen.

12.00 ▲

12.03 Prohibition on Certain Gear or Lines in Waters Under Jurisdiction of the Commonwealth.

(1) It shall be unlawful for any person to fish fixed fishing gear with:

(a) Lines floating at the water's surface;

(b) Positively buoyant groundline; and

(c) Buoy lines comprised of positively buoyant line except the bottom portion of the line which may be a section of floating line, not to exceed 1/3 of overall length of the buoy line.

(2) It shall be unlawful to abandon any fixed gear.

12.00 ▲

12.04 Seasonal Gillnet Closures & Gear Restrictions. The following closures complement federal regulations intended to minimize gear entanglements of right whales in the Critical Habitat and Cape Cod Bay as well as harbor porpoises in Massachusetts Bay and Cape Cod South during seasonal periods when right whales and harbor porpoises are most likely to be aggregated in these areas.

(1) Definitions.

Pinger means an acoustic deterrent device which, when immersed in water, broadcasts a 10 kHz (±2 kHz) sound at 132 dB (±4 dB) re 1 micropascal at 1 m, lasting 300 milliseconds (±15 milliseconds), and repeating every 4 seconds (±.2 seconds).

(2) Closures.

(a) Right Whale Critical Habitat and Cape Cod Bay. It is unlawful to fish, store, or abandon gillnets in Critical Habitat and in waters of Cape Cod Bay west of the Critical Habitat south of 42 [degrees] during the period January 1 through May 15. 322 CMR 12.04 may be amended in a future rulemaking, with notice and opportunity for public comment, if gillnet specifications are developed and demonstrated that will minimize risk of entanglement to right whales

(b) Massachusetts Bay Harbor Porpoise Closure. It is unlawful to use, set, maintain, or fish with bottom or sink gillnets during the period March 1 through March 31, inclusive, in waters under the jurisdiction of the Commonwealth encompassed by an imaginary line beginning at the intersection of the 42 [degrees] 30'N parallel of

latitude with the shoreline of Marblehead; thence in an easterly direction following the 42 [degrees] 30'N parallel of latitude to a point where it intersects the territorial seas line; thence in a southerly and then easterly direction following the territorial seas line to its intersection with an imaginary straight line extending from 42 [degrees] 04.8'N/70 [degrees] 10'W to 42 [degrees] 12'N/70 [degrees] 15'W; thence in a southeasterly direction following said line to the shore in Provincetown; thence in a westerly direction along the shore of Cape Cod Bay and Massachusetts Bay to the starting point.

(c) South of Cape Cod Harbor Porpoise Closure. It is unlawful to use, set, maintain, or fish with bottom or sink gillnets during the period March 1 through March 31, inclusive, in waters under the jurisdiction of the Commonwealth west of the 70 [degrees] 30'W longitude line and south of a line drawn westerly from the intersection of the 70 [degrees] 30'W longitude line with the Mashpee shoreline.

(3) Pinger Requirements.

(a) Attachment. An operating and functional pinger must be attached at the end of each string of gillnets and at the bridle of every net within a string of nets.

(b) Areas & Times When Required. It is unlawful for any fisherman to fish sink gillnets as defined in 322 CMR 4.14 without pingers attached as specified in 322 CMR 12.12 during the following times and in waters under jurisdiction of the Commonwealth within the following areas:

i. September 15 through May 31 in Upper Massachusetts Bay and Ipswich Bay from Marblehead to the New Hampshire Border within the waters under the jurisdiction of the Commonwealth north of the 42 [degrees] 30' line to the Massachusetts/New Hampshire border.

ii. From December 1 through February and April 1 through May 31 in the Massachusetts Bay Area, an area bounded by straight lines connecting the following points in the order stated:

Point	N. Latitude	W. Longitude
MB1	42 degrees 30'	Massachusetts Shoreline
MB2	42 degrees 30'	70 degrees 30'
MB3	42 degrees 12'	70 degrees 30'
MB4	42 degrees 12'	70 degrees 00'
MB5	Cape Cod Shoreline	70 degrees 00'
MB6	42 degrees 00'	Cape Cod Shoreline
MB7	42 degrees 00'	Massachusetts Shoreline

iii. From December 1 through February and April 1 through May 31 in the Cape Cod South Area, an area bounded by straight lines connecting the following points in the order stated:

Point	N. Latitude	W. Longitude
CCS1	Rhode Island Shoreline	71 degrees 45'
CCS2	40 degrees 40'	71 degrees 45'
CCS3	40 degrees 40'	70 degrees 30'
CCS4	Massachusetts Shoreline	70 degrees 30'

(c) Exceptions

i. Pinger requirements as specified in 322 CMR 12.12. do not apply to non-anchored surface gillnets as defined in 322 CMR 4.14

12.00 ▲

12.05 Fixed Gear Seasonal Gear Restrictions

(1) Single Pots and Pot Trawls in **Right Whale** Critical Habitat. To minimize the number of vertical buoy lines during the period January 1 through May 15, in theCritical Habitat, fishermen may fish them in either multiple pot trawls of four pots or more with vertical buoy lines on each end or may set doubles. It is unlawful to fish, store, or abandon:

(a) single pots, or

(b) a trawl with less than four pots with vertical lines on the first and last pot of the trawl.

(c) a trawl with four or more pots having other than a single vertical line attached to the first and last pot of the trawl.

(d) a double with more than one vertical buoy line.

(2) Modifications. The Director may amend by emergency authority the gear time and area restrictions in response to changes in right whale migrations and distributions. The Director may suspend the fixed gear rules if whales depart the Bay early in the season. If at least three full surveys of Cape Cod Bay are successfully completed after April 1 yielding no right whale sightings, and if corroborating evidence supports whales' departure from the Critical Habitat, the Director may suspend the fixed gear restrictions beginning on April 21 or thereafter.

(3) Experimental Fishery Permits for Gear Testing. The Director may issue experimental fishery permits to authorize a person to fish fixed gear that does not conform with the specifications set in 322 CMR 12.00 for the purposes of developing and testing new gear designs to minimize risk of right whale entanglement inCritical Habitat.

12.00 ▲

12.06 Year-round Gear Restrictions

(1) Gillnets. It is unlawful to fish any gillnet in any waters under the jurisdiction of the Commonwealth unless the net is rigged with the following breakaway features:

(a) Knot-less weak link at the buoy with a breaking strength of 600 lbs.

(b) Weak links with a breaking strength of up to 1,100 lbs. are installed in the float rope between net panels.

(c) Anchoring system for the gillnets must anchors with the holding power of at least 22 pound Danforth anchor.

(2) Trap/Pot Gear. It is unlawful to fish any traps or pots in any waters under the jurisdiction of the Commonwealth unless all buoy lines are equipped with a Weak Link that will part when subjected to 600-lbs. or less of pull pressure along the buoy line.

(3) Exceptions.

(a) During January 1 through May 15, all buoy lines attached to traps or pots fished in the Right Whale Critical Habitat shall be equipped with a Weak Buoy Link that will part when subjected to 500-lbs. or less of pull pressure along the buoy line.

(b) Weak link requirements shall not apply to buoy lines attached to non-commercial lobstser traps or pots until January 1, 2010.

(4) A list of DMF approved weak links is available from DMF and furnished to fishermen upon request.

12.00 ▲

12.07 Buffer Zone

Except as otherwise provided for in 322 CMR 12.09, it is unlawful:

(1) for any vessel to enter a right whale buffer zone,

(2) for any vessel to approach or intercept a right whale within a buffer zone;

(3) for any vessel not to depart immediately from a buffer zone, or;

(4) for any commercial fishing vessel which has completed a haul back, a tow of its gear or otherwise completed its fishing operation and is no longer at anchor not to depart immediately from a buffer zone;

12.00 ▲

12.08 Harassment and Harm

It is unlawful for any vessel to harass or to harm any right whale at any time or place.

12.00 ▲

12.09 Entanglement Reporting

It is unlawful for any commercial or recreational vessel to fail to

report the entanglement of a right whale in its gear or lines.

12.00 ▲

12.10 Exceptions

(1) Federal Permit. Any person issued a permit from any federal department, agency or instrumentality having authority to issue permits for the scientific research, observation, or management of the right whale, may conduct the activity authorized by such permit.

(2) State Permit. Any person issued a permit in accordance with 322 CMR 7.01(4)(d) for the scientific research, observation, or management of the right whale may conduct the activity authorized by such permit.

(3) Commercial Fishing. Commercial fishing vessels in the act of hauling back, towing gear or engaged in fishing operations within a buffer zone created by the surfacing of a right whale, may complete the haul, tow or fishing operation provided it does so with a minimum of disruption to the right whale, hauls, tows or conducts it fishing operation in a direction away from the right whale, and departs form the buffer zone immediately after the haul, tow or fishing operation. In no event may 322 CMR 12.09(3) be construed to authorize a commercial fishing vessel to begin to haul, tow or conduct its fishing operation in or into a buffer zone.

(4) Disentanglement.

(a) To assist federally approved disentanglement efforts for whales, any vessel that reports to the National Marine Fisheries Service, the Division of Environmental Law Enforcement, the Coast Guard, or to designees of those agencies, that it has sighted an entagled whale may operate in the buffer zone to assist those agencies in locating and tracking the whale if requested to do so by those agencies.

(b) Any vessel operating in the buffer zone under 322 CMR 12.06(4) shall:

1. operate so as to minimize disruption to the right whale, and

2. immediately depart the buffer zone once the dientanglement effort begins, or when requested to do so by the agencies or their designees.

(c) When conducting activities within the scope of 322 CMR 12.06(4), vessels shall make every effort to comply with 322 CMR 12.00.

Attachment B

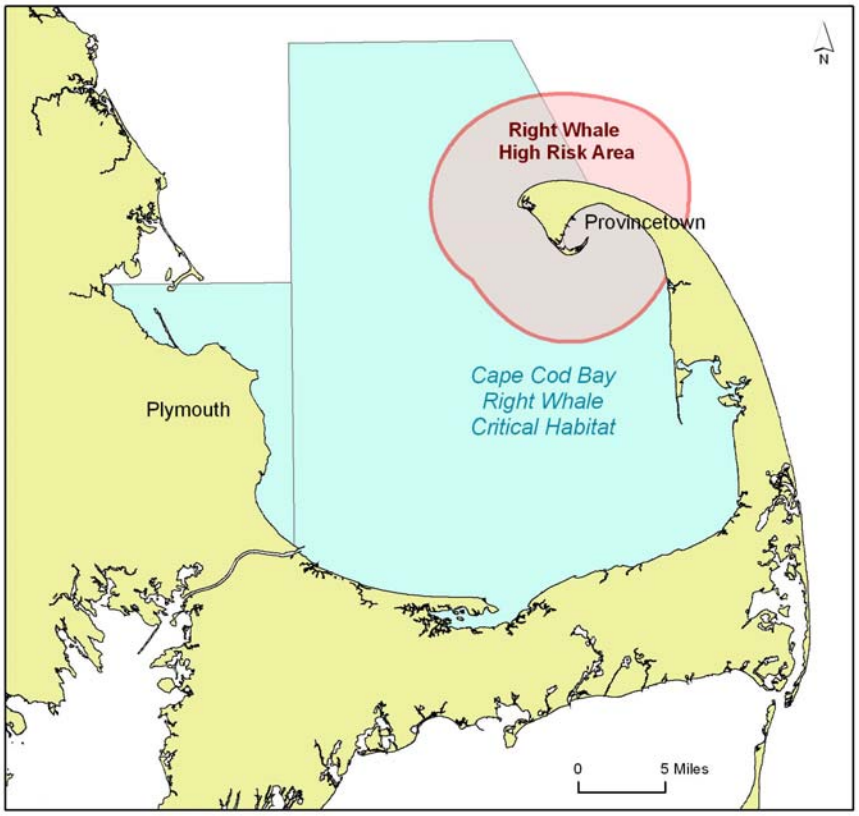
ADVISORIES AND NOTICES POSTED BY THE COMMONWEALTH
REGARDING RIGHT WHALES.

ADVISORY TO MARINERS

AGGREGATION OF RIGHT WHALES FROM LONG POINT TO HIGHLAND LIGHT

An aggregation of right whales off Provincetown has prompted the Division of Marine Fisheries (*MarineFisheries*) to issue an advisory to all vessel operators. Operators are advised to reduce speed (10 knots), post lookouts, and proceed with caution to avoid colliding with this highly endangered whale. The DMF/CCS aerial survey team has reported an aggregation of 20 right whales sub-surface feeding around the tip of Cape Cod. The habitat sampling team confirmed that plankton patches in this area are stable and extensive. The plankton resources in this region are high enough to support right whale feeding, aggregation, and residency. The zooplankton resource will be analyzed again in the next few days, and we will re-evaluate the level of risk. When right whales depart the area, the advisory will be lifted.

Vessels are prohibited by state and federal law from approaching within 500 yards of a right whale. Massachusetts Environmental Police and U.S. Coast Guard are authorized to enforce the 500- yard rule. Fishermen are reminded that the approach rule also prohibits them from starting fishing operations (setting or hauling gear) within 500 yards of a right whale.



Whales that are surface feeding on dense blooms of plankton (copepods) are at great risk for vessel strike. More vessel traffic is expected in this area over the next few weeks with seasonal increases in recreational and commercial fishing, as well as whale watching, and passenger ship activity. Right whales are the most endangered large whale in the North Atlantic, with a population of approximately 350 animals. Ship strikes are a major cause of human-induced mortality for right whales. On March 12, 2007, the CCS aerial surveillance team spotted a juvenile right whale off Provincetown with deep propeller wounds. It is unknown where this vessel interaction took place, but based on the condition of the wound, the injury likely occurred only weeks prior to the sighting. This sighting highlights the risk posed to right whales by vessel traffic.

Management of maritime activities near right whales is part of the *MarineFisheries* Right Whale Conservation Program. The Right Whale Conservation Program is a cooperative effort between *MarineFisheries* and the Provincetown Center for Coastal Studies (CCS) to study and protect right whales in Cape Cod Bay.

Real-time monitoring of right whales through vessel and aerial–based surveillance, and forecasting of right whale presence through habitat analysis, makes the Massachusetts Right Whale Conservation Program the most comprehensive of any program throughout the species' range. The presence of whales is also being monitored by *MarineFisheries* and Cornell University researchers through real-time acoustic listening stations. Since 2003, *MarineFisheries* has collaborated with Cornell University and Woods Hole Oceanographic Institute (WHOI) to build the world's first real-time acoustic monitoring system for right whales in Cape Cod Bay**.** Right whale "call" are detected by the buoys and communicated back to Cornell and shared with researchers, vessel operators, and fishery managers. Support for the Conservation Program is granted from NOAA Fisheries and the National Fish & Wildlife Foundation.

The National Marine Fisheries Service (NOAA Fisheries) issues warnings to mariners via the Northern Right Whale Sighting Advisory System (SAS). Participating agencies in the SAS include *MarineFisheries* and the Massachusetts Environmental Police, the U.S. Coast Guard, the U.S. Army Corps of Engineers (ACOE), CCS, and other research groups. Advisories can be viewed at the NOAA Fisheries Northeast Region web site (www.nero.noaa.gov/ro/doc/whale.htm) and are broadcast over NOAA weather radio (http:// 205.156.54.206/nwr/).

For more information, visit the *MarineFisheries* website at www.mass.gov/marinefisheries or contact Erin Burke (□ HYPERLINK "mailto:Erin.Burke@state.ma.us" □Erin.Burke@state.ma.us□, 978 551-0152) or Dan McKiernan (□ HYPERLINK "mailto:dan.mckiernan@state.ma.us" □dan.mckiernan@state.ma.us□, 617 626-1536). Center for Coastal Studies (www.coastal studies.org) right whale researchers Dr. Charles (Stormy) Mayo and Dr. Nathalie Jaquet can be reached at (508) 487-3623.

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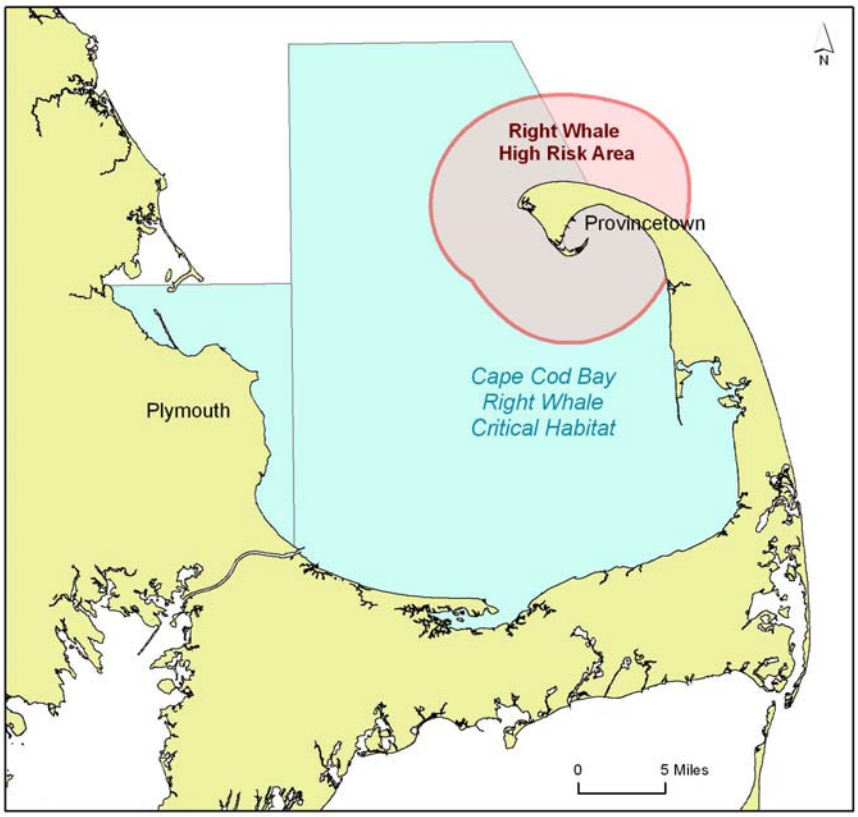
UPDATED ADVISORY TO MARINERS

AGGREGATION OF RIGHT WHALES FROM LONG POINT TO HIGHLAND LIGHT

An aggregation of right whales off Provincetown has prompted the Division of Marine Fisheries (*MarineFisheries*) to re-issue an advisory to all vessel operators. Operators are advised to reduce speed (10 knots), post lookouts, and proceed with caution to avoid colliding with this highly endangered whale. On April 25, *MarineFisheries* issued an initial advisory for this area. The DMF/CCS aerial survey team reported an aggregation of 20 right whales surface feeding around the tip of Cape Cod. The habitat sampling team confirmed that plankton patches in this area are stable and extensive. Survey efforts conducted on May 5 established that right whales are still present and feeding in this area. The plankton resources in this region are still high enough to support right whale feeding, aggregation, and residency. The zooplankton resource will be analyzed again in the next few days, and we will re-evaluate the level of risk. When right whales depart the area, the advisory will be lifted.

Vessels are prohibited by state and federal law from approaching within 500 yards of a right whale. Massachusetts Environmental Police and U.S. Coast Guard are authorized to enforce the 500- yard rule. Fishermen are reminded that the approach rule also prohibits them from starting fishing operations (setting or hauling gear) within 500 yards of a right whale.



Whales that are surface feeding on dense blooms of plankton (copepods) are at great risk for vessel strike.

More vessel traffic is expected in this area over the next few weeks with seasonal increases in recreational and commercial fishing, as well as whale watching, and passenger ship activity. Right whales are the most endangered large whale in the North Atlantic, with a population of approximately 350 animals. Ship strikes are a major cause of human-induced mortality for right whales. On March 12, 2007, the CCS aerial surveillance team spotted a juvenile right whale off Provincetown with deep propeller wounds. It is unknown where this vessel interaction took place, but based on the condition of the wound, the injury likely occurred only weeks prior to the sighting. This sighting highlights the risk posed to right whales by vessel traffic.

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For more information, visit the *MarineFisheries* website at www.mass.gov/marinefisheries or contact Erin Burke (□ HYPERLINK "mailto:Erin.Burke@state.ma.us" □Erin.Burke@state.ma.us□, 978 551-0152) or Dan McKiernan (□ HYPERLINK "mailto:dan.mckiernan@state.ma.us" □dan.mckiernan@state.ma.us□, 617 626-1536). Center for Coastal Studies (www.coastal studies.org) right whale researchers Dr. Charles (Stormy) Mayo and Dr. Nathalie Jaquet can be reached at (508) 487-3623.

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RIGHT WHALE AGGREGATION DEPARTS RACE POINT AREA

ADVISORY LIFTED

Recent survey efforts by the Center for Coastal Studies and the Division of Marine Fisheries have determined that the large aggregation of right whales observed off Provincetown and Truro have departed. No right whales were sighted from the aircraft or boat, and habitat monitoring revealed a decline in the zooplankton resource, suggesting that right whale aggregations are not likely to return in the near future. The zooplankton resource remains patchy, but it is possible that the occasional right whale will be seen feeding in the outer near-shore region for 3-5 days. Mariners should remain on the lookout for any lingering right whale activity.

With the departure of these animals the Commonwealth is lifting the April 25 and May 5th advisories to mariners in the Race Point area. *MarineFisheries* would like to thank fishermen, whale watch companies, and others for their assistance and compliance with measures designed to protect this highly endangered animal. *MarineFisheries* monitors the presence of right whales in Cape Cod Bay through aerial surveys, habitat sampling, and acoustic monitoring. Sightings observed through these efforts allow *MarineFisheries* to address threats to right whales on a real-time basis. We greatly appreciate the diligence and alertness of mariners and our surveillance team during the 2007 season.

The National Marine Fisheries Service (NOAA Fisheries) issues warnings to mariners and others through the Northern Right Whale Sighting Advisory System (SAS). Advisories regarding Cape Cod Bay and surrounding waters can be viewed at the NOAA Fisheries Northeast Region web site (http://www.nero.noaa.gov/ro/doc/whale.htm) and are broadcast over NOAA weather radio (http:// 205.156.54.206/nwr/).

For more information, visit the *MarineFisheries* website at HYPERLINK "http://www.mass.gov/marinefisheries" http://www.mass.gov/marinefisheries or the Center for Coastal Studies at www.coastalstudies.org.

ATTACHMENT C

2007 OUTREACH EFFORTS OF THE PROTECTED SPECIES PROGRAM

Date	Event	Location	Topic
Feb 2-4	Mass. Lobstermen's Assoc. Annual Meeting	Hyannis, MA	Booth and presented on DMF gear work
April 25-26	Atlantic Trawl Gear Take Reduction Team meeting	Baltimore, MD	Attended
May 11	New England Aquarium rope meeting	Boston, MA	Presented on rope work
June 20	Mass. Lobstermen's Assoc. delegate meeting	Quincy, MA	Presented on Mass Lobster campaign
July 27	Large Whale Disentanglement Training	Provincetown, MA	Trained at Level 3
Aug 1-31	New England Aquarium field station	Lubec, ME	Assisted in right whale research
Nov 1	Massachusetts Lobster campaign meeting	Boston, MA	Program pitch to NEAq
Nov 20	Massachusetts Lobster campaign meeting	Plymouth, MA	Program discussion with WDCS
Nov 7-8	Right Whale Consortium Meeting	New Bedford, MA	Presented on groundline compliance
Dec 17-19	Harbor Porpoise Take Reduction Team	Philadelphia, PA	Attended