Northeast Consortium 2009/10 Mid-year Progress Report

DOGGRATE: Development of a Spiny Dogfish Excluder in a Raised Footrope Whiting Trawl

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Project Objectives

Our goal is to produce and test a spiny dogfish *Squalus acanthias* excluder grate within a whiting (silver hake) *Merluccius bilinearis* net. Additionally, we plan to explore the usage of such a gear for an expanded whiting fishery area and time of year. In order to accomplish the goals, we have identified the following objectives:

1. To observe the behaviors of spiny dogfish and whiting around excluder grates using underwater video;
2. To identify the optimal excluder grate properties gauged by target species catches and spiny dogfish exclusions;
3. To continue refining the excluder grate design;
4. To produce a prototype grate design to be used in follow-up commercial trials;
5. To make recommendations for an expanded whiting fishery in Cape Cod Bay and Massachusetts Bay.

Major accomplishments and milestones

Massachusetts Division of Marine Fisheries (MA DMF) continued to work towards the project's objectives. This progress reported includes all work completed since July, 2009.

Preparations were conducted leading up to and in between field days. MA DMF personnel purchased field and analytical equipment, modified camera cables, replaced net mensuration sensor batteries, sent the headrope sensor to Notus Electronics Ltd. for repairs, and prepared the necessary field work data forms. Industry partners purchased the new raised footrope whiting

net and mounted the constructed grates within the net's extension. After field work was completed the winch and power unit were sent to Pine Hill Electronics for necessary maintenance and repairs.

The main field work trials were performed on the F/V *Barabara L. Peters* outside the Gulf of Maine MA Special Access Program (SAP) Whiting Area (between 42°12'W lat. and 42°30'W lat.)(Figure 1). An exempted fishing permit (EFP# 9058) was granted by NMFS in August 2008 and reissued (with revisions) in July 2009 to conduct this work. Twenty-four tows were completed over nine days in July and August 2009 supervised by MA DMF biologists. Additional researchers who assisted during day trips included: Rachel Feeney (NEC), Doug Zemeckis (SMAST), Andrew Applegate (NEFMC), Tyler Staple (NOAA), and Steve Voss (MA DMF).

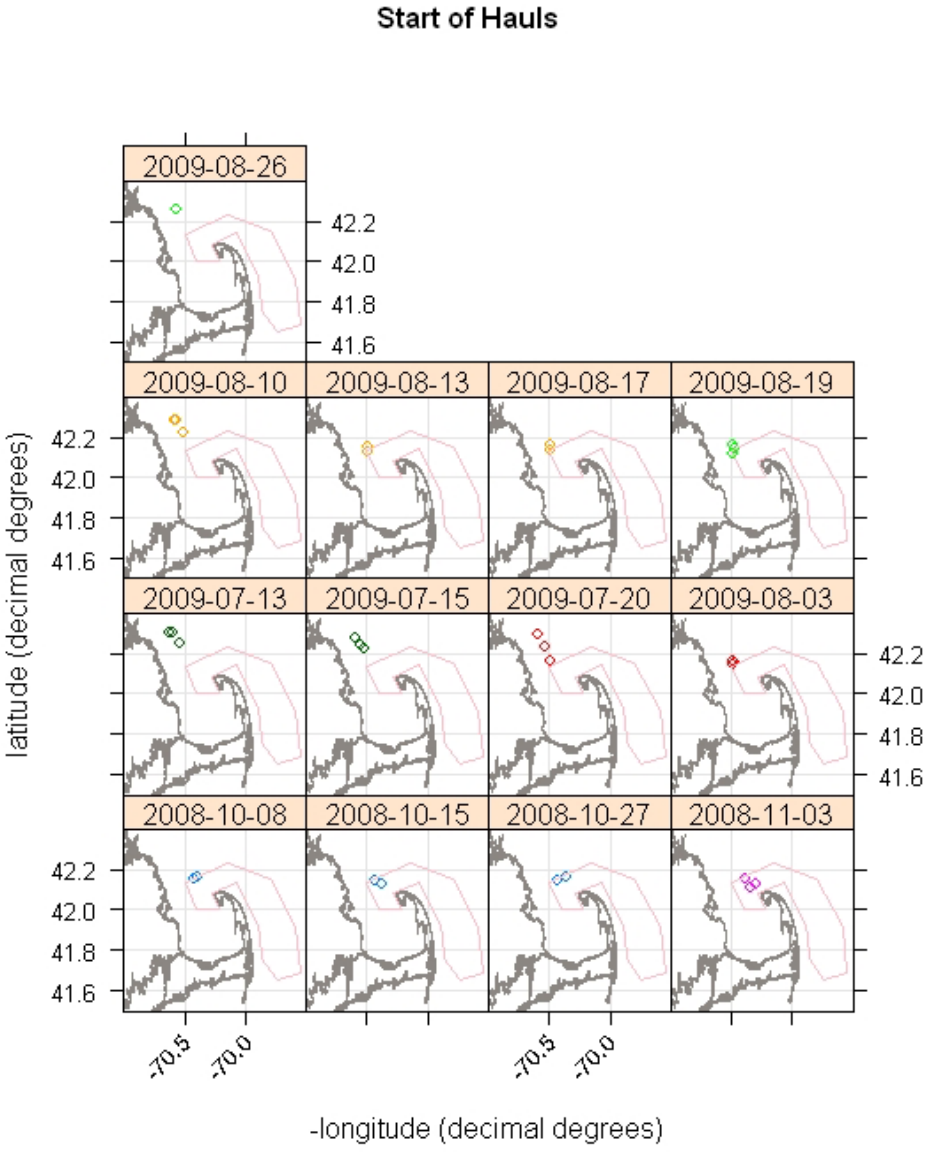

Figure 1: Location of tows by trip during pre-trials (in 2008) and actual trials (in 2009). Colors of points represent different gear arrangements used (see below).

Trials were conducted using the two re-designed grates (black and white colored respectively). The re-design occurred due to structural warping of the original design during the pre-trials (Figure 2).

Figure 2: The grate used during the pre-trials. Warping of the bars is evident.

The new grates were constructed with an additional horizontal cross bar to reinforce the vertical bars' integrities (Figures 3 and 4). Bar spacing was kept the same as in the pre-trial (2 inches).

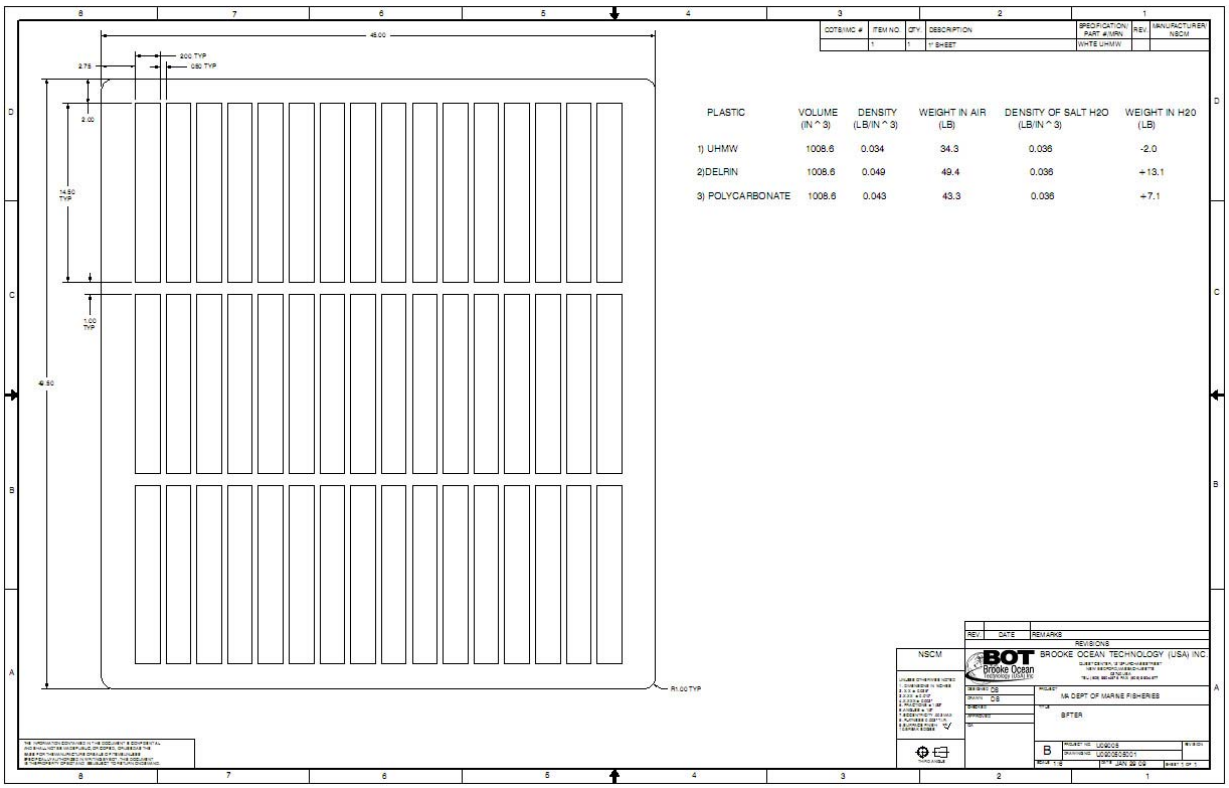

Figure 3: Schematic of the final grate design.

Figure 4: The final white grate mounted in the net's extension.

A new net was constructed by Levin Marine Supply Co. and paid for by Frank and Andrew Mirarchi; the design of the net was approved by Chosid from DMF and conforms to a standard raised footrope whiting design (Figure 5). The headrope was 94 feet, 1 inch; the footrope was 96 feet, 9 inches; the codend was approximately 2.5 inch mesh and the extension was approximately 2 inch mesh; other sections of the net ranged between approximately 2.5 - 6 inches.

Figure 5: The new raised footrope whiting net used.

The white grate and black grate were tested in various configurations to see if the colors and/or orientations change the fish reactions. We tested the following gear arrangements in order:

1. Black grate, top of grate forward facing 45^{o} angle, upward guiding panel, lower escape vent (6 tows, dark green points on Figure 1).
2. Black grate, top of grate aft facing 45^{o} angle, downward guiding panel, upper escape vent (6 tows, red points on Figure 1).
3. White grate, top of grate aft facing 45^{o} angle, downward guiding panel, upper escape vent (7 tows, gold points on Figure 1).
4. White grate, top of grate forward facing 45^{o} angle, upward guiding panel, lower escape vent (5 tows, light green points on Figure 1).

During field trials, an underwater camera was mounted inside the net pointing aft to the grates and the images were live-fed into the vessel wheelhouse. The first goal of the filming is to ensure proper net and grate rigging and orientation. No video was taken on the first tow which was used familiarize ourselves with the gear; video was captured on all other tows (Figure 6). Except for tows 30 and 31, an additional camera (borrowed from Pingguo He at UNH) was mounted at various locations on the gear and extra video was captured. We also deployed a net mensuration system to observe and record gear characteristics. Geometry data acquired included wing and door distances and spreads, headrope distance and height, and mouth distance and opening of the net. Once proper rigging had been established, we observed reactions of spiny dogfish and whiting in real time. Video and net data were recorded for subsequent in-depth analyses.

Figure 6: Underwater image of the black excluder grate while fishing. Whiting are present.

Tow lengths were primarily determined by observations of the quantity of fish on the video but were generally about 1 hour. Catch composition and weights were determined for all captured organisms. Lengths were recorded for spiny dogfish, whiting, red hake *Urophycis chuss*, managed species (Atlantic cod *Gadus morhua*, yellowtail flounder *Limanda ferruginea* and winter flounder *Pseudopleuronectes americanus*, etc.) and any other catch that may be landed. Operational data (location, time, wave height, etc.) were recorded for each haul. Additionally, temperature data was collected using an Onset Tidbit logger. Marketable fish were landed and sold. Catches were reported to NMFS after each trip per the conditions of the EFP.

Data were recorded and entered into a customized database. All data that were analyzed were completed using the R statistical package and Microsoft EXCEL. Unless specified, default R conventions were followed.

Total catch results during the pre-trials and actual trials are provided below in Figure 7 (shown as catch/hour) for selected species. Catches were adjusted for sub-samples when taken. These data were examined using box and whisker plots (McGill et al., 1978[1]). Box widths are proportional to the square roots of the sample sizes within each grouping.

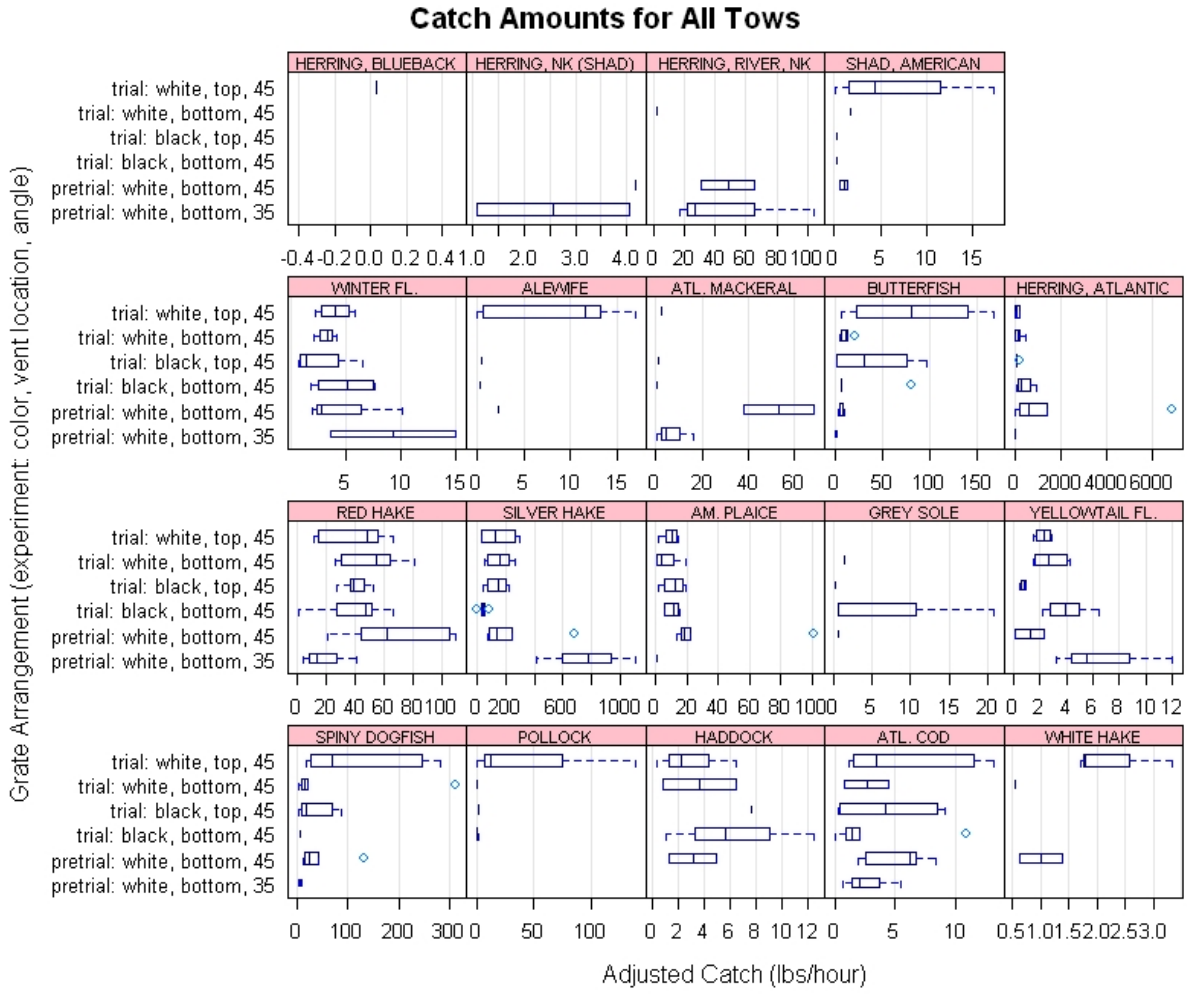

Figure 7: Box and whisker plot of the adjusted catches (lbs/hour) for selected species using different gear arrangements.

Other tasks completed within the progress report's time period includes:

- David Chosid and Pingguo He (UNH) reviewed video taken and discussed methods for conducting a behavioral analysis on spiny dogfish.
- Videos were compiled of the grate while fishing for the NEC, Andrew Applegate (NEFMC), and the New Bedford Working Waterfront Festival (September 26-27, 2009).
- A poster was presented at the Northeast Consortium 8th Annual Project Participants Meeting titled "Let Slip the Dogs of War! Development of a Spiny Dogfish Excluder in a Raised Footrope Whiting Trawl" (March 25, 2009, Portsmouth, NH).
- The meshes of the new whiting net were measured (sampled) prior to and after the field work was completed. This data has not yet been analyzed for changes over time.

[1] McGill, R., J.W. Tukey, and W.A. Larsen. 1978. Variations of Box Plots. The American Statistician 32: 12-16.

- Inspection of the winch, camera gear, and cables post field work.

Unexpected difficulties and project alterations

Some unexpected difficulties arose during the field trials:

- A tradeoff occurred between the cameras' fields of views and the optimal distance back that the cameras were mounted. If the cameras were mounted too far from the area of interest in order to view a larger area, clarity and detail would be lost.
- Malfunctions of the imaging equipment had occurred during some tows and caused us to end tow 33 early (the last tow). After later inspection of the gear, we found that the problems were due to a mix of faulty cables and the winch's slip ring, which was later repaired.
- When spiny dogfish were encountered in large groups, the grates became clogged (tows 21, 23, 26, and 31). These tows were ended once these events occurred and could not be cleared (as seen on the live-streaming video). The best alternative to this problem is avoidance of these large schools. Also, dogfish in these quantities would most likely be problematic for the fishermen and catches within the codend as well as before the grate.

Next step, tasks for next 6 months

Fieldwork has now been completed. Data entry and analyses are planned to continue in 2010. The analyses will focus mainly on the optimal grate arrangement with respect to catches and video observations. We will also attempt to conduct behavioral analyses for spiny dogfish although this will depend largely on our ability to discern their individual actions on the video.

Acoustic sensor and temperature results will also be reviewed and will be consistent with analyses conducted in the pre-trial research. Only mensuration data acquired after at least five minutes after the start of the tow will be used to allow for the net to settle. Also, five minutes of data will clipped at the end of the tow to assure that the doors were actually on bottom.

A final report will be constructed.

Impacts to fishermen/fishing community and science/science community

The trials have had very positive results. Although we are not able to accurately quantify the number of spiny dogfish that were excluded while using the grate, we have observed large numbers of dogfish entering the net which were not present in the codend. At the same time, commercial quantities of whiting have been retained, although the quantity lost is unknown. The partner industry members on this project already feel that the exclusion of the dogfish have significantly reduced their total fish handling time and improved the quality of their catch; they have adopted this design to use during their normal whiting season and have generated further interest in the fishing community. Furthermore, this method likely reduces the dogfish mortality that would otherwise occur through discards.

The exclusion of spiny dogfish in a whiting net could lead to an expansion of the whiting fishery

by time and/or location, if low dogfish stocks or low spawning stocks threaten the fishery. An excluder grate may be a cheap cost effective solution. Furthermore, other stocks of concern may also be excluded as a side effect.

David Chord 1/8/10

Signature Date