National Fish and Wildlife Foundation
Final Programmatic Report

Project Name and Number: Large Whale Cooperative Management Plan IV (ME) (2006-0093-004) – DMR 2305

Recipient Organization/Agency: Maine Department of Marine Resources

Recipient Organization Web Address: http://www.maine.gov/dmr/index.htm

Date Submitted: 3/17/09

1) Summary of Accomplishments

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

A final low-profile groundline product (specific gravity of 1.02) was developed and field tested and is ready for implementation in the lobster fishery should it be allowed by the Atlantic Large Whale Take Reduction Team (ALWTRT) and NOAA Fisheries. A CTD/plankton survey was completed and samples fully analyzed. The results informed the implementation of a larger survey and will be written up and posted on DMR's website. A vertical line survey sampled 15% of the lobster fishery and produced baseline information on gear densities and configurations throughout the season that will be important to the large whale take reduction process. The disentanglement and sighting networks were maintained and expanded.

2) Project Activities & Results

If your grant agreement included an approved logic framework, paste the logic framework table here.

Activities

- Describe and quantify the primary activities conducted during this grant (refer back to your approved logic framework, if applicable).
- Briefly explain discrepancies between the activities conducted during the grant and the activities agreed upon in your grant agreement.

Low-profile groundline

- Three types of low-profile rope with varying specific gravities were purchased and field tested. Sixty coils of rope were distributed to fishermen along with reporting log sheets. Fishermen filled out log sheets and expressed their views on how the rope preformed as well as submitted a sample of used rope for strength testing. Six fishermen were chosen to field test rope using data depth loggers. These loggers were set on multiple sets of gear per fishermen and recorded the arc height of the line in the water column over at least a week. After finalizing the analysis from the first round of testing, the experimental line with a specific gravity of 1.02 was chosen as the final product due to its consistently low arc height (average height of 0.19m off the bottom with a maximum of 0.97m) and positive comments received from

fishermen on its performance. In order to increase the sample size, an additional 50 coils of this final product were purchased through another funding source. This rope was distributed and tested in the same way. Eight fishermen have field tested this rope with data loggers and the data is being analyzed now. Analysis will continue and a report will be made available to NOAA Fisheries, the ALWTRT and posted on the web. This product may still be a viable option for future risk reduction in exempted areas if needed.

- DMR used the data obtained from the testing above to come up with alternative proposals to the Final Rule (ban on floating groundlines). One proposal to use low-profile line close to shore was presented at the ALWTRT meeting in Baltimore in the spring of 2008. The team did not feel that the product had been adequately tested (which is why more testing occurred in late 2008/early 2009). Subsequently, a proposal to re-gain the use of floating groundlines in specific areas in exchange for a reduction in the number of endlines also failed at an ALWTRT sub-group meeting in July 2008.
- The continuation of the low-profile groundline project is a discrepancy from the proposal. It came to light at the ALWTRT meetings that more information was needed on the low-profile product to move forward with any proposals to the team. DMR sought and gained approval from NFWF to re-task money budgeted for experimental endlines and the purchase of a CTD to finishing the low-profile groundline project. The ALWTRT could not move on with endlines until the groundline issue had been resolved.

<u>CTD/plankton survey</u>

- DMR purchased plankton nets and supplies, contracted fishermen as vessel platforms and sampled 88 sites from Mid-coast to Downeast Maine. We used duplicate vertical plankton tows and a CTD cast at each site to characterize the zooplankton assemblage in near-shore waters and determine the depth of the bottom mixed layer. Plankton samples were analyzed by the University of New England and CTD casts were analyzed by DMR staff. A preliminary report was given to the ALWTRT in the spring of 2008. Those results showed an inshore/offshore difference in the species and size class of zooplankton found. Additionally, the bottom mixed layer was found to be deeper at the Downeast sites which also contained a higher concentration of late stage *Calanus finmarchicus*. Data will continue to be finalized and a final report will be put together by the program scientist and made available on the DMR website. The program scientist will also pursue presenting the data at a scientific meeting such as the Biennial Conference for the Society of Marine Mammalogy.
- Results from this preliminary survey were used to frame the protocols and sampling stations of a larger survey undertaken by DMR and the Gulf of Maine Research Institute in the summer of 2008. The results from both surveys will be used to craft a near-shore *Calanus* prediction model for right whale habitat determination.
- There is one discrepancy from the proposal in this project. We originally planned on sampling the same sites twice, once early and once late in the season. Due to the cost of chartering vessels we were unable to do that. We chose to sample once in August/September. This is historically when right whales tend to show up Downeast.

Vertical line survey

- A survey was mailed to 4500 randomly selected lobster license holders asking about the amount and configurations of gear that they fish seasonally in different areas. We received over 830 responses back, roughly 15% of the entire population of lobster fishermen. The survey responses were entered into a database and are currently in their final stages of analysis.
- Information gained from the survey includes how fishermen are rigging their traps (configurations such as singles, pairs, 4 trap trawls, etc.) in certain areas in different months throughout the year. This data was used to determine how many vertical lines that gear translates to in each area seasonally by extrapolating out to the entire population. Baseline information on where the gear is and how much of it there is will become vital in the next round of discussions through the ALWTRT since vertical line risk reduction is the next topic on the agenda. A report will be finalized in the spring of 2009 and disseminated to NOAA Fisheries, the ALWTRT and posted on the DMR website. Additionally, this data is being used as the baseline for other projects, including NOAA Fisheries' model to determine areas of risk to large whales due to vertical lines.
- This entire project is a discrepancy as it was not originally planned in the proposal. However, the need to obtain good baseline information on the amount of vertical lines in Maine's near-shore waters became apparent through the ALWTRT process. The work has proven to be very valuable to assessing not only the amount of gear in the water at any given time but also the risk of entanglement to large whales that might be associated with it.

Networks

- The sightings network was maintained by continuing to update the database with sightings, seeking out other sighting sources such as Allied Whale/Bar Harbor Whale Watch, and maintaining the near-real time interactive web map.
- The disentanglement network accomplished several training achievements, including sending two DMR staff and one Marine Patrol Officer to Provincetown Center for Coastal Studies for apprentice training, completing training for higher level and new Marine Patrol Officers and an introductory training for fishermen. Tool kits were inventoried and re-distributed. A new order has been placed for more disentanglement tools through another funding source.
- There are no discrepancies in these programs with what was proposed. We expected more reports of entanglements that we would have to respond to but that changes from year to year. Only one response was mounted in 2008 and the animal was not re-sighted.

Outreach

- Outreach continued throughout the project and included materials made available at the Maine Fishermen's Forum and attendance of industry meetings by a DMR staff to inform fishermen of progress on key issues as well as answer questions.

Results

- Describe and quantify progress towards achieving the project objectives or outcomes described in your grant agreement. (Quantify using indicators from your approved logic framework, if applicable, or by using new indicators not included in the application.)
- Briefly explain discrepancies between what actually happened compared to what was predicted to happen.
- Provide any further information (such as unexpected outcomes) important for understanding project activities and results.

- Two alternative proposals to the Final Rule were made to the ALWTRT, one involving the final low-profile product and the other the re-institution of floating groundline. While these proposals were not accepted we made headway in working as a team to compromise and educate each other on tough issues. It also raised the awareness of what we need more data on and how vital it is to fill in those gaps before we try and have the difficult discussions. This is where the discrepancies in how the grant was implemented in the end came from. Money was moved from experimental endlines and purchasing a CTD to finalizing a low-profile groundline. A vertical line survey was added to fill the gap regarding baseline data on the density and configurations of gear in Maine coastal waters.
- A low-profile product was finalized, rope with a specific gravity of 1.02. This product has now been extensively field tested and will be ready if needed to reduce risk in areas such as the current near-shore exemption area.
- The baseline amount of vertical lines seasonally for different areas was determined through the vertical line survey. This is an unexpected but extremely important outcome as it will frame discussions for how Maine can reduce the risk of entanglement to large whales due to vertical lines from this point forward.
- We completed the CTD/plankton survey and used the results to frame larger scale work through a different funding source. This data will continue to be worked up and presented.
- We have a current, trained and equipped disentanglement network to respond to entanglements.
- We have kept the industry engaged by participating in projects and being available at industry meetings.

3) Lessons Learned

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

One lesson that was learned that changed the focus of the grant was that you have to know your baseline information before you can propose to change it. We originally proposed to work with experimental endlines before we realized that we desperately needed some basic information about where and how much gear is fished in Maine. Now that we have that bigger picture in place it will be infinitely easier to discuss ways to mitigate the risk that those vertical lines are causing.

We learned that field testing gear in an active fishery takes a lot longer than you anticipate. Not only is the work weather dependant (chose months to work in that people can get their boats out) but we are also relying on fishermen who's first priority is their livelihood, not necessarily your research plan.

We also learned that to be successful and gain compliance with a complicated issue like gear regulations to protect endangered large whales you have to engage the industry. When the lobstermen feel invested and a part of the discussion and solution they are more likely to comply with the regulation set in place. This is due in part to the fact that they know the fishery and may be able to come up with alternatives that scientists and managers may not think of.

4) Dissemination

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

All results, proposals and reports are disseminated to NOAA Fisheries and the ALWTRT as well as posted on the DMR website. The survey and plankton results are being fed into other projects (determining whale/gear overlaps and near-shore right whale prey forecasting models) and will continue to be analyzed by the program scientist. Results may be presented at scientific meetings and potentially written up for publication in a peer-reviewed journal.

5) Project Documents

a) Include with your report 2-10 representative photos from the project. Photos need to have a minimum resolution of 300 dpi.
b) Include with your report publications, GIS data, brochures, videos, outreach tools, press releases, media coverage, and any project deliverables per the terms of your grant agreement.

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

Maine Whale Disentanglement Network

MAINE MARINE ANIMAL REPORTING HOTLINE: 1.800.532.9551

Whales can become entangled in fishing gear and other man-made material. While these events are rare, and often not immediately fatal, entanglements resulting in death can slow the recovery of endangered whale populations. The State of Maine whale disentanglement network provides 24 hours a day, 7 days a week response to reports of whale or other entanglements. Currently, the Department of Marine Resources is authorized to disentangle minke whales and sea turtles as well as establish joint industry stand-by assistance and support for fin, humpback and right whale entanglements.

Humpback fluking: Photo by Jeremy Winn

WHAT TO LOOK FOR, WHAT TO DO (AND NOT TO DO):

Immediately report entanglements by calling (800) 532-9551 or the Coast Guard on Channel 16

Humpback spyhopping: Photo by Cara Pakarcik

- Identifying an entanglement: Look for buoys and lines, moving or unusually clumped, near a whale.
- Determine type of whale. If it is a right whale, remain at 500 yards unless authorized to move closer.
- Please provide the following information:
  - Position
  - Species (or best description)
  - Behavior (is the whale surfacing in the same place or is it free swimming? is the tail visible?)
  - Description of the entanglement (is the gear entangled near the mouth, fluke, flipper?)
  - How to get in touch with you
- You may be requested to stand-by the whale (on a voluntary basis). If you are unable to stand-by, please report the last position of the whale and the direction in which it was swimming.
- A network vessel will be dispatched whenever possible in order to transport a team or assume stand-by responsibilities. Disentanglement operations are subject to manpower availability, weather and sea conditions and fisheries law enforcement commitments.
- **DO NOT** attempt to disentangle without authorization and instructions through the Network. Initial instincts to enter the water, cut some of the gear or haul the gear are dangerous and do not work. Large whales are powerful and unpredictable. Cutting lines close to the tail can make attempts to remove the remaining gear difficult.

Blow from a humpback. Humpback blows are bushy: Photo by Cara Pakarcik

The disentanglement network and related programs were established collaboratively with the commercial fishing industry and are partially funded by the Maine lobstermen. Some industry members have been trained to participate in disentanglement response. Participation by the industry is vital to the continued success of this network.

For more information, please contact Erin Summers at erin.l.summers@maine.gov or by calling (207) 633-9556. Please keep this information on your boat.

Maine Department of Marine Resources Large Whale Conservation Program 2007/2008 Report

April 21, 2008

Prepared by Erin Summers, Lorraine Morris

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Introduction

The Maine Department of Marine Resources (DMR), in collaboration with the Maine commercial fishing industries and the National Marine Fisheries Service (NMFS), initially developed a "Cooperative Management Plan for Large Whales and Sea Turtles in the State of Maine" in 2001 to reduce the risks posed by these fisheries to large whales and other protected resources. Since its origin, the DMR protected resources program has expanded from industry outreach/education and sightings and disentanglement networks to include a Section 6 Agreement with NMFS, gear research and development, and a large whale foraging research component. DMR's knowledge of State of Maine commercial fishermen and of the lobster and gillnet fisheries within its waters is integral to successful large whale take reduction plan. The State of Maine is fully committed to the protection of Atlantic large whales, while at the same time protecting the economic and operational realities of the State's fisheries. Maine's Large Whale Conservation Program (Conservation Program) acknowledges the variability in spatial distribution between whales and fishing gear off the Maine coast, and recognizes that every situation that involves both the fisheries and marine mammals is different and unique.

Under the Conservation Program's protocols, DMR manages a sighting network for the surveillance and monitoring of movements of all whales observed to be in an area of overlap with State of Maine fishing gear. This regional approach allows DMR and Maine commercial fishermen to effectively monitor the position of whales during their residency. .

The sighting network ties closely to the state sponsored disentanglement network, coordinated by the DMR protected resources scientist and the stranding coordinator. The network consists of trained Maine Marine Patrol (MMP) and industry members who supply disentanglement and standby assistance for any potential whale and turtle disentanglement efforts. Marine Patrol Officers (MPO) are involved with every reported entanglement.

In 2007 DMR received continued funding from the National Fish and Wildlife Foundation and carried out several cooperative research and project initiatives related to large whale conservation that included low-profile groundline field testing, habitat surveys, digitizing historic large whale sightings, right whale tagging, and the maintenance of the sightings and disentanglement networks.

Gear research and development continued with the field testing of three additional products of low-profile groundlines. Lobstermen fished three different specific gravities of rope made into two different diameters. Upon completion of the fishing season, DMR collected log sheets and rope samples for strength testing. Additionally, these ropes were field tested with data depth loggers to record their arc heights, or the height of each rope off the bottom at its highest point. One rope, specific gravity 1.02, emerged as a viable alternative to sinking groundline as it tested well in the field with fishermen and had an average arc height of 0.19m with a maximum height never exceeding 1 meter. This

effort culminated in the submission of a proposed amendment to the Atlantic Large Whale Take Reduction Plan (ALWTRP) to allow low-profile groundlines in some areas in Maine coastal fishing habitats.

The largest expansion of the program was seen in large whale foraging and habitat research. DMR began several initiatives aimed at understanding where and when large whales occur in Maine, how they behave in Maine's unique rocky and tidal habitats and how we can reduce the potential for interaction between large whales and Maine's coastal fixed fisheries. A project was completed with College of the Atlantic's Allied Whale and the Bar Harbor Whale Watch to digitize whale sightings logbook data. This effort allowed for a finer scale understanding of the distribution and seasonality of right, humpback, fin and minke whales in the Mount Desert Island area. Additionally, DMR supported and collaborated on a project by Woods Hole Oceanographic Institute and Ocean Works, Inc. to tag right whales in Maine coastal fishing waters to determine their diving behavior over rocky bottoms and more specifically their altitude off the bottom. Finally, DMR collaborated with the University of New England and the Maine lobster industry to carry out a CTD/plankton survey in areas proposed for low-profile groundline use to determine the distribution and abundance of right whale prey.

Outreach efforts supplemented DMR's research and management efforts and will continue to be a large part of the Conservation Program. The long-term goal of the program continues to be the protection of endangered and threatened large whales while maintaining the viability of Maine's fishing industries. In 2008, DMR will continue its efforts to conserve right, humpback, fin and minke whales through expanded habitat monitoring and research, acoustic detection, tagging studies, and endline risk reduction strategies.

Conservation Program Objectives

The Maine Large Whale Conservation Program is multi-phase with short and long-term goals, and will be accomplished through these three objectives:

- Protect, manage and enhance marine mammal populations by assessing population status and trends as well as life history needs of these species using Maine waters;
- Identify and coordinate existing roles, responsibilities, and activities of the various involved parties, and promote improved coordination among them; and
- Improve and promote public education and participation.

Conservation Program Collaborators

Federal: National Marine Fisheries Service, United States Coast Guard, United States Navy

State: Department of Marine Resources, Marine Patrol, Department of Transportation Department of Environmental Protection, Department of Inland Fisheries and Wildlife

Industry: Maine Lobstermen's Association, Down East Lobstermen's Association, Southern Maine Lobstermen's Association, Maine Gillnetters Association, Grand Manan Fishermen's Association, East Coast Tuna Association, Gulf of Maine Lobster Foundation

Conservation: New England Aquarium, Center for Coastal Studies, Chewonki Foundation, Humane Society of United States, Ocean Conservancy, Allied Whale, Whale Center of New England

Academic: University of Maine, College of the Atlantic, Bigelow Laboratories, University of New England, Woods Hole Oceanographic Institute, Gulf of Maine Research Institute

Strandings: New England Aquarium, University of New England, Allied Whale

Others: Cruise Maine Coalition, Maine Pilots Association, Whale Watches, Harbor Masters

2008-2009 Conservation Program Goals

- Propose and implement into state rulemaking low-profile groundline use areas by the Atlantic Large Whale Take Reduction Program (ALWTRP) amendment's deadline of Oct. 5, 2008.
- Assess endline risk in different use areas of the Maine coast using the survey sent out to state permit holders and take recommendations for gear modifications to the ALWTRT
- Continue to further develop the current sightings and disentanglement networks as well as industry/community outreach programs
- Seek additional Level 3 and 4 training for key members of Marine Patrol and industry disentanglement network members
- Collaborate with Northeast Fisheries Science Center and other academic institutions to expand on and implement comprehensive GOM surveys for large whale distribution and abundance of prey.
- Tag humpback, fin and right whales with Dtags to understand feeding and diving behaviors over rocky tidal habitats
- Continue large whale habitat monitoring program
- Explore possibility of acoustically monitoring known habitats and potentially shipping lanes for large whale presence
- Model whale sightings, fishing effort, habitat and prey information to assess and predict the risk of entanglement.
- Expand existing GIS sightings program to include Stellwagen Bank survey data

- Encourage and facilitate Canadian collaboration with disentanglement and sightings networks
- Obtain funding for State wide coastal aerial sightings surveys for large whales

2007 Conservation Program Accomplishments

Sightings Network

Maine's Large Whale Sightings Website is an interactive GIS/web-based application that enables commercial fishermen and other interested groups to access real-time sightings information of large whales in the Gulf of Maine (Figure 1). Sightings are received from a variety of sources (including NOAA aerial and shipboard surveys, ferry operators, commercial fishermen, recreational boaters, whale watches and the Maine Marine Patrol), reported via email, fax or the Maine Marine Animal Reporting Hotline, a toll-free number from anywhere in New England. When a sighting is received from a reliable and confirmed source, the coordinates and sighting information are entered into a GIS mapping system and are immediately viewable to the general public through an Internet Map Server (IMS) interface on the Conservation Program sightings page (http://megisims.state.me.us/WhaleSightings/). Associated information linked to the sighting point and available to the viewer includes the species of whale, source, date and time of sighting, and other relevant observations (whether the whale is feeding, traveling, etc.). The website allows archived sightings to be displayed as a layer, and viewers can manipulate the program to depict contemporary sightings by time period to show trends.

Sightings entered since 2006 include 1,608 sightings of right, humpback, fin and minke whales. 2006 recorded 748 sightings, 2007 contributed 763 and so far in 2008 there have been 97 reported sightings in the region (through 3/1/2008). Included in these sightings since 2006 are 3695 humpback whales, 3824 fin whales, 764 minke whales and 89 right whales. These recorded sightings are not just for the Maine coast but include NMFS aerial surveys and right whale alerts from other areas in the Gulf of Maine region.

The primary limitation of the effectiveness of the current web page is the availability of sightings reports. Aerial and shipboard surveys completed by NOAA provide the majority of sightings information. Although outreach efforts have been made to many other groups capable of providing sightings information, such as whale watch tours, commercial fishermen, and deep-sea charter boats, sightings reported from these groups are sporadic and voluntary. NOAA aerial surveys fly specific patterns that do not always cover coastal Maine. Therefore, an increased number of sightings from other sources are needed to provide a more realistic picture of large whale presence in State and near shore waters.

The Conservation Program's sightings page is capable of providing much more information than it does currently, however, expansion is dependent upon additional funding. The usefulness of the site could be greatly enhanced by including additional map layers displaying shipping lanes, plankton concentrations and potentially near-shore *Calanus* and right whale forecasting. The area of sightings coverage could be expanded

to include a greater range of New England coastline. While adding shipping lanes to the display would be relatively simple, adding plankton data would be complex and thus costly. The sightings page has the potential to be used as a tool for fishermen and mariners, a resource for scientists, and as an informational service for the general public.

Disentanglement Network

There are currently over three-hundred Maine Lobstermen who have received Level 1 disentanglement training. Forty-four of these lobstermen and all of the State's MPOs (52) have been trained in disentanglement to at least Level 2 including whale behavior and identification, preliminary entanglement response and assessment training. Four MPO boat Captains have received advanced Provincetown Center for Coastal Studies (PCCS) training, which included the technique for satellite tagging of an entangled whale and video case studies.

Level 1 and 2 training has been conducted by disentanglement experts from PCCS, New England Aquarium and College of the Atlantic, and Level 2 involved a hands-on component unique to the Maine Large Whale Conservation Program, the use of a life-size whale model. This model whale greatly enhances the trainings and allows participants to practice disentanglement techniques. Special disentanglement tools, based on those created for PCCS, were built for use by the MMP and the advanced trained lobstermen. All Marine Patrol vessels and eleven Level 2 trained lobstermen have been issued either full or "mini" disentanglement kits (Figure 2). The ongoing training and tools have allowed DMR to provide full disentanglement coverage along the entire Maine coastline.

Authority to disentangle minke whales was received by the State in 2001, and permission to disentangle other large whales is obtained on a case-by-case basis through direct consultation with NOAA and PCCS. To date the Maine Disentanglement Team has successfully disentangled 5 minke whales following protocols established by NOAA and incorporated into the Conservation Program.

Gear Modification Research and Development

DMR fully recognizes that disentanglement is a stop-gap measure, and that preventative gear modification efforts are necessary to reduce the threat of entanglement to large whales in Maine waters. Although there is a high compliance (97%) by Maine fishermen with the current ALWTRP gear modification requirements, many fishermen have become interested in the development of operationally viable gear modifications to prevent entanglement. Spurred by this industry interest DMR spearheaded a coast-wide effort to inform and solicit input from lobstermen regarding risk-free gear modification profiles. It was through this initiative that the concept and development of low-profile groundlines began.

Multiple versions of low profile rope have been made by two rope companies and over 250 coils of rope have been handed out to fishermen in 2005, 2006, and 2007. Fishermen who received this rope recorded the operational performance of the rope in the habitats

they fish. Their comments were used to enhance the low profile products, which has culminated in DMR's recommendation of a low-profile line of specific gravity 1.02 for use in specific areas along the coast. Additionally, loggers were deployed in 2006 and 2007 to judge the effectiveness of low-profile rope products. In 2006 DMR presented preliminary results to the ALWTRT for consideration. The operational problems with low-profile rope technologies have since been resolved through further work with manufacturers. The results from the 2007 field testing of these final products were submitted to NMFS for inclusion in the ALWTRT materials. Please refer to the Amended Maine Low-Profile Groundline Area Proposal and Line Field Testing Report for more information.

Risk associated with endlines or vertical lines will also be addressed in 2008. In an effort to better understand the degree of risk in different areas of Maine's coast seasonally, DMR has sent out a survey to a random selection of state license holders. The survey asks questions about the number of traps and configurations of gear set out in different areas by month. The results of the survey will be complimentary to the results of the survey sent out in 2006 to federal license holders and will allow managers to assess the changing degree of risk with respect to the density of gear in different places.

Foraging Research

Large whale forage research is a high priority. Maine sponsored a large whale foraging workshop in 2005 that included many regional experts, invested academics, managers, and industry members. The recommendations from this workshop are now being implemented in the Conservation Program. Work has included the digitizing of log book sightings near Mount Desert Island, a directed plankton/CTD survey in potential low-profile groundline use areas, right whale tagging in coastal waters, monitoring of known large whale habitats and some opportunistic sampling near right whale sightings.

Digitized log book sightings

DMR collaborated with the College of the Atlantic's Allied Whale and the Bar Harbor Whale Watch to digitize historic log book sightings of large whales from whale watch vessels from 1990 through 2007. These sightings include 8,817 records which are dominated by humpback and fin whale sightings. Figure 3 shows all sightings of humpback, fin, right and minke whales from the log book entries. Data are opportunistic and are not corrected for effort. That information is not available for most of these sightings. However, there are some tends to be noted in the data. Most of the sightings on the near-shore legs of the trips consist of minke whales with some fin whales being sighted close to shore. There are two pockets of whale activity which consist of the area around Mount Desert Rock and about 15nm to the northeast of there in the Inner Schoodic Ridges. The majority of humpback and fin whale sightings are found here. Additionally, there is a cluster of right whale sightings just outside the three mile limit around Mount Desert Rock to the east. This area has been named by local whale watches the "right whale hole" as it is deeper here than surrounding areas. Figures 4-7 depict each of the four target species by month. The only months included are May (very

occasionally) through October due to the whale watch boat seasonality. Figure 4 indicates right whale sightings in the "right whale hole" as well as along the Inner Schoodic Ridges in most months sampled, with the majority of sightings occurring later in the summer, Aug – Oct. Figure 5 shows the presence of minke whales in all months sampled in the two main areas around Mount Desert Rock and the ridges. Additionally, there are more inshore sightings of minke whales than other species. There is also a late season aggregation to the northeast of the ridges that occurs in September and October but that may be an artifact of effort. Fin whale sightings are abundant throughout the sampled area in all months as seen in Figure 6. The late season sightings noted in Figure 5 exist here as well. Humpback sightings show more seasonal changes than fin whales with more early season sightings occurring around the Inner Schoodic Ridges and late season sightings near Mount Desert Rock. Again, the late season sightings to the northeast are present here as well.

These sightings will be added to the sightings database and used in conjunction with effort data to assess the risk of entanglement within the sampled area. Further collaboration with the project partners may yield some sightings per unit effort data, which will enable DMR to better assess the actual risk of entanglement in these high use areas.

Right Whale D-Tagging in Coastal Fishing Habitats

This project was funded through a grant from National Fish and Wildlife Foundation to Ocean Works Group, Inc. and the Woods Hole Oceanographic Institute. DMR became involved as a collaborator and provided some additional funding for the production of the pinger buoys as well as personnel and local expertise on board the R/V Stellwagen for the duration of the project. The focus of this project was to quantify entanglement risk as a function of depth for right whales in New England inshore fishing areas, especially over rocky bottom. There were several elements to the project. The first included the surveying of a large area of inshore waters of the Gulf of Maine from Jeffery's Ledge to Mt. Desert Rock (Figure 8). During the surveys, observations were made of marine mammals, fishing gear and vessel traffic. The observer efforts and photo id were supervised by Monica Zani from the New England Aquarium. The second element to this project was to place a Dtag on a right whale in these waters to get at not only the diving and potential feeding behavior of a right whale over rocky bottom habitats but more specifically the whale's altitude above the bottom during these activities. To accomplish the latter task the deployment of four pinger buoys would give an underwater GPS location of the whale while the Dtag was on and not only demonstrate the whale's location but also altitude off the bottom over an extended period of time. The R/V Stellwagen would then confirm bathometry with onboard echo sounder to verify actual depth.

The cruise was carried out June 9-July 10, 2007. Over 1,000nm of track lines were surveyed during this time. Sightings of marine mammals noted along those track lines are displayed in Figure 8. The cruise did come across one mother/calf pair and two other mother/calf pairs were sighted by project partners, NMFS aerial survey team and Bar

Harbor Whale Watch. However, no right whales were tagged due to permit constraints with mother/calf pairs. The full cruise report is available in Appendix I with detailed methods for D-tagging and pinger buoy deployment as well as results from photo-identification of sighted right whales.

CTD/Plankton Survey

In August of 2007, DMR implemented a CTD/plankton sampling survey in collaboration with the University of New England and the lobster fishing industry. Transects were sampled from mid-coast to Downeast Maine through areas of potential low-profile groundline use, totaling 84 sites (Figure 9). The survey focus was to serve as a pilot project to begin to understand the potential for large whale prey to aggregate near the bottom and at what depth that might occur. Each station was sampled with a vertical CTD drop and two vertical plankton tows using 200µ mesh nets. Duplicate plankton tows were taken at each site to account for variability. Lobster boats were used as research platforms, using the hauler and block to drop and haul back the CTD and nets to and from the bottom. The methods for determination of the Bottom Mixed Layer and the results of the CTD vertical profiles is documented in the Amended Maine Low-Profile Groundline Proposal and Line Field Testing Report that is included in the TRT materials.

Plankton samples were fixed in alcohol and counted by the University of New England. The complete results for those samples are not available but what is finished is presented here. To date 57 of the 84 stations have been counted, 39 with one tow counted and 18 with both duplicate tows counted. Fourteen of the tows were counted more than once to account for variability in the count. The following copepod species were accounted for in at least one of the sampling stations: *Calanus finmarchicus, Calanus helgolandicus, Pseudocalanus newmani, Acartia clausii, Acartia hudsonica, Acartia tonsa, Candacia armata, Centropages hamatus, Centropages pelagicus, Centropages typicus, Evadne spp., Labidocera aestiva, Oithona colcarva, Paracalanus parvus, Parvocalanus crassirostris, Pseudodiaptomus pelagicus, Temora longicornis, Temora turbinate, Tortanus discaudatus,* and *Tortanus setacaudatus*. Also present in the samples were various fish, shrimp and crab larvae, polycheates, amphipods, and jellies. The results presented below when discussed as total organisms contain all species, copepod counts contain only numbers of copepod species and results discussed as calanus contain only *Calanus finmarchicus*.

Across all stations there was a range of 0.71 – 3,266 organisms m^{-3} with an average of 474 organisms m^{-3}. There was no significant difference between the number of organisms counted in duplicate tows ($p = 0.74$) or when one tow was counted twice ($p = 0.52$). When the stations were calculated for only copepod species the range dropped to 0.43 – 1618 organisms m^{-3} as did the average to 224 organisms m^{-3}. When only calanus were analyzed the average declined to 170 organisms m^{-3} with the percent of a sample being made up of calanus ranging from 4 – 79% across all stations. Within those percentages, anywhere from 0 – 100% of the calanus in a sample were stage IV or greater.

Plankton samples were analyzed in three different contexts: by region, by corresponding depth of the Bottom Mixed Layer and by bottom depth. Table 1 shows the average, minimum, and maximum values for total organisms, calanus only, and all copepod species for three different regions, "Southern", "Mid-coast" and "Downeast". The southern region contains samples taken from transect lines 1-6, the mid-coast regions consists of lines 7-12 and the downeast region contains lines 13-18. While the downeast region had a higher percentage of calanus stage IV and above, the southern and mid-coast regions have higher concentrations of organisms as well as copepods and calanus than downeast. T-tests were run to test the differences between regions for all copepod species as well as calanus abundances (p-values in Table 1). The southern and mid-coast regions were significantly different from the downeast region in both total copepods and calanus abundances using a 95% confidence interval. This result corresponds to the CTD data that was presented in the Amended Maine Low-Profile Proposal and Line Field Testing Report that showed that the bottom mixed layer at many stations in the downeast region were largely non-existent, potentially due to currents near the bottom in that area. Copepod and calanus abundances are higher in regions that have more defined and stratified water columns, such as the mid-coast region.

Samples were also analyzed by the depth of the bottom mixed layer (Table 2). Despite the above results that had higher abundances of copepods, specifically calanus, in the downeast region, there were no corresponding significant differences in plankton abundances between sites with shallow, deep or no bottom mixed layer. Abundances in this project are relatively low and may not be occurring in quantities large enough to tease apart relationships with water column make-up. The abundance of larger stage calanus were less likely to occur at stations with deep bottom mixed layers, making up only an average of 15% of the calanus sampled there.

Lastly, samples were identified with regard to the bottom depth where they were taken. Table 3 has the abundances for organisms, copepods and calanus for sites arranged in the following depth categories: 0 – 40, 40 – 80, and 80 + meters. While there are no significant differences there seems to be a trend that while the average abundances of organisms, calanus, and copepods decreases with increasing depth, the maximum numbers are increasing. This suggests that while the majority of deeper sampling sites do not contain higher numbers there are pockets of increased abundance in sites with deeper water. There is also an increase in the percentage of calanus that is stage IV and above in deeper water, an average of 50% versus 28% in the shallow category.

Overall, the maximum abundance of calanus that was recorded at any sampling station during the survey was 1106 m^{-3}. Baumgartner and Mate (2003) state that the minimum concentration of stage V calanus needed to meet the daily metabolic needs of a right whale is 3600 m^{-3} and would require 24 hour a day foraging. Also in this study, a tagged right whale recorded "searching" behavior in calanus abundances of 1300 m^{-3}, a level still above the highest reading seen here, suggesting that a right whale would ignore concentrations this low because they do not contain enough energy. Several other sources cite abundances in known right whale feeding habitats (Great South Channel) significantly above those recorded here: 3124 – 14945 m^{-3} (Baumgartner and Mate 2003),

within patch measurements of 6210 m^{-3} (Wishner *et al*. 1988), and 8.7 x 10^3 m^{-3} (Beardley *et al*. 1996). This project as a pilot study suggests that there are not abundances of copepods in the sampled waters at high enough concentrations to support a feeding right whale. However, a larger scale survey is being set up for the summer of 2008 to sample plankton abundances state-wide and will look further into inshore-offshore differences in assemblage and abundance as well as night sampling. It is possible that all of the stations sampled in this study were further inshore than a feeding right whale would be in the Gulf of Maine based on sightings evidence that has been presented elsewhere.

Future Programs

There are several research initiatives planned for 2008. As referenced above, a survey intended to better understand fishing effort and related entanglement risks has recently been distributed to industry and will be analyzed over the next year. Additionally, foraging, behavior and habitat research plans include habitat and acoustic monitoring, an expanded state-wide plankton survey, the production of near-shore Calanus and right whale forecasting models and D-tagging right, humpback and fin whales. These projects are being funded through several sources including the National Fish and Wildlife Foundation, Section 6, and dedicated money from the State of Maine. Maine's dedicated funding is the direct result of support from Maine lobstermen to increase their trap tag fees by ten cents per tag specifically for research to help identify and mitigate the risk of entanglement to large whales by fishing gear in Maine.

Sightings and Reporting Network

DMR plans to enhance the current GIS web page through collaborations with NOAA and the Northeast Fisheries Science Center to incorporate additional sightings information as well as relevant future surveys. DMR, in collaboration with NOAA and the existing strandings group, will increase public outreach in order to expand the number and coverage of sighting reports.

Disentanglement Network

The minke whale and sea turtles are currently the only species that the Maine disentanglement network is authorized to address without the direct involvement of NOAA and PCCS. DMR plans to maintain the existing disentanglement network and will continue the annual training of its members. However, with the exception of right whale disentanglements, a logical outgrowth of the Recovery Plan is increased responsibility and authority for other large whales. Further advanced training is needed and DMR, NOAA Fisheries and PCCS remain committed to offering such training to network members in the state. Two DMR staff members will undergo apprentice training at PCCS this spring, a training course is being held for interested industry members in May and trainings with Marine Patrol are on-going and subject to officer availability.

Gear Research and Development

DMR has submitted an amended proposal for the use of low-profile rope to NOAA Fisheries and the ALWTRT. Subsequently, work will begin on endline entanglement risk mitigation strategies. The first of these is the endline survey discussed above.

Foraging Research

Habitat monitoring – *The following was taken from the statement of work provided to DMR by Jeffery Runge and Andrew Pershing with the School of Marine Sciences University of Maine/Gulf of Maine Research Institute for the collaborative work to be done starting the spring of 2008.*

Fixed Station Sampling: monitoring abundance of *Calanus finmarchicus* and other zooplankton along the Maine Coast

The planktonic copepod, *Calanus finmarchicus*, dominates the biomass of the zooplankton community in deep waters of the Gulf of Maine. It is not endemic to coastal regions shallower than the 100 m isobath, however, because the shallow depths are not favorable for successful survival through the overwintering phase of its life cycle. Our time series observations initiated in 2003 at a fixed station on Jeffreys Ledge in the coastal western Gulf of Maine off Portsmouth indicate that *Calanus finmarchicus* abundance in coastal waters varies by an order of magnitude between years. The window of abundance of the lipid-rich, overwintering pre-adult stage CV, the favored food of northern right whales, is highly variable in timing, magnitude and duration during summer. The factors controlling this variability likely involve the timing and duration of spring phytoplankton production along the coast, the abundance cycle of *Calanus* in the deep Gulf of Maine that supplies the coast and variation in cross shore transport of *Calanus* to the coast, especially in fall and winter.

We propose to contribute to the establishment of two fixed observing sites along the Maine coast, one located downeast in the vicinity of Mt. Desert Rock and one located off the mouth the Damariscotta Estuary, west of Monhegan Island. Each site is situated near areas where high whale activity along the Maine coast is observed historically. Each site comprises two stations and will be sampled every other week year round, on average, using the same protocols established for the Jeffreys Ledge time series. These protocols are also used by the Canadian Atlantic Zonal Monitoring Program, offering the opportunity for direct comparison of time series data across latitudes in the coastal northwestern Atlantic, useful for assessment of region-wide impacts of climate change. The basic measurements involve collection of hydrographic information with a CTD, water samples for concentration of chlorophyll a as an indicator of primary production cycles and vertical ring net samples for assessment of zooplankton species composition and abundance of *Calanus* life stages.

The time series data will be useful for the evaluation of environmental conditions influencing northern right whale distribution in coastal areas. Our Jeffreys Ledge data

indicate that order of magnitude differences in abundance of *Calanus* in coastal areas are seasonally persistent, so that the semimonthly frequency of sampling is sufficient to detect the seasonal trends in coastal *Calanus* abundance. While these data do not provide information on the presence of the very high, fine scale patches of *Calanus* that attract northern right whales, our hypothesis is that the frequency and magnitude of these patches are related to the underlying relative abundance of coastal *Calanus*, such that the ring net data represent a proxy for conditions attracting whales. The time series data provide valuable empirical information needed to test hypotheses about the mechanisms controlling coastal *Calanus* abundance and to develop and run an operational physical-biological model, as described below, to predict coastal *Calanus* abundance and northern right whale distribution patterns.

Work statement

We will analyze zooplankton samples collected from both sites for *Calanus* stage abundance and total zooplankton abundance and composition, in compliance with the AZMP and Jeffreys Ledge analysis protocols. We will collect samples at the Damariscotta site with the University of Maine, Darling Marine Center research vessel, the *R/V Ira C*. We will train the College of Atlantic team in the standard protocols used for the time series collection. We will analyze statistically and graph the hydrographic, chlorophyll and zooplankton data, interpret the inter-annual and seasonal patterns in relation to other environmental variables, and participate in the development of the physical biological model that uses the data for prediction of abundance and distribution. We will contribute to presentation of the project at a session organized at the Fisherman's Forum.

Acoustics

Two pop-up acoustic buoys will be placed in 2008 by College of the Atlantic/Allied Whale in conjunction with their on-going acoustics project near Mount Desert Rock. Supplemental to their existing array, two additional buoys will be placed near the "right whale hole" and another at the I buoy for comparison. They will record vocalizations from July – September at which time the buoys will be retrieved and the data will be analyzed by Allied Whale. The presence and abundance of whales at different times during the study time will be correlated with the habitat monitoring sampling that is described above. If results warrant expanded research more buoys may be placed in the following year.

Plankton Survey - *The following was taken from the statement of work provided to DMR by Jeffery Runge and Andrew Pershing with the School of Marine Sciences University of Maine/Gulf of Maine Research Institute for the collaborative work to be done July of 2008.*

In order to build confidence in the interpretation and spatial extrapolation of temporal patterns at the time series stations, knowledge of the along-shelf, cross-shelf and vertical distribution of *Calanus* is needed. The horizontal and vertical distribution of *Calanus* along the Maine coastal shelf can be assessed by ring net samples, as well as bongo and

Tucker trawls (for vertical distribution) at selected stations and LOPC sampling during survey cruises. The survey cruise is planned to have a duration of 7 days, during which five transect lines of 8 stations will be sampled. The lines will investigate the cross shelf distribution at five more or less evenly spaced locations, including the whale hot spots near Mt. Desert Island and west of Monhegan Island. Vertical distribution will be investigated by day-night vertically stratified sampling with an opening-closing Tucker Trawl at selected stations along the transect lines. Hydrographic data collected with a CTD and chlorophyll a concentrations would also be taken at the survey stations.

Work statement

We will participate in the survey cruise, operate the bongo, LOPC, Tucker and vertical ring nets, and collect hydrographic and phytoplankton data and samples. The water samples will be analyzed for chlorophyll a concentration and the zooplankton net samples will be analyzed for *Calanus* life stage abundance and, for ring net samples, total zooplankton abundance. The sample data will be analyzed statistically, plotted graphically and compiled for data archiving. The results will be reported at public meetings, such as the Fisherman's Forum, and in research articles in combination with other data and analysis of coastal Maine *Calanus* population dynamics.

Forecasting model - *The following was taken from the statement of work provided to DMR by Jeffery Runge and Andrew Pershing with the School of Marine Sciences University of Maine/Gulf of Maine Research Institute for the collaborative work to be done in 2008*

Towards Operational Forecasting of Coastal Zooplankton Populations

Due to constraints on time and money, zooplankton sampling can only be sustained at a small number of stations. To understand the zooplankton resource, and how cetacean populations may respond to it, we need a procedure to fill in gaps, in both space and time, between samples. The copepod species that will be the focus of our sampling efforts can go through a generation in less than a month. This fast growing time relative to the sustainable sampling frequency of ~2 weeks, means that the copepod community can change rapidly between surveys. Furthermore, copepods are transported by the horizontal circulation. Using 30 cm/s as a representative alongshore velocity (e.g. Pettigrew et al. 1998), we expect that the copepods observed at a fixed station traveled over 300 km to reach the station.

With funding from NOAA and NASA, we have developed a stage-based copepod model for the Gulf of Maine. This model is currently providing operational estimates of *Calanus finmarchicus* abundance and a forecast of when right whales are likely to arrive in the Great South Channel critical habitat. We are also developing a three taxa model: *Pseudocalanus* spp., *Centropages typicus*, and *C. finmarchicus* for use in Cape Cod Bay. This model will use an ensemble Kalman filter to assimilate net tow data to provide a realistic hind-cast and forecast of copepod distributions.

Work statement and budget

We will evaluate the suitability of our three-taxa model for use in Maine coastal waters. We plan to compare the relative impact of the bi-weekly sampling and the surveys on the overall accuracy of the model predictions. This analysis will provide a quantitative way of identifying areas that might warrant additional sampling. We will also compare different operational circulation model products for use in coastal waters.

D-tagging humpback, fin and right whales – *The following was taken from the proposal to the Section 6 grant announcement submitted by DMR.*

Project Description
(a) Project goals and objectives:

Humpback and fin whales are two of the federally endangered large whales that occur in Maine waters. Additionally, both of these species are included in the on-going Atlantic Large Whale Take Reduction Plan (ALWTRP). This program began in 1997 and included protection measures such as area closures and minimal gear modifications. However, entanglement rates have not declined for these species to acceptable levels and additional measures have been presented in a new final environmental impact statement (FEIS) and final rule due to be published October 1, 2007. The preferred modification outlined in the FEIS requires the use of sinking groundlines all along the east coast. Additionally, experimental low-profile groundline options are still being explored by the State of Maine and the Take Reduction Team (TRT) as an alternative to sinking line that still reduces the risk of entanglement. This issue is difficult to discuss as a suitable option for many members of the TRT largely due to the lack of data that either quantifies the risk of entanglement of these experimental lines or elucidates the feeding and diving behavior of large whales over rocky bottom habitats such as those in coastal Maine. These two data gaps form the base of all of the questions posed by the rather unique scenario that exists in Maine. Currently, Maine lobstermen say that floating rope is vital to the survival of their industry. They need the flotation to get around the jagged and rocky bottom without losing gear and creating unsafe fishing situations with the increased occurrence of hang-downs. Therefore, gear modifications such as low-profile groundlines have been tested and are being proposed to the TRT for exemption to the imminent sinking line mandate. However, it is still unknown what the risk of these lines will be to whales that coexist in these habitats. By answering the question of how deep whales dive over rocky bottom habitats and by assessing the potential entanglement risk for these species around lines of differing arc heights scientists, managers, industries and the conservation community will have the data they need to make informed decisions about what measures will not only be effective in reducing the risk of entanglement to large whales but will also allow for the Maine lobster industry to fish safely and efficiently. Additionally, these data will be used to guide the gear research and development programs started by Maine DMR in 2001.

In order to answer the questions set out above we propose to implement the following objectives:

- To tag humpback and fin whales that are found in coastal Maine fishing habitats with an emphasis on the mid-coast to down-east regions. This will be done

aboard the R/V Stellwagen with a team of researchers from Maine DMR, Ocean Works Group, Inc., and WHOI. Dtags will be deployed on at least three animals of each species.

- Deploy pinger buoys to create precise GPS tracks of the whales' movements and behavior while verifying the depth and therefore altitude of the whale off the bottom.
- Quantify the risk of entanglement as a function of depth and diving behavior
- Identify depths for which fishing line and gear will pose the least threat to humpback and fin whales in these areas
- Compare findings of whale behavior with what is known about the latest low-profile groundline product, the spatial and temporal patterns of fishing gear in Maine, and prey distributions based on the Maine DMR inshore trawl survey
- Communicate suggestions for gear modifications to NOAA Fisheries, the Maine lobster industry and members of the TRT
- Publish results in a peer-reviewed format

These objectives will be carried out by a team of researchers from Maine DMR, Ocean Works Group, Inc., and WHOI. Tagging will commence in the 2008 field season and analysis will take place in the fall and winter for results to be disseminated in the subsequent spring.

This work was started in the summer of 2007 with a right whale tagging project funded by the National Fish and Wildlife Foundation. That project was carried out successfully with over 1,000 nautical miles of survey effort completed in Maine coastal waters. Three mother/calf pairs of right whales were found during the effort but were not able to be tagged due to permit regulations. This project is the continuation of what was started in the 2007 project, with the expansion into two other species being protected under the ALWTRP, humpback and fin whales. Many of both of these species were observed and logged during the survey effort of this project. The data is equally important for humpback and fin whales as the risk of entanglement is real for all species governed in the plan. Gear modifications that are imposed should protect all target species. The proposed project will use the same staff, crew and methods used in the right whale tagging study (see attached post cruise report in Appendix).

(b) Project Narrative

Work will be carried out on the R/V Stellwagen, a 70' vessel, and will include 14 working days. Dtags, developed at WHOI by Peter Tyack and Mark Johnson, will be used to non-invasively tag at least three each of humpback and fin whales. It has successfully been used on many species including humpbacks in non-rocky bottom habitats in other New England areas. The collaborative research group will include Maine DMR, WHOI, Ocean Works Group, Inc., The Whale Center of New England and the NOAA Fisheries NE region. Standardized boat-based surveys will be carried out along track lines aboard the R/V Stellwagen throughout the study region (mid-coast to down-east Maine). Aerial support will be called in as necessary for sighting verification from Maine Marine Patrol and NOAA Fisheries. Whale watches in the area will also be contacted for communication of sightings. Observers will be stationed port and starboard

on the fly bridge during surveys at a height of eye of 25' in a two hour rotation. All sightings of marine mammals will be recorded on a laptop on the fly bridge as well as environmental conditions, visibility, Beaufort sea state, cloud cover, wind speed and direction, fishing gear densities, and the presence of active fishing boats. GPS survey effort and pinger buoy location will also be recorded automatically on the laptop. Tagging procedures and the placement of pinger buoys will be conducted on a 23' hard bottom inflatable. After the tag is deployed, three to four pinger buoys will be deployed around the whale and moved with the inflatable vessel as needed. The R/V Stellwagen will run operations and verify bottom depth data with on-board equipment. Additional tagging, Dtag and pinger buoy information can be found in the right whale post cruise report attached in the appendix.

Work will be conducted under research permits 605-1607 and 605-1904 through the Whale Center of New England. Please see attached letter of support.

Analysis will largely be contracted out to WHOI engineers and will include analysis of Dtag and pinger buoy data. Behavioral data from the Dtag will be used to determine risk of entanglement in relation to depth and bottom. Altitude off the bottom will be determined by the pinger buoy tracks and verified bottom depths. Additionally, behavioral observations and photo-identification will be processed and analyzed by staff at the Whale Center of New England.

Synthesis of this data set with other relevant data sources, such as gear configurations and densities in the study area, will be done by collaborators from DMR, WHOI, and Ocean Works. A final report will be written up by the Project Manager and the Co-Investigators as well as at least one research paper for submission to a peer-reviewed journal.

Dissemination of the results to the scientific community will occur through presentations and peer-reviewed publication, the TRT and NOAA Fisheries through technical reports and meetings, and to the industry through directed meetings and presentations. Processed data and analysis will be made available to the public on the DMR website. We will also work to facilitate discussions on how to direct management concerns and gear research and development in light of the data and provide insight into what the optimal gear modifications might be for both entanglement risk reduction and the continuation of a fishery. This specifically applies to the question of experimental low-profile ropes and their effectiveness at reducing the entanglement risk to humpback and fin whales in given areas of proposed use.

(c) Benefits or results expected

The direct results of this project will be a quantifiable risk of entanglement for both humpback and fin whales in the rocky bottom habitats of Maine's coastal fishing waters. This measure will be used to address management decisions aimed at reducing this risk in U.S. waters. Data collected from this study will not only be instrumental in understanding the behavior that leads to entanglements in rocky habitats but will be used to direct gear research and development that has been on-going since 2001 in the State of Maine. Currently, low-profile groundlines are at the forefront of issues being addressed

by the TRT. Information from this study will enable the team to look at the low-profile proposals with the knowledge of whether or not these experimental lines actually reduce the risk of entanglement and in what areas the risk reduction is enough to approve the use of these lines in the industry. The end result is a better management plan that uses data to drive the decisions it makes regarding a fishery as well as protection for endangered species from human-induced mortality and serious injury. Success of this project will be assessed in the production of usable data and reports to the TRT, managers, the scientific and conservation communities and the industry. The recommendation of optimal gear modifications for risk reduction is the primary end goal of this project, although success will also be measured in the direction it is able to provide for future gear research and development.

(d) Need for government financial assistance
The research necessary for this project will be solely funded by this source. A right whale tagging component may be combined with this project using unused money from the 2007 right whale tagging project funded by NFWF. However, no Section 6 money will be used for right whale research. This research falls under the Maine DMR Large Whale Conservation Program, which is fully funded by grant money. Other projects being carried out under this program will benefit from the data collected under this proposal.

(e) Federal, State, and local government activities
This proposal complements the work currently being conducted by the Maine DMR Large Whale Conservation Program. Projects under this program that will benefit from the data collection under this proposal include experimental low-profile groundline research and development. It is currently unknown how high a rope can float and still reduce the risk of entanglement for a humpback or fin whale. By quantifying this risk the proposed tagging project will have significant impact on the direction that low-profile groundline research will take and if and where it will be approved for use in the State of Maine by the TRT. Other projects that are currently being carried out by the state that would be impacted by this study are large whale foraging projects, the assessment of areas of entanglement risk within the state's coastal waters by overlaying sightings history, gear configurations and densities, prey and oceanographic variables. Additionally, a similar project was begun in 2007 tagging right whales in Maine's rocky bottom habitats. The survey found three mother/calf pairs but could not tag those under permit guidelines. We are currently petitioning to use the remaining money to conduct that study again in the summer of 2008 simultaneously with this proposed project. Please see attached cruise report for more information. By tagging all three large whales included in the Take Reduction Plan, a more comprehensive and thorough measure of protection can be implemented that also takes into account the needs of the fishery.

(f) Environmental impacts
The only potential negative impact would be minor disturbance reactions of humpback and fin whales from tagging procedures. The tags are attached non-invasively using suction cups. Responses to close approaches by the tagging vessel or to tag attachment are occasionally observed, but are only minor and brief, such as turning or an early dive.

Currently, these whales are both on the endangered species list and are being taken at a rate that will not allow for recovery of the species. In the absence of information on the depths at which humpback and fin whales feed and dive and how their behavior modifies the risk of entanglement, it is nearly impossible to optimize gear modifications to reduce that risk. Therefore we are confident that the data collected in the project will improve protection for these endangered species and offer potential gear modifications that will also minimize the impact on the fishery.

(g) Project management

This grant will be managed by Erin Summers of Maine DMR. She will handle all reporting and budget responsibilities as well as facilitating the implementation and progress of the project with Co-investigators Alex Loer of Ocean Works Group, Inc., Peter Tyack of WHOI, and Mark Johnson of WHOI. Contracts will be written out to Ocean Works Group, Inc. for vessel use and fuel and to WHOI for field staff time, analysis, administrative costs and tag use. Additionally, some volunteer services may be provided by area whale watches, College of the Atlantic/Allied Whale, the Maine Lobstermen's Association and others. Representatives from DMR will handle outreach activities with the lobster industry and presentation to the TRT. Ocean Works Group, Inc. will handle much of the coordination with the field staff and permit reporting. Peter Tyack and Mark Johnson will be largely responsible for the tagging and pinger buoy equipment as well as the analysis and interpretation of the data and will co-write any peer-reviewed publications.

Aerial surveys

The DMR will continue to pursue funding sources for year round aerial surveys in Maine to obtain the necessary baseline data of marine mammal distribution and abundance with respect to the fishing industry and entanglement risk mitigation strategies.

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Maine Sinking Groundline Exemption Proposal

Submitted to the Atlantic Large Whale Take Reduction Team

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Maine Department of Marine Resources

July 9, 2008

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Questions to Have Considered

Executive Summary:

The State of Maine proposes to exempt the sliver waters, defined as the waters between the amended Atlantic Large Whale Take Reduction Plan (ALWTRP) exemption line and the state waters boundary, of Lobster Zones A-D from the universal sinking groundline requirement. The conservation equivalency components of this proposal will result in a net reduction of rope in the water column by capping the numbers of endlines in this area at 300 and banning the fishing of single traps. This proposal will achieve a significant conservation benefit by removing 25-32% of the rope from this area, equaling 6053 to7808 miles of rope. Maine's proposal will also limit the length of floating groundlines in this proposed exemption area to 10 fathoms and requires a mandatory two foot mark in the center of the line to assist in enforcement and monitoring of the exemption.

Rationale:

This is an area specific proposal for Downeast Maine which is characterized by rocky habitat, extreme bottom currents, an infrequent occurrence of strategic stock whales and low plankton abundance. Fishing with sink rope groundlines in these areas will result in frequent hang downs, safety concerns and may result in unnecessary economic hardships.

The near-shore Coast of Maine is characterized by the widespread occurrence of rocky and broken bottom that lobstermen fish year round. In 1996, the Maine Geological Survey compiled existing side scan sonar, seismic reflection and bottom grab samples to form a surficial geology map of the Coast of Maine. All Maine lobster management zones have a combined 48% of the area classified as "predominantly rock" and/or 52% of the area containing rock (Barnhardt et al. 1996) (Table 1, Figure 1 A and B). Throughout the Atlantic Large Whale Take Reduction Plan (ALWTRP) rule making process, the Maine Department of Marine Resources (DMR), Maine Lobstermen's Association (MLA), Downeast Lobstermen's Association (DELA) and many Maine lobstermen consistently commented that flotation is needed in groundlines to operationally fish this rocky/tidal habitat.

What separates Downeast Maine from other areas of the Maine coast is not an increased occurrence of rocky substrate but rather increased tidal flows and strong bottom currents. Tidal heights in Downeast Maine are significantly greater than in Southern Maine peaking at 22 feet, compared to only 10 feet in Southern Maine (www.maineboats.com/tide-charts). More frequent contact between the line and the bottom eventually abrades the groundline as it rubs back and forth on rocks and hard bottom making it operationally difficult to fish.

Similarly, the bottom current measured along the coast of Downeast Maine are significantly stronger than those measured in Southern Maine. The Gulf of Maine Ocean Observing System (GOMOOS) maintains a buoy array measuring current velocity at

50M depth at several cites in the Gulf of Maine. A comparison of current speeds measured at the Western Maine shelf (Buoy B) and the Eastern Maine shelf (Buoy I) from January through June 2008 indicate the Western Maine shelf current speed at .1m/s or lower, while the current speed at the Eastern Maine shelf was consistently greater than .25 spiking at greater than .5 m/s (www.gomoos.org). Preliminary work conducted by the Gulf of Maine Lobster Foundation (GOMLF) suggests that the current profile off Jonesport, Maine is consistent from the surface to 1 m off the bottom (Figures 2 and 3). This result corresponds to the CTD data that was presented at the April 2008 ALWTRT (Stockwell 2008) that indicated that the bottom mixed layer at many stations in the Downeast region were largely non-existent. The small bottom boundary layer result in the reduction of the arc height of floating groundlines by dragging groundlines down and indicates a well mixed water column that provides a physical barrier to concentrate zooplankton at any depth.

Plankton data collected in 2007 confirm the current observation by suggesting that the area proposed for exemption to the sinking groundline rule is not a good source of long term habitat for large whale species. While there are significant regional differences in the abundance of copepods, and more specifically *Calanus* species, none of the maximum levels recorded in the three regions of the Coast of Maine were high enough to support feeding when compared to published values for areas where whales typically forage (Baumgartner and Mate 2003; Wishner *et al* 1988; Beardsley *et al* 1996).

The Maine lobster industry is primarily an inshore fishery, with more than 75% of license holders limited to fishing within Maine state waters. Approximately 85% of Maine lobster gear is fished as singles, pairs, or triples (21% singles, 56% pairs, 7% triples). The amended ALWTRP universal mandate for sinking groundlines will likely result in a dramatic increase in the number of endlines fished in Downeast Maine waters due to the difficultly these lobstermen will face in fishing sinking groundline. Rather than risk a high rate of gear loss and the safety risk associated with hauling rope that is compromised or hung down, many lobstermen will reconfigure their gear from triples and pairs to single traps. The unintended consequence of the amended ALWTRP and resultant gear reconfiguration would likely be a significant increase of risk to whales from endlines.

Areas:

The State of Maine proposes a year-round exemption for the State sliver waters, defined as those waters between the exemption line established under the amended ALWTRP and the 3-mile territorial line, of Downeast Lobster Zones A-D (Figure 5). As a tradeoff, lobstermen fishing in this area will remove rope from the water via an endline cap and ban on the fishing of single traps, in combination with other measures described below.

Tradeoff Proposal:

Any lobsterman fishing gear in the State sliver waters in Zones A through D would adhere to the following vertical line reduction measures:

- 300 endline cap
- Singles Ban

In exchange, these lobstermen would be allowed to fish floating groundlines according to the following standards:

- Maximum 10 fathom poly groundlines
- Unique groundline marking – one 2 foot mark mid-way on the line

In order to eliminate safety concerns posed by senior citizens and students fishing in small skiffs around islands, the State of Maine proposes a ¼ nautical mile exemption for singles around the islands. These lobstermen would be allowed to fish singles, but would still adhere to the 300 endline cap.

To allow Downeast lobstermen the operational flexibility they will need to fish under the endline cap, the State of Maine will modify current state regulations that limit the number of traps on a line in order to allow for a broad range of gear reconfigurations (i.e. remove pair and triple only areas to allow for use of longer trawls).

To implement this plan in a timely manner and ensure credible enforcement, DMR will codify this plan in State rulemaking. DMR is bound by procedures set forth in the Maine's Administrative Procedures Act (APA), which allows new rules to be put in place in approximately 90 days.

Expected Conservation Benefits:

The amended ALWTRP accomplishes a 17% reduction of rope by removing floating groundlines from the water column when compared to the baseline (Table 3). The State of Maine's Sink Rope Exemption Proposal achieves a 25-32% reduction in rope when compared to the baseline, removing 5,957 to 7,808 miles of rope with a net decrease in the number of endlines in this area by 36% or 7,277 miles of rope. The net conservation benefit achieved by this proposal compared to the amended ALWTRP is a 9-18% reduction in rope, or 1,841 - 3,692 miles of rope removed from the water column.

Gear Marking:

The State of Maine proposes to limit the length of floating groundlines fished in the proposed exemption area to a maximum of 10 fathoms and to require that these floating groundlines be uniquely marked at the center point with a 2 foot colored tracer. Fishermen will have the option of painting, weaving in a colored tracer or attaching another permanent mark as approved by the NMFS Gear Team. Zones A/B will have a different color mark than Zones C/D. The State of Maine will work with the NMFS Gear Team to establish a unique color for each area. Endlines will be marked with a unique numbered tag, issued by the State of Maine, placed directly below the buoy for credible

Maine Marine Patrol enforcement of the endline cap. This tag system will be managed and enforced similarly to the Maine's existing trap tag program.

Implementation:

The State of Maine APA Rulemaking process takes approximately 90 days and will begin immediately following favorable consideration of this proposal by the Atlantic Large Whale Take Reduction Team (ALWTRT). These rules will be promulgated under the Commissioner's existing statutory authority to set rules to promote the conservation of marine organisms. This proposal will require a delay of implementation of the sinkrope groundline mandate in Downeast Maine within the Zones A-D sliver waters during the period following the implementation of the sinking groundline mandate until NOAA Fisheries is able to complete federal rulemaking for this exemption.

Monitoring:

Compliance and enforcement will be monitored by Maine Marine Patrol as part of the State's Joint law Enforcement Agreement with NOAA Fisheries. The State of Maine has an exemplary record of monitoring and enforcing existing ALWTRP measures. In addition, DMR supports the creation of an independent peer review panel to address Northern Gulf of Maine (NGOM) large whale risks and risk reduction measures as well as an independent peer review panel to advise and monitor all future forage research in the NGOM.

In addition to current research conducted by the State of Maine, which includes acoustic and habitat monitoring and near-shore *Calanus* forecasting, DMR is currently pursuing funding to begin a photo-identification regimen at three sights within the state that will detect and monitor entanglements and associated scarring rates. DMR is also in the process of completing a follow-up vertical line study to further document gear configurations for state and federal waters lobstermen, and has implemented trip level mandatory harvester reporting that will better inform this process as we move forward.

Contingency Plan:

Maine proposes to cluster and uniquely mark groundlines in the Zones A/B and C/D slivers. This division is justified by separating the differing bottom habitats between the bold shores of Zones A/B and multiple islands in Zones C/D. The lack of islands off Zones A/B in the exemption area distinguish it from Zones C/D as a more coastal and tide-driven habitat. A measurement of the maximum distance from shore documents this difference showing the average maximum distance from the mainland in the C/D group at approximately 21 nautical miles as compared to approximately 7.5 nautical miles in the A/B group. The occurrence of a confirmed entanglement of a strategic stock in a uniquely marked groundline in either cluster will result in an immediate return to sinking groundlines in that specific cluster and a corresponding return to the allowance of singles in that specific area. However, the endline cap will remain in place which will maintain the conservation benefit by preventing an increase in vertical lines. Maine Marine Patrol

will continue to monitor compliance and the Maine disentanglement network will continue to collaborate with NOAA Fisheries and the Provincetown Center for Coastal Studies for timely and trained response to reported entanglements.

Strategic Research:

DMR's 2008 research plans include acoustic monitoring for right whales around Mount Desert Rock, habitat monitoring at three sites within the state including Jeffrey's Ledge, Mid-coast and Mount Desert Rock, a state-wide plankton survey, near-shore model building for abundance of *Calanus*, and D-tagging humpback, fin and right whales in Downeast fishing waters. Additionally, research will continue on low-profile groundlines and endline risk reduction measures. Potential research projects that will require additional funding and/or discussion are cited below:

- Add endline configurations to harvester reporting logs
- Photo-identification/monitoring for entanglements and entanglement scarring – focus humpbacks and develop for fins
- Shortening groundlines
- Manufactured nugget unique rope marking
- Aerial surveys
- Expanded acoustic monitoring and real-time detection

Conservation Benefit

The Maine Department of Marine Resources (DMR) based its calculations on data from the 2006 Vertical Line Survey and 2006 State of Maine lobster trap tag purchases. Data from a 2003 ROV survey data and sea sampling data from 2001-2002, 2004-2006 were used as supporting information. The following text explains the specific methodologies used to calculate the reduction in line and the resulting conservation benefit. For analytical purposes, endlines and groundlines are considered on a one to one basis, with both being weighted equally as a risk to large whales.

Survey Background

In 2006 DMR responded to the need for baseline information regarding the potential entanglement risk due to vertical lines off Maine's coast required by the Atlantic Large Whale Take Reduction Team (ALWTRT). This was done through a collaborative mail survey with the University of Maine and the Maine lobster industry that aimed at establishing the baseline spatial and temporal patterns of vertical lines and gear configurations throughout Maine's coastal waters.

A vertical line was defined as the line that extends from the trap or traps on the ocean floor to the buoy at the surface and trap configuration was defined as the number of lobster traps set on a buoy. These patterns can range from singles (a single trap on a vertical line), pairs (two traps on a vertical line), triples (three traps on a vertical line), or

trawls (greater than three traps with either a single vertical line or multiple vertical lines). During the analysis of this survey any trawl with five or more traps was assumed to have two vertical lines, consistent with common fishing practices.

Surveys were sent to all of the 1,245 Maine lobstermen who were issued both a state and federal lobster license in 2006. Recipients were asked to fill out the survey and return it to DMR. The table below shows the number of surveys sent, the number of respondents and the response rate.

Summary of 2006 Vertical Line Survey Response Rate

Zone	Number of federal lobster permit holders	Number of Surveys Returned	Return Rate By Zone
A	268	40	14.9%
B	154	29	18.8%
C	155	37	23.9%
D	192	39	20.3%
E	132	22	16.7%
F	194	26	13.4%
G	150	23	15.3%
Total	**1,245**	**216**	**17.3%**

Results were entered into a database and analyzed by zone and distance from shore to establish the baseline trap configurations for these areas. The results of the survey can be found in the report at http://www.maine.gov/dmr/rm/whale/whale.html or request a hard copy from DMR (Smith 2006).

Although the 2006 Vertical Line Survey targeted only federally permitted lobster fishermen, the general trends within the data hold true for the fishery on the whole. For example, baseline trap configurations derived from the state's sea sampling program track well with those determined through the vertical line survey (Table 8). Further, outreach with lobstermen throughout the coast of Maine has confirmed that these baseline trap configurations are representative of fishing habits. The survey results further document the movement of the fishery which largely occurs in the summer months with the vast majority of vertical lines being found inside of three miles from shore. It is clear that even given the option to fish outside of 3 miles, many prefer to fish within state waters for much of the year. This choice is driven in large part by where the lobsters are most prevalent. The seasonal migration of lobsters moves inshore in the spring and summer and subsequently returns to deeper waters offshore in the fall (Carl Wilson pers communication).

This fishing pattern is confirmed by the increase in the number of vertical lines that occurs in April across all zones. In Zones D to the west, the number of vertical lines peak in July, and in Zones C to the east, the peak occurs in August. Following this peak in mid-summer, the number of vertical lines declines slowly through the months of October,

November and December. Inside 3 miles, the presence of vertical lines in January, February and March demonstrates that there are indeed people fishing, however, there are far fewer than in the summer. Over the course of the year, the number of vertical lines recorded gives a reliable idea of how much fishing is occurring. Data reported through this survey suggests that many fishermen are setting their gear in the spring, fishing hard through the summer and fall, thus putting most of the fishing intensity inshore during periods of time when whales have been sighted in waters of the NGOM.

The trend of seasonality affirms that most lobstermen, federally permitted or not, fish the peak months (the only months used here) inside of three miles. This survey is therefore relevant for the purposes used in the below analysis.

Conservation Benefit - Calculation Methods

Baseline

Baseline numbers and miles of rope for endlines and groundlines were calculated using gear configuration information from the 2006 DMR Vertical Line Survey as well as trap tags purchased in 2006. To accomplish this, trap configurations were taken from each Lobster Management Zones (A-D) for 0-3 miles in the months with the highest number of endlines recorded in those areas (Table 4). This occurred in August for all zones except Zone D, which had its peak in July. The number of traps in each configuration was extrapolated to the entire population of lobstermen in each Zone using 2006 numbers for trap tags purchased (Table 5). These numbers were then scaled to the size of the proposed exemption area in each Zone from A-D using calculated area estimates (Table 6). For example, 42% of Zone A's area from 0-3 miles would be designated as proposed exemption area, the rest is within the amended ALWTRP exemption line. Using that area percentage, 42% of the gear reported within 0-3 miles from shore would fall within the proposed exempted area. Area estimates were obtained using ArcGIS's ArcMAP program. The number of total endlines in each Zone was then calculated by assigning one line to configurations including singles, pairs, triples, and four's, and two lines to the remaining larger trawls. The length of each endline was calculated based on the average depth in an area. Using ArcMAP, twenty depth measurements in each lobster Zone were taken from within each of the proposed exemption area and averaged together. The length of an endline for the sliver in each zone was calculated to be 33% longer than the average depth, which is the standard fished by Maine lobstermen to compensate for tides. The length was then converted to miles.

A baseline was also calculated for the number and length (miles) of groundlines in these areas. The aggregate numbers for groundlines present in each zone's sliver were calculated using the same baseline trap configurations used to derive the endline lengths. To calculate the number of groundlines one groundline was assigned for pairs, two for triples and so on, and was extrapolated out to the entire population of lobsterman using the 2006 trap tags purchased (Table 5). Average groundline lengths were estimated in each Zone from a DMR survey done in 2003 that documented gear configurations using a

remotely operated vehicle (Table 7). The number of groundlines in an area was then multiplied by the average length and converted to miles.

Calculations are noted within the respective tables.

Sea Sampling Data

Concerns have been expressed that the 2006 Vertical Line Survey is not representative of the state fishery because it was sent to only lobstermen who held both a state and federal permit. However, the summer season is a time when the fishery is almost exclusively near-shore regardless of permit type due to the migration of lobsters. DMR does not share this concern, and therefore compared the gear configurations received from the survey with string types recorded by the state's Sea Sampling Program (Table 8). Only trips within the proposed exemption area in the peak months were used to correspond with the survey results used here. Trips were recorded from 2001-2002; 2004-2006. The results for Zones B-D are very similar to the survey results and reflective of the configuration of the fishery. Zone B shows a roughly 1/4, ¾ split between singles and pairs in both the survey and sea sampling data. Also showing consistency between data sets, Zone C is predominately reported as pairs and Zone D is split roughly in half between singles and pairs. Zone A is less similar between the two data sets but is still reflective of the fact that the fishery in that particular zone has a longer trawl component. One reason for the difference in data is the locations of the sea sampling trips. Figure 6 shows the sites in all zones of corresponding sea sampling trips. Zone A is largely concentrated offshore at Machias Seal Island and is not reflecting the shorter configurations of gear used near-shore as the survey results show.

Endline Cap and Singles Ban

The conservation benefit of the 300 endline cap and singles ban was calculated as a range. The lower number in the range, "Configuration Change", represents the benefit gained if all lobstermen only changed the configuration of their gear and fished the same number of traps to comply with the endline cap. The larger number in the range, "Trap Adjustment", represents the benefit gained assuming that all lobstermen would continue to fish their current gear configuration (except moving singles to pairs) but reduce the number of traps to comply with the endline cap. DMR received comments from the industry that both of these scenarios would take place in order to deal with an endline cap and therefore did not assume that one would occur over the other. Additionally, the trap adjustment scenario was run with the raw survey data to validate the range calculated above.

To determine the conservation benefit using the "Configuration Change" and "Trap Adjustment" assumptions, a "fisher unit" was established by dividing the total number of traps in each zone's sliver by 800, which is the maximum number of traps that any single lobsterman can fish. For example, lobstermen in Zone A purchased 279,229 traps within the sliver, making up 349 fisher units for that zone. The changes for both "Configuration Change" and "Trap Adjustment" were made to one fisher unit and then expanded up to

the population. In the "Configuration Change" scenario the percentages of gear configurations from the survey change to accommodate the endline cap (Tables 9-12). It was assumed that a lobsterman would trawl up to the smallest gear configuration allowable under the endline cap. In Zone A, a lobsterman would have to shift all of his singles and about half of his pairs to triples to keep all 800 traps and be under the endline cap. The numbers and miles of endlines and groundlines are calculated using the methodology described in the Baseline section of this document to determine the amount of rope in the water column resulting from reconfiguring gear to meet the endline cap. Once this is determined for an individual fisher unit the numbers are extrapolated out to all units in a zone to represent the population of lobstermen in that zone's proposed exempt area. The conservation benefit achieved from the "Trap Adjustment" scenario is done using this same methodology, except that the number of traps in a unit is adjusted to meet the endline cap while the gear configuration remains constant (except for singles moving to pairs under the singles ban). For example, a Zone A lobsterman would reduce the amount of traps fished from 800 to 664 to comply with the cap.

To provide an additional check to these calculations, the trap adjustment scenario was also done using the raw survey data to validate the range calculated above. This was done by individually adjusting the number of traps a survey respondent fished based on the declared gear configuration. This resulted in a decrease in the number of traps surveyed in each zone (Table 13). That percent decline in the number of traps was multiplied by the number of traps fished in each zone's proposed exempted area to get a new total of traps fished in that area (Table 14). For example, in Zone A there would be a 4% decrease in the number of traps fished. The total number of traps in the proposed exempted area for that zone, 279,229, is multiplied by one minus that percentage to get a new total of 269,456 traps. That new number was then multiplied through the configurations from the survey as described above in the baseline calculations.

Calculations are noted within the respective tables.

The proposal includes a ¼ mile buffer around the islands where singles would be allowed in order to accommodate the safety issues related to children and seniors fishing from small boats. The areas that this would affect were re-calculated and the change did not affect the area calculations for any zone (all numbers stayed within rounding) so the buffer was therefore determined to be negligible.

Rope Reductions

Rope reductions were calculated for both the amended ALWTRP with the sinking groundline requirement in place and on a zone by zone basis for the 300 endline cap and singles ban in the proposed exemption trade-off (Table 3). Negative numbers in the table represent rope taken out of the water while positive values represent rope being put back into the water column. The baseline numbers for groundlines were calculated using current average lengths from the 2003 ROV survey as described above (Table 7). Groundlines being added back into the water column (as a result of the exemption) in the form of floating groundlines were calculated back in at 10 fathom lengths as proposed in

the plan. The reduction in endlines accomplished by the singles ban and the endline cap are presented in miles and also yield new endline totals and a % decrease in the miles of endlines in an area. The net rope reduction and corresponding percentage reduction achieved through this proposal as compared to the baseline are calculated by the following equation:

$$Linereduction_{net} = (EL_{new} + GL_{float}) - (EL_{base} + GL_{float})$$

Where EL = enlines, GL = groundline under baseline and new configuration.

Rope reductions and respective percentages as compared to the amended ALWTRP are calculated by the following equation:

$$Linereduction_{ALWTRP} = (EL_{new} + GL_{float}) - (EL_{base} + GL_{snk})$$

Where EL = enlines, GL = groundline , under baseline and new configuration.

Results and Discussion

Baseline

The baseline numbers of endlines and groundlines in the proposed areas were calculated as discussed above from the 2006 DMR Vertical Line Survey. That survey yielded information regarding the baseline configurations of gear used in different areas of the coast. Table 4 consists of a current (baseline) breakdown of gear configurations by lobster management Zone (A-D). These numbers represent the current configurations before the October 5, 2008 deadline. The results that are immediately apparent are the large proportions of shorter sets of gear, namely singles, pairs, and triples. In state waters Zones B and C have very high densities of shorter gear configurations with 83% and 92% of their gear make up of pairs respectively. These gear configurations were then calculated out to determine the baseline for the numbers and miles of endlines and groundlines in each area. In 2006 Zones A-D had a total of 19,984 miles of endlines and 4,116 miles of floating groundline within the area being proposed for sinking groundline exemption.

Amended ALWTRP

The numbers for the amended ALWTRP that will go into effect October, 2008 have been calculated in Table 3 for the proposed exemption areas. Compared to the 2006 baseline the amended ALWTRP with its sinking groundline provision achieves a conservation benefit of a 17% reduction of the rope out of the water column. This is solely accomplished by removing 4,116 miles of floating groundlines and replacing them with sinking groundline.

Exemption Area Proposal

The proposed exemption area will establish a 300 endline cap and a ban on singles. The conservation benefit of this tradeoff has been calculated in a range using gear configuration changes and trap adjustments to stay under the endline cap (Table 3). For the proposed area between the amended ALWTRP exemption line and the state waters boundary in Lobster Zones A-D there will be a net conservation benefit between 25-32% when compared to the 2006 baseline numbers. This translates into 5,957 – 7,808 miles of rope being taken out of the water column from the status quo. This benefit includes a 36% or 7,277 mile reduction in endlines alone (up to 49% in any one zone).

After the universal sinking groundline component of the amended ALWTRP goes into effect in October, 2008, the baseline for the amount of rope in the water column changes due to the lack of floating groundline. When the current proposed plan is compared to the amended ALWTRP there is a net conservation benefit of 9-18% greater than the amended plan or 1,841 – 3,692 additional miles of rope out of the water column (up to a 34% net reduction in Zone D).

The numbers calculated for the conservation benefit were verified against numbers generated by changing the actual raw survey responses for trap adjustments (Table 3). Calculating the benefit this way returns a 25% net gain (6,053 miles of rope) when compared to the 2006 baseline and a 10% net gain (1,936 miles) greater than the amended ALWTRP.

Conclusion

DMR has long asserted that, due to the rocky and tidal habitat of the NGOM, some flotation is needed in groundlines in order for the Maine lobster fishery to fish safely and efficiently. For the past five years, DMR has collaborated with NOAA Fisheries and the Maine lobster fishing industry to develop and test alternative fishing gear modifications that will reduce the risk of entanglement to large whales while maintaining operational viability for the Maine lobster fishery. While new gear technologies have not yet been approved by the ALWTRT, the concept of a conservation trade-off may yield the result that DMR has been striving for, ensured industry viability while reducing risk of entanglement to large whales. The proposed exemption to the sinking groundline requirement of the amended ALWTRP for Downeast Maine achieves not simply a conservation trade-off but offers an opportunity to realize real and significant risk reductions in the form of 36% of endlines in the sliver out of the water. This is a reduction of 9-18% in rope over and above what the current plan can accomplish and 25-32% less rope in the water column than the status quo. DMR is confident that through this trade-off proposal that significant steps can be made to conserve threatened and endangered whales without also endangering the State of Maine's vital lobster industry.

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Web Sites:

www.maineboats.com/tide-charts.com
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Amended Maine Low-Profile Groundline Area Proposal and Line Field Testing Report

Submitted to the Atlantic Large Whale Take Reduction Team

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April 10, 2008

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Introduction

The Maine Department of Marine Resources (DMR) has long asserted that, due to the rocky and tidal habitat of the Northern Gulf of Maine (NGOM), some flotation is needed in groundlines in order for the Maine lobster fishery to fish safely and efficiently. For the past five years, DMR has collaborated with NOAA Fisheries and the Maine lobster fishing industry to develop and test alternative fishing gear modifications that will reduce the risk of entanglement to large whales while maintaining operational viability for the Maine lobster fishery. In 2006, DMR presented the Atlantic Large Whale Take Reduction Team (ALWTRT) a detailed summary report of a promising low-profile groundline alternative technology. This groundline prototype floated less than one meter from the bottom but was not yet significantly abrasion resistant. Over this past year DMR has worked with rope manufacturers to resolve this operational issue.

The publication of the Final Rules to Amend the Atlantic Large Whale Take Reduction Plan (ALWTRP) by NOAA Fisheries on October 5, 2007 resulted in Maine lobstermen considering alternative options to the way that they configure their fishing gear in order to address the operational challenges of the mandatory sinking groundline requirement. The Maine lobster industry is an inshore fishery that fishes 85% of its gear as singles, pairs, or triples (21% singles, 56% pairs, 7% triples). Using short configurations of gear allows a Maine lobsterman to efficiently work a variable and broken rocky bottom while avoiding gear conflict that occurs with longer trawls in congested fishing areas. It is widely asserted that many fishermen will experience significant gear loss while fishing sink rope in these areas. For this reason lobstermen are considering breaking their gear up into pairs or singles to eliminate or reduce gear loss caused when sinking groundline chafes or gets hung down. A change of this kind, from pairs to singles, will increase the time it takes a fisherman to haul all of his/her gear. However, after discussions with lobstermen on this matter it is the general consensus that a couple of extra hours a day is sufficient to handle the increase in hauling and is worth the decreased risk of gear loss. DMR highlights that as gear is reconfigured this way it will significantly increase the number of endlines (the line from the trap to the buoy sometimes referred to as vertical lines) in the water column within the NGOM. Consequently, the Final Amended ALWTRP will result in a large scale increase in the number of endlines greatly increasing risk to large whales in the NGOM, a risk regarded by some as a larger threat of entanglement to large whales than groundlines. Therefore, it's with a dual purpose that DMR proposes low-profile groundline for use in specific NGOM areas. The implementation of the proposed low-profile groundline will result in up to a 94% reduction in the amount of floating rope in the water column while not only preventing a build up of endlines from the existing effort but actually reducing the amount of vertical line in the water by up to 16,862 miles of rope. Maine's lobster fishery will be able to operationally fish with a viable alternative groundline while concurrently reducing the risk of groundline entanglements and preventing the substantial increase in the number of endlines.

Updated Proposed Amendment to the Atlantic Large Whale Take Reduction Plan

See Figure 1

Universal:

- Maintain current technology list in Maine exempted waters (Figure 1 – gray area)

Maine State Waters Sliver – Outside the Exemption Area (Figure 1 – yellow area):

- Maintain current exemption line (outlined in the Amended ALWTRP)
- Implementation of low-profile groundlines (maximum specific gravity of 1.02) – maximum 10 fathom length between traps
- Uniquely mark low-profile groundlines with an industry consistent cord tracer
- Sink rope groundlines in Mt. Desert Rock state waters area
- No singles
- No more than 1 endline for 5 traps or less
- Adopt measures in Maine state rulemaking

Maine Federal Waters (Figure 1 – pink area):

- Implementation of low-profile groundlines in specific rocky/tidal habitat areas (Lobster Zones A-D) – maximum 25 fathom length

Aspects of the Proposed Amendment

Universal

- *Maintain the current technology list in all current exempted Maine waters.* Though not required for exempted areas in the Amended ALWTRP, this will maintain a level of protection within all state waters with the continued use of weak links and existing gear marking.

Maine State Waters Sliver

- *Maintain current exemption line.* Floating groundlines will be allowed within near shore parts of state waters as outlined in the Amended ALWTRP.
- *Low-profile groundline* is defined as a rope with a maximum specific gravity of 1.02. This is the density of rope that data has demonstrated an average arc height off the bottom of 0.19m and maximum arc height of 0.97 m (Table 1). The concept of low-profile rope has been a contested topic for a number of years in the ALWTRT forum. After five years of research and eight field tested products of low-profile line, DMR has successfully developed a product that reduces the arc height of groundlines by up to 94% (compared to standard floating line) while allowing a very low level of floatation as required for operational Maine fishing practices. Additionally, the state waters low-profile

area will require 10 fathom groundline maximums. This length will maintain maximum arc heights less than 1 meter and ensure that while the number of groundlines increases due to a singles ban, the overall amount of rope in the water due to groundlines doesn't increase.

- *Uniquely marked* - Low-profile groundlines will a have a manufactured uniform cord tracer for identification. Manufacturers already do uniform marking of this type for identifying groups of rope (for example all neutrally buoyant lines carry the same color tracer). A mandate for a uniform tracer will allow for field enforcement by Maine Marine Patrol and other enforcement officials and as a means of assessing the rope in the event of an entanglement. If there is question as to the make up of the rope a sample can be taken for specific gravity analysis in a laboratory setting.
- *Sinking groundline in Mount Desert Rock State Waters.* Mount Desert Rock State waters will maintain sinking groundlines due to the occurrence of large whales within the area on an annual basis. A project was recently undertaken by DMR in collaborations with College of the Atlantic/Allied Whale and the Bar Harbor Whale Watch to digitize 26 years of logbook sightings (1982 – present) data in the area of Mount Desert Island and Mount Desert Rock. The results of that endeavor can be seen in Figure 2a-b with a significant number of sightings of humpback and fin whales through out the state waters around Mount Desert Rock. Additionally, there is a pocket of sightings of right whales two to three miles to the east of Mount Desert Rock in an area that has been named by local whale watch boats "the right whale hole". It is in light of these sightings that this area was determined to remain sinking groundline as outlined in the Amended ALWTRP. It is likely that as a result of this mandate fishermen will either choose to fish singles in this area or move their gear out completely.
- *Singles ban* and the requirement to have only *one endline for 5 traps or less* will greatly reduce the number of endlines within the state waters low-profile area from current effort as well as prevent a build up of endlines. This measure reinforces the State of Maine and the lobster industry's commitment to reducing risk of entanglement to whales while attempting to flush out a more comprehensive conservation plan that also works for this important industry.
- *Adopt into state rulemaking.* All proposed measures will be adopted into state rulemaking for enforcement purposes and legal implementation for immediate risk reduction benefits.
- *Low-profile in federal area with a maximum length of 25 fathoms.* Greater than 10 fathom groundline length is needed in this area to account for safety issues related to the greater depths. As a fisherman hauls a trawl from greater depths the groundlines between traps must have sufficient length so that the full weight of the trawls is not put on the block and hauler at once. Data shows that while float rope arc heights increase with length, there was no difference with low-profile rope (t-tests between arc heights of 6 and 18 fathom length low-profile groundlines resulting in a non-significant p-value of 0.377 while the same test for float rope yielded a significant 0.0076 p-value).

Areas Selected

The proposed low-profile areas were selected based both on the operational need for some flotation in groundlines as well as the best available data on whale sightings in the NGOM. Figures 3 a-c demonstrate the widespread rocky and broken bottom that Maine fishermen work around on a daily basis. Maine lobstermen commented throughout the rule making process that some flotation is needed in groundline to fish the kind of rocky bottom, tidal habitat that is common on Maine's coast. Much of the near-shore coast is predominately rock. Fishing with sink rope groundlines in these areas presents an operational challenge due to frequent hang downs, safety concerns and economic hardships due to gear loss and replacement costs. The data in Figure 3 was assembled by the Maine Geological Survey in 1996 (Barnhardt et al. 1996) taken by side-scan sonar, seismic reflection and bottom samples used to elucidate the bottom topography for near shore Maine. All areas surveyed contained large segments made up predominately of rock and hard bottom. Table 2 is a representation of what is seen on the map in Figure 3. The breakdown of a predominately rocky bottom by lobster Zone shows percentages up to 54% in Zone E, meaning of the bottom samples taken in that Zone, 54% consisted of predominately rocky habitat. These numbers translate to 48% coast wide across all Zones. Additionally, when one considers other habitat types (gravel, sand and mud) that also contain some rocky habitat the percentage increases to close to 60% in Zone E and 52% coast wide. This reality coupled with the lobstermen's need to keep gear configurations short (77% of gear coast wide is currently singles and pairs) to efficiently fish this type of bottom will result in a wide spread change in fishing practices.

There are pockets of areas in Maine that have used sink line effectively as groundlines, such as Grand Manan Channel in Downeast Maine. This area is predominately gravel and can be seen in the eastern most habitat in Figure 3a. This area allows fishermen some leeway in groundline types, including large diameter sinking rope (1/2 inch) as has been discussed in previous TRT and other meetings by a fisherman in this area. This scenario, while true for that particular instance of fishing location and style is not the case for the vast majority of lobstermen Downeast. DMR still believes that blanket measures, such as the sink line mandate, will not work for the majority of lobstermen who deal with severe bottom types in most other areas of the state.

A rocky bottom alone is not the only environmental factor that contributes to high rates of gear loss in Maine coastal waters due to rope chafing and hang downs. Tidal currents in many areas of the state push even float rope to the bottom and work to abrade rope as it rubs back and forth on rocks and hard bottom. The Gulf of Maine Lobster Foundation (GOMLF) received a Northeast Consortium development grant to measure bottom currents off of Jonesport Maine for five months through the peak fishing season (June, July, August, September, and November of 2007). Two devices were deployed, an acoustic Doppler current profiler to get the current measurements throughout a vertical profile of the water column and a mechanical flow meter near the bottom set next to a 20 trap trawl. The preliminary results can be seen in Figures 4 and 5. The results portrayed

a different story than one might expect for bottom currents. In Figure 4, the current does not decrease significantly in speed until about one meter off the bottom and the speeds on the bottom were stronger than expected. Figure 5 portrays the current at one fathom or six feet off the bottom. Here the current velocity is still recorded at speeds up to one knot. The preliminary findings from this study suggest that currents in portions of Maine, particularly in the Downeast region, are stronger than expected all the way to the bottom. Not only does this act to reduce the arc height of groundlines but it keeps the water column well mixed and therefore not able to concentrate zooplankton near the bottom.

The above data as well as extensive outreach with the fishing industry aided DMR in the generation of areas proposed for the use of low-profile line. The areas are weighted towards the mid-coast and Downeast regions due to bottom type and the occurrence of high tidal currents in these areas.

The needs of the fishing industry were not the only driving factors in the placement of the low-profile areas proposed. (Figure 6; Figure 2 a-b). The sightings in Figure 6 were taken from a DMR maintained database that includes sightings dated back to 1972 from the University of Rhode Island maintained database, and more recently sightings from NOAA aerial surveys, local whale watch boats, as well as fishermen and other local mariners. The seaward boundaries of these areas were chosen to remain inside of large concentrations of whale sightings. Special attention was paid to aggregations of right whale sightings, one of which was identified through the joint DMR, College of the Atlantic/Allied Whale project to digitize historic sightings logbooks (Figure 2). Using this data, state waters around Mount Desert Rock were determined to remain as a sinking groundline despite the depth and bottom type in this area. Lobster Zones E, F and G do not include any federal waters in the low-profile proposal due to the annual occurrence of large whales closer to shore in these Zones as well as the historic locations of DAM closures (Figure 7). DAM's were designed to indicate persistent potentially feeding aggregations of right whales. Therefore, federal waters where these aggregations took place were not considered for the use of low-profile line.

A major driving force in the way that the lines were selected and drawn was the potential to enforce them once they are a part of the regulations. To this end all of the seaward boundaries of low-profile areas are defined by Loran lines. This is an easy way to locate and understand the different fishing areas that will be created in the state. Most fishermen still use Loran on board their boats and will be able to discern easily where their gear is being set in relation to those lines. Additionally, Maine Marine Patrol will have a straight forward way to carry out enforcement of these lines.

Timeline

Upon favorable consideration of this proposal, DMR will immediately begin rulemaking to adopt all measures into state regulations. The State of Maine APA process takes approximately ninety days, and DMR anticipates that all measures will be in place by the October 5, 2008 deadline as specified in the amended ALWTRP

Enforcement

Adoption of these rules will allow for Maine Marine Patrol to enforce these regulations as part of Maine's Joint law Enforcement Agreement with NOAA Fisheries. Maine Marine Patrol has documented a compliance rate of all State ALWTRT regulations greater than 97% and 95% in the Maine enforced DAM Zones. Marine Patrol will continue a high level of at sea enforcement. Unique tracer cord marking of low-profile line will enable simple and effective on the water enforcement. Appendix I includes a copy of the 2007 enforcement report that was put out by Maine Marine Patrol.

Contingency Plan

Maine currently holds authority to disentangle minke whales, and the trained industry and Marine Patrol disentanglement team has successfully performed multiple minke whale disentanglements. Cooperatively with Provincetown Center for Coastal Studies, NOAA Fisheries and Allied Whale, DMR has trained over 300 fishermen in basic whale identification and behavior as well as stand-by and disentanglement procedures. Every Maine Marine Patrol officer is given basic hands on disentanglement training as well with some higher level training for the boat specialists. Training is on-going and DMR continues to work with partners to increase training levels and offer any stand-by and disentanglement support necessary in the event of a humpback, finback, or right whale entanglement. Multiple training sessions are planned for the spring of 2008 including industry basic and refresher courses, upper level training for Marine Patrol boat specialists, and apprentice training for two DMR staff. In addition to training there are specialized disentanglement tool kits that are maintained by DMR in 25 locations coast-wide, including 6 industry boats and 19 Marine Patrol vessels. Provincetown Center for Coastal Studies has also placed a satellite tag on a Marine patrol vessel.

All low-profile gear configurations and associated marking will be adopted through the state rulemaking process for ease of enforcement by the Maine Marine Patrol.

Additionally, research is being conducted by DMR to better assess the entanglement risk associated with low-profile groundline and endlines. This research is discussed in detail in subsequent sections of this document.

In the unlikely event of a verified (by the NOAA Fisheries gear team) entanglement in low-profile line, DMR will work with NOAA Fisheries to analyze the specific entanglement and reassess the area in which low-profile line is allowed. The results of this analysis will determine potential modifications to the specific low-profile areas and the need for real time monitoring.

Methods and Results for Determining Baseline Effort, Potential Increases in Endlines and the Effect of the Implementation of Low-Profile Line

Methods

Baseline

Baseline numbers and amounts (miles) of rope for endlines and groundlines were calculated using the 2006 DMR Vertical Line Survey. To accomplish this, trap configurations were taken from each Lobster Management Zone (A-G) for both 0-3 miles and 3-12 miles in the months with the highest number of endlines recorded in those areas. For example, Zone A had a peak in Aug. for 0-3 miles and in Nov. for 3-12. This information can be found in the vertical line report given to the ALWTRT at the Dec. 2006 meeting or on DMR's website. The number of traps in each configuration was extrapolated out to the entire population of lobstermen in each Zone using the most recent numbers available for trap tags purchased. These numbers were then scaled to the size of the State and Federal low-profile areas in each Zone using calculated area estimates. For example, 42% of Zone A's area from 0-3 miles would fall within the proposed low-profile area, the rest is within the exemption line. Using that area percentage, 42% of the gear reported within 0-3 miles from shore would fall within the proposed low-profile area. Area estimates were obtained using ArcGIS's ArcMap program. The number of total endlines in each Zone was then calculated by assigning one line to configurations including singles, pairs, triples, and four's, and two lines to the remaining larger trawls. To get a sense of how much rope the number of endlines translates to, the amount of rope in miles was calculated based on the average depth in an area. Using ArcMAP, twenty depth measurements in each lobster Zone were taken from within each of the state and federal proposed low-profile areas and averaged together. The length of an endline in each area was calculated to be 33% longer than the average depth to compensate for tides. The length was then converted to miles.

A baseline was also calculated for the number and amount (miles) of groundlines in these areas. The aggregate numbers for groundlines present in each area were simply calculated from the configurations in the survey, one groundline for pairs, two for triples and so on and multiplied out as done above to cover all trap tags purchased within the proposed low-profile area. This data was also translated into miles. Average groundline lengths were estimated in each Zone from a DMR survey done in 2003 that documented gear configurations using a remotely operated vehicle (Table 5). The number of groundlines in an area was then multiplied by the average length and converted to miles.

Sink line scenario

Once the baseline was calculated DMR compared some broad changes in gear configurations in the proposed low-profile areas to those original numbers to illustrate how they would change as lobstermen break up their gear to use sinking groundline as now mandated in the ALWTRP. These included scenarios with up to 6 trap trawls being broken up to singles in state waters and up to 6 trap trawls being broken up into pairs in

federal waters (already a singles ban in place in federal waters). The following scenarios were calculated:

- *Up to 3's* – In state waters any traps configured as pairs or triples were broken up into singles. In federal waters any traps configured as triples were broken up into pairs. The numbers and amounts of endlines were then re-calculated as described above.
- *Up to 4's* – In state waters any traps configured as pairs, triples, or in four trap trawls were broken up into singles. In federal waters any traps configured as triples or four trap trawls were broken up into pairs. The numbers were re-calculated as described above.
- *Up to 5's* – In state waters any traps configured as pairs, triples, or four or five trap trawls were broken up into singles. In federal waters any traps configured as triples, or four or five trap trawls were broken into pairs. The numbers were re-calculated as described above.
- *Up to 6's* - In state waters any traps configured as pairs, triples, or four, five or six trap trawls were broken up into singles. In federal waters any traps configured as triples, or four, five or six trap trawls were broken into pairs. The numbers were re-calculated as described above.

Low-profile scenario

One scenario was also calculated to show the changes in endlines and groundlines due to the requirements of the low-profile proposal. Numbers and amounts of rope for both endlines and groundlines were calculated as described above with the only configuration change occurring in the state proposed low-profile areas where singles will be banned. In these areas singles were assumed to change to pairs. During the groundline calculations, the lengths used to calculate the miles of rope in a given area were the maximum allowed under the low-profile proposal (10 fathom in state waters and 25 fathom in federal waters).

Results and Discussion

Baseline

The numbers of endlines and groundlines in the proposed areas were calculated as discussed above from the 2006 DMR Vertical Line Survey. That survey yielded information regarding the configurations of gear used in different areas of the coast. It is within these configurations that the information on the impact of the impending sinking groundline mandate can be found. Table 3 consists of a breakdown of gear configurations by lobster management Zone (A-G) and proposed low-profile areas (state, federal and both combined). These numbers represent the current configurations before the October 5, 2008 deadline. The results that are immediately apparent are the large proportions of shorter sets of gear, namely singles, pairs, and triples in state waters (24, 57, and 25% respectively) and pairs in federal waters (32%). In state water some Zones (such as B and C) have very high densities of shorter gear configurations with 83 and 92% of their gear make up of pairs respectively. Federal waters follow closely in Zones

B and D with 81 and 62% respectively. These gear configurations were then calculated out to determine the baseline for the numbers and miles of endlines and groundlines in each area. Table 4 contains the current calculations for endlines and groundlines by Lobster Zone and low-profile proposed areas. The low-profile areas make up about 31% and 16% of state and federal waters (out to 12 miles) respectively. Within those areas there are a total of 615,406 endlines currently, which translates to about 26,784 miles worth of rope. Groundlines account for 7,062 miles of rope collectively with a total of about 514,937 lines. These numbers are also broken down by management Zone and proposed area.

Endline increase

The high densities of short gear configurations that are seen in the baseline information in Tables 3 and 4 will be broken up into singles in state waters and pairs in federal waters. Fishing singles or pairs in these areas eliminates or decreases the need to use sinking groundline and allows lobstermen to work hard rocky bottom without losing gear due to chafing and excess wear.

The reconfiguring of gear to predominately singles will result in a significant build up in the number of endlines seen in these areas. Its DMR's intent to prevent this build up with a holistic plan that accomplishes two goals: allows minimal flotation in groundlines for use in specific areas of the state (see Figure 1) and provides a greater reduction of risk of entanglements to large whales in the NGOM than the amended ALWTRP. In this effort DMR has calculated not only baseline numbers for the amount of rope in the proposed areas of change but also tried to simulate what a few different scenarios of configuration changes would look like. Table 6 presents the results of several of these scenarios. Currently there is a total of 26,784 miles of endlines in state and federal proposed low-profile areas combined. If the current sinking groundline mandate remains in place in these areas the increases in endlines due to a build up of singles would range from 52 to 63% depending on how vast the change-over is. If only pairs and triples change to singles in the state area and triples change to pairs in the federal area then there would be a 52% increase in the number of endlines resulting in a total of 40,780 miles of rope (a 13,995 mile increase). Changes in gear configurations were calculated for up to six trap trawls changing over to singles or pairs. This worst case scenario resulted in a 63% increase for a total of 43,646 miles of rope (a 16,862 mile) increase. The information in Table 6 is also broken up by low-profile area. The majority of the configuration changes occur in the state low-profile proposed area due to the density of gear there, up to a 68% increase in endlines.

Low-profile proposal

A large part of the plan that DMR has laid out includes a ban on gear fished as singles in the state low-profile area (a ban on singles already exists in federal waters). Table 7 contains the calculations for the impact that the low-profile proposal will have on the amount of rope in the water in these areas. If singles are banned in the state low-profile area there will be a total reduction of 21% in the number of endlines compared to the

current baseline numbers (a decrease by 4,782 miles of rope). It is important to remember that the numbers of endlines and groundlines are related. As there is a decrease in the number of endlines due to trawling up gear, there is an opposing increase in the number of groundlines in the water. However, there are length requirements for groundlines in the low-profile areas under DMR's proposed Amendment. Although there will be an increase in the number of groundlines in the water, the overall amount of rope will actually decrease by about 342 miles or by about 5%.

Additional Justification

When considering a proposal such as this the idea of risk is a recurring theme. While this is hard to ascertain with minimal data in the region it is a vital concern. Figures 2a-b and Figure 6 show the cumulative sightings in DMR's database of all three species of whales protected under the ALWTRP from 1967 to present. Table 8 shows a breakdown of the sightings in number format by area presented on the map in Figure 6. There are a total of 1,126 sightings from shore out to 12 miles of all three species. Of those 1,126 sightings 121 or 11% of them occur within the exemption area that was defined in the Final Rule. By comparison only 9% of those sightings occur within the proposed state low-profile area and only 0.6% occurs within the federal low-profile area (both areas considered together result in 9% of the total sightings). Conversely, the sightings that occur outside of either proposed area make up 80% of the total sightings out to 12 miles. While there seem to be significant percentages of sightings within some Zones (50 and 46% within the state low-profile areas in Zones C and D respectively), there are actually relatively few sightings occurring in these Zones compared to neighboring Zones (a total of 62 and 71 compared to over 300 in both Zones B and E). DMR is confident that the low-profile areas proposed are of low entanglement risk to large whales in the region. There are fewer sightings in these areas than in the area determined to be exempt from risk reduction measures. The proposed Amendment effects a significant reduction in the risk of entanglement to large whales in the form of a reduction of rope in the water. Maine's proposal for low-profile use areas not only prevents a substantive rope build up but reduces rope from current levels, something the current ALWTRP does not accomplish.

Research

Large whale foraging and diving behavior over rocky and tidal habitats must be conducted in the NGOM in light of questions raised about the risk reduction achieved by low-profile lines. Although work has shown regular feeding of right whales within the engybenthic layer near the bottom in Cape Cod Bay and other habitats made up of sand and mud, little is known about how right and other large whales utilize the water column during feeding or alternate behaviors over a hard and variable substrate. Specifically, the depth at which a large whale will dive is of vital importance when assessing the use of line that does not lay flat on the bottom.

CTD/Plankton survey

DMR and the Maine lobster industry fully comprehend the importance of understanding whale behavior when trying to mitigate the risk of entanglement in both groundlines and endlines. To this point, in August through October of 2007 DMR conducted a CTD and plankton survey collaboratively with the lobster industry and the University of New England in the proposed low-profile use areas to begin to understand the potential for large whale prey to aggregate near the bottom and at what depth that might occur. The sampling transects can be seen in Figure 8 and range from mid-coast to downeast Maine. Each line was sampled with a vertical CTD drop and two vertical plankton tows using 200µ mesh nets. The plankton analysis was not ready at the time of submission but will be including in the Maine Department of Marine Resources Large Whale Conservation Program 2007/2008 Report available at the TRT. The CTD data was used to determine the height and width of the bottom mixed layer (BML) in the water column. This measure was used because in Baumgartner and Mate (2003) the average dive depth of a right whale correlated with the average depth of the BML (R = 0.865). It was also stated in that study that Calanus tended to aggregate an average of 7 meters above the BML. Here we sought to determine the occurrence and depth of the BML over rocky bottom habitat and whether those conditions might be right for the aggregation of right whale prey near the bottom where low-profile groundline would occur.

The BML was determined to be the deepest depth at which the density differed from the bottom density by 0.05 kg m^{-3} (Baumgartner et al. 2003). After density was calculated using Seabird software the resulting data was categorized into "shallow" and "deep" bottom mixed layer sites. Table 9 displays the difference between these two categories with "shallow BML" averaging 23 m depth and 40 m width while "deep BML" averaged 74 m depths and 0.64 m widths. The sample sites in Figure 8 are displayed by color, blue for shallow BML sites, orange for deep BML sites and red for sites that had no density change at all. The majority of the sample sites in Downeast Maine (east of Mount Desert Island) have BML's very close to the bottom or none at all. This is potentially due to the tidal currents measured in this area by the GOMLF discussed previously that may act to mix the water column and prevent this layer from forming. The data was also broken up into sample site depth (Table 10). In this analysis 100% of the sites in 40 meters or less of water had shallow BML, followed by 68% from 40-80 meters and only 43% in 80+ meters (maximum of 182 m). Also of note was that 100% of all sample sites in more than 93 meters of water had deep or non-existent BML's. Figure 9 a-c shows some representative BML depths in relation to bottom depth. Figure 9a is a graph of sample line 17 and depicts the lack of density changes in the first four sites sampled and then a switch to a very shallow BML, just under the surface. Figure 9b depicts samples from line 6 and shows where there are more fluctuations in density changes. The BML starts off near the surface, disappears completely at station number 21 and then reappears deeper for the remaining sites. Figure 9c depicts the samples from line 13. This line starts with a relatively shallow BML which disappears at site number 59 and the line remains mixed until the last station which is still very deep.

The aggregation of Calanus at many of these sites, especially Downeast where extensive mixing occurs and many sites saw no change in density, seems unlikely but will be determined by the plankton samples when analysis is finalized. Baumgartner *et al.* (2003) states that the probability of right whales feeding increased where the BML is higher in the water column. This coupled with the statement in Baumgartner and Mate (2003) that right whale feeding dives did not occur near the bottom leads one to conclude that risk of entanglement at or very near the bottom is low. Right whales tagged in Baumgartner's studies did venture to the bottom only occasionally in v-shaped dives but he states that none remained there. A more extensive write up of this research will be available at the TRT in the Maine Department of Marine Resources Large Whale Conservation Program 2007/2008 Report.

Right Whale Tagging Project

A right whale tagging study to determine dive and foraging behaviors in Maine inshore fishing areas was attempted in the summer of 2007. No whales were tagged but a cruise report, track lines and sightings from the trip will be included in the Maine Department of Marine Resources Large Whale Conservation Program 2007/2008 Report available at the TRT. DMR is collaborating again in the summer of 2008 with Ocean Works Group Inc. and Woods Hole Oceanographic Institute to attempt the project again, this time extending the species to fin and humpback whales as well.

Digitizing Logbook Sightings Data

In a collaborative project with the College of the Atlantic/Allied Whale and the Bar Harbor Whale Watch sightings dating back to 1982 were transferred from written logbooks into GIS format. The preliminary map is shown in Figures 2a-b. The full report of this work will be included in the Maine Department of Marine Resources Large Whale Conservation Program 2007/2008 Report to be distributed at the TRT meeting.

Future Work

DMR will be conducting the following research in 2008:

- Expanded vertical line survey to assess the densities of gear within the new fishing Zones seasonally (exemption area, state and federal low-profile areas)
- Endline entanglement risk mitigation
- D-tagging humpback, fin and right whales in coastal fishing habitats; Collaborators include Ocean Works Group, Inc., Woods Hold Oceanographic Institute, and The Whale Center of New England
- Monitoring known right whale seasonal habitat around Mount Desert Rock with water column and plankton sampling. Another sampling site will be set up mid-coast near Rockland. Both of these sites will be directly comparable with the on-going Pulse monitoring program on Jeffery's Ledge; Collaborators include Gulf of Maine Research Institute, Allied Whale, local lobstermen.

- Summer plankton sampling survey using tucker trawls, and a laser optical plankton counter; Collaborators include Gulf of Maine Research Institute
- Acoustic detection of right, fin and humpback whales in areas around Mount Desert Rock; Collaborators include Allied Whale and Cornell University.
- Production of explanatory and forecasting near shore models for Calanus in NGOM; Collaborators include Gulf of Maine Research Institute
- Opportunistic sampling of zooplankton by local whale watch and fishing boats in the event of a right whale sighting
- Expansion of the current state-wide trained sighting network to include additional industry members
- Expansion of the current state-wide trained disentanglement network to increase the number of higher level trained personnel in the state.
- Assessment of potential areas of increased risk of entanglements by mapping the distribution of gear taken from the DMR conducted endline surveys, sightings of large whales, prey data and oceanographic variables
- Upgrade the GIS database and web page to include additional sightings and correct for effort using sightings per unit effort (SPUE)
- Analyze historic fish trawls in Maine waters from the DMR inshore trawl survey and overlay what is known about the distribution and abundance of humpback and fin whales.

Future plans that are pending funding include:

- State-wide, near-shore aerial sighting surveys conducted year round and coupled with boat response for opportunistic sampling, including CTD drops and plankton trawls, as well as photo-identification and potentially isotope and population genetic studies.

Information learned from these studies will fill in gaps in knowledge about processes that drive the distribution and abundance of prey in Maine waters as well as the distribution and behavior of large whales over rocky and tidal habitats. DMR encourages the scientific community to expand tagging and other relevant research projects out of known habitats to include areas such as the Northern Gulf of Maine where little is known about the biology of these endangered species.

Low-profile Rope Specifications and Field Testing

Background

DMR's effort to identify alternate gear options began in early 2003 with three pilot surveys using a remotely operated vehicle (ROV). Working off of commercial lobster boats, groundline profiles were observed in various areas of the coast. This exercise was not only an eye-opening experience for industry members involved but also underscored the challenge ahead in considering gear options in such a rocky and tidal habitat. The promising results of these early surveys were transformed into a state-wide large scale ROV survey. This project worked to document the underwater profile of many

commonly used ropes and how that arc changes with gear configuration. In addition, this massive survey documented for the first time the underwater topography of many bottom habitats previously not described in Maine coastal waters. Many lobstermen contributed ideas to the research and development process for the production of groundlines that floated lower in the water column than the standard poly line normally used. As a result five configurations of gear were field tested and filmed using additional ROV work. The footage from these early trials was made into videos for outreach and educational purposes. Valuable information taken from these endeavors helped to shape the experimental low profile groundlines that were manufactured on a larger scale in 2005. Emphasis for these products centered not only on lowering the profile of a line's arc but improving the durability and strength of these lines as they contact the rocky bottom during times of high current velocities.

In 2005 around one hundred coils were distributed to more than 50 fishermen state wide. Fishermen rigged their gear according to personal preference and fished the rope through the winter and into the spring of 2006 and maintained logbooks documenting the performance of the ropes. This qualitative data was used to modify the low profile product for additional distribution and field testing during the 2006 fishing season.

Three related projects were taken on in the spring, summer, and fall of 2006 by the DMR Large Whale Conservation Program in conjunction with the DMR Lobster Biology Research Group and the Gulf of Maine Lobster Foundation. The first consisted of deployment of depth recording data loggers on the DMR Regional Ventless Trap Survey. The aim of this experiment was to document the profiles of experimental low profile line as well as standard float line under controlled conditions. The second phase employed six additional fishermen to fish each of the four low profile products as well as standard float line side by side using their normal fishing practices using data loggers. Finally, over 120 coils of low profile groundline products were distributed to over 60 fishermen state-wide to determine industry feasibility.

The 2006 product was not sufficiently chafe resistant so DMR went back to the manufacturer and devised a study of three differing specific gravities to target a density that would allow rope some flotation but remain off the bottom just often enough to reduce chafing. The resulting study is outlined below.

Methods

The 2007 low-profile rope study aimed at determining a specific gravity or density of rope that would yield a product that was above the bottom just enough to reduce chafing but stayed lower than one meter in the water column. To accomplish this task Polysteel Atlantic Ltd. produced three ropes with varying specific gravities. The specific gravities included 0.98, 1.008, and 1.020 (see Table 1). DMR added a couple of ropes to the test that included a Polysteel Atlantic standard float line (specific gravity 0.893) and an off the shelf Orion "Hoverline" which is currently being marketed as a low-profile line (specific gravity 1.049). The field testing of these products consisted of two phases. The first phase involved handing out roughly 55 coils of the three manufactured low-profile

lines to lobstermen to fish on their gear and fill out log sheets rating the rope in several categories. At the end of the fishing season lobstermen were asked to return their log sheets with a sample of the low-profile rope that they fished, which was used for strength testing. The strength testing results were not available at the time of submission but may be included in a packet to be given out at the TRT. The second phase of field testing involved setting out gear with depth data loggers to determine the arc heights of each specific gravity rope. The arc height is defined as the height of the rope above the bottom at its highest point. The bottom depth is determined by the traps on either side of the groundline. Sets were set up in order to be able to compare not just the different specific gravity ropes but also to investigate whether or not rope diameter changed the arc height of a rope and how the length of the groundline affects the arc height. Therefore, two different rope diameters were used with the Gray low-profile rope and three sets were done for float rope and the yellow low-profile rope, 6 fathoms, 10 fathoms, and 18 fathoms.

Five areas of the coast were selected for testing (Figure 10). At each of these five sights, ten triples were set, each one with a different line type or groundline length. Each triple used two experimental groundlines, resulting in two sets of each line per site. The different sets are included Table 1. All ropes, unless specified are 7/16 inch diameter and 10 fathom lengths. Five data loggers (Star-Oddi DST-milli's) with a configured accuracy up to 100 m ($\pm$ 0.4% depth accuracy) were used per triple to record depths. One logger was attached to the top of each trap and one spliced into the center of each of the two groundlines using a length of twine. Protective rubber casings provided by the manufacturer were used to house the loggers. Prior to deployment, data loggers were set up to record a depth once every 10 minutes. Loggers were attached to the gear during the set by DMR staff and loggers were removed by the lobstermen at least three days later. The duration of deployments ranged from four to fourteen days between mid-Oct. and late Dec. This variation was due to weather and haul schedules.

Once loggers were returned to DMR after deployment they were downloaded using the manufacturer specific software, SeaStar. DAT files were created during retrieval of the data containing depth readings in meters every ten minutes for the duration of the set. Data was subsequently processed and outliers flagged based on user specified criteria for maximum allowable depths and rates of change in the recorded depths. Depth readings were then corrected for inherent error by averaging the error recorded at the surface and adding or subtracting that number from all depth readings. After the data was processed, arc heights were calculated for each groundline. This was done by averaging the depth of the traps on either side of the groundline and subtracting the average groundline depth from that number. The trap height was also added to the average arc height to correct for the logger's position above the bottom. Some negative values resulting during this calculation due to the nature of the slope of the bottom. Where this occurred these values were not used. The resulting mean groundline arc heights were exported to excel where summary statistics were calculated for each area and line type and T-tests were run to check for significant differences between the heights of different line types. This was done using a 99% confidence interval and with the hypothesis that that the difference for

all relationships was zero. Additionally, graphs of each set were made to show the difference in behavior of each line type through tidal cycles.

Results

The summary results for each line type can be seen in Table 1. The overall average and maximum arc heights include all field sites tested. The 10 fathom length float line rose to a maximum height of 7.48 meters during our field trials. The maximum heights of low-profile lines ranged from 0.90 to 6.83 meters off the bottom. It is demonstrated in both the average and maximum arc heights of the Polysteel Atlantic low-profile ropes that as the specific gravity gets closer to the definition of sink rope (1.03) the arc heights decrease. This is not the case for the off the shelf Orion "Hoverline" that was tested, potentially due to differing rope constructions and composition. The only product tested that fit the definition of low-profile rope, average and maximum arc heights below one meter off the bottom, was the Polysteel Atlantic yellow (sp = 1.020). DMR therefore proposes this product for approval to be fished in low-profile areas and re-defines low-profile groundline as having a specific gravity of 1.02 or greater.

Regional differences are displayed in Table 11. There are some visible differences in average and maximum arc heights between areas, for instance the arc heights of float ropes between Cutler and Jonesport. However, it should be noted that the yellow product did not experience large fluctuations between areas.

Differences between ropes are readily apparent in Table 12. Significant p-values are marked with an asterisk. Some notable differences are the difference between short and long groundline length in float rope versus yellow low-profile. The arc heights of 6 and 18 fa float ropes are significantly different with a p-value of .0076, while they are not for the yellow rope (p = .3770). Additionally, the arc heights of all lengths of yellow rope are significantly different than float rope, while the orange low-profile and Orion ropes are not.

Graphs of each set in each location are displayed in Figures 11-15. The first graphs display the sets using 10 fathom length groundlines. All ropes are displayed together to show the difference in arc height. The second set of graphs contains the deployments of the 6 and 18 fathom length groundlines for float and yellow low-profile rope for comparison.

Tidal currents affect each rope differently, depending on how high in the water column the rope is floating. Figures 16-20 depict the action of tide on float and yellow low-profile rope in each of the sites. These graphs show the arc height changes when overlaid on the bottom depth (as determined by trap loggers) and therefore the tidal cycle. One will notice that the arc heights of all of these ropes correspond to slack tides or the peaks and valleys of the depth line. The drastic drops in arc height occur at a tidal switch and the lowest arc heights occur during an incoming or outgoing tide. Another pattern to

notice is the difference between tidal effects on float and the yellow low-profile line. This is apparent at all the sites sampled. The variation in height of the low-profile line is much tighter than that of float rope. The low-profile line is not floating up into the water column and is therefore less affected by the change in tidal currents. The fluctuations still occur but do so on a much smaller scale (note the arc height axis ranges).

There were also variation in bottom slopes experienced in this study. Figures 21 and 22 depict the two scenarios of steep and flat slope in the data. The Jonesport set had a fairly flat slope of 0.31m difference between traps while the Southwest Harbor set had a steep slope at 5.12m difference between traps.

DMR also analyzed the responses of about 55 lobstermen to questions regarding the handling characteristics of the low-profile line they were given to fish. Figure 23 shows the average responses for the yellow low-profile line. Lobstermen were asked to rate the rope in comparison to what they normally fish in the following categories: fouling, chafing, hang ups, noise, kinking, general durability, and general handling. The yellow low-profile rope ranked above average (depicted by the orange line) in all categories except for chafing. Comments that were included with the rankings made statements that the rope tended to chafe near the bridle or where it is tied into the trap. This is common with a line that does not float high above the bottom. The consistent response in comments was while it did not seem to last as long as floating groundline, they could use low-profile line in areas where they have tried sinking groundline and lost gear.

Conclusions

As suggested in the results above DMR is proposing the yellow low-profile product for use in specified low-profile areas and amending the definition of low-profile rope to mean a groundline with a specific gravity of 1.02 or greater. DMR asserts that the behavior of this rope has been well documented in regards to its arc height above the bottom and how that changes with several different factors including rope diameters and groundline lengths, location, and tidal current influences. Additionally, this rope reduces the height of a groundline off the bottom by 94% when compared to standard floating line. This is a significant reduction in the risk of entanglement to whales. This notion is being further supported by continuing work with CTD and plankton data as well as the other whale behavior and habitat studies outlined in the research section. DMR is committed to continuing this research and adapting regulations in light of new information. In regards to the CETAP surveys conducted on the east coast Winn (1986) states that right whales do not pause in the NGOM on migration between critical habitats. In spite of this DMR is committed to reducing the risk of entanglement to right and other large whales that do inhabit Maine's coastal waters by introducing a more complete and comprehensive plan than is currently laid out in the Amended ALWTRP.

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