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Annual Progress Report #2

**Design and Test of a High Opening Raised Footrope Trawl for
Haddock and Pollack for the inshore Gulf of Maine**



Submitted to:



**The Northeast Consortium
142 Morse Hall
University of New Hampshire
Durham, NH 03824**

July 2006

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by

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Design and Test of a High Opening Raised Footrope Trawl for Haddock and Pollack for the inshore Gulf of Maine

Summary. This project focuses design and test of a trawl targeting haddock and pollack in the Gulf of Maine suitable for implementing “B” Days-At-Sea use. Key features of the new trawl are high headline opening and the raised footrope with long drop chains. The substantial increases in haddock and pollack biomass in Gulf of Maine, and much slower increase in cod stocks provide basis for use of such trawls in the multispecies fishery to reduce fishing pressure of cod. The initial phase of design and flume tank tests has been completed. The full scale gear based on tank test results has been constructed. Sea trials have started and are continuing.

Introduction

The recent report of the New England Fisheries Management Council indicated tremendous increases in overall biomass of twelve managed groundfish stocks in the northeast United States, even though the growth was not uniform among managed species or stocks. Among those stocks, haddock spawning biomass showed the greatest increase (Howard, 2003). Haddock stocks have shown tremendous recovery and they are not experiencing overfishing. Pollack is not “overfished” nor experiencing “overfishing” according to the overfishing definition and data provided by the New England Fisheries Management Council (Howard, 2003). Cod stocks, both in the Gulf of Maine (GOM) and on Georges Bank, on the other hand, are still “overfished” and still experience “overfishing”. Various management measures implemented and/or being considered are aimed at reducing the mortality of cod thereby aiding recovery of the stocks. One of the measures proposed in Amendment 13 to the Northeast Multispecies Management Plan is to reduce fishing effort by reducing Days-At-Sea (DAS) and by creating a so-called “B” DAS category. Fishermen may use “B” DAS to target species such as haddock and pollack with minimum catch and discard of other species such as cod. This project intends to design and test of such a haddock trawl for targeting haddock and pollack for use as “B” DAS gear in the inshore and nearshore otter trawl sector.

Worldwide decline in marine fish stocks has generated great interests in developing species selective fishing gears targeting “healthier” stocks while leaving “depressed” stocks to recover.

There are a number of approaches to separate species during fishing processes in trawls. Physical separations include mesh sizes and shapes, grids and inclined mesh panels. Behavioral separations include separator trawls, towing speeds, headline and fishing line height, among other means. Selective fishing using species-specific behavioral differences requires good understanding of behavior of the species to their physical differences (Wardle, 1983).

In the early 1980s, underwater observations carried out by researchers in Aberdeen, Scotland revealed distinct behavior of cod, whiting and haddock when approached by trawls (Main & Sangster, 1982). Haddock was observed to swim up and attempted to escape over the headline of a trawl, while cod stayed relatively low, and whiting lays in between haddock and cod. This finding resulted in a prototype separator trawl where a horizontal separator panel was installed to divide the trawl into the top and the bottom compartment. In this way, haddock and cod might be separated into the upper and lower codends respectively. Since then, a number of separator trawls were tested in Europe and in Canada (Main & Sangster, 1985; Galbraith & Maine, 1989; Boudreau & Tait, 1991; Cooper, 1992; Engas *et al.*, 1998). However, “the proper insertion of a horizontal panel in a trawl is not an easy task” (Cooper, 1992). This device thus “suffers in being overly complex and very hard to regulate for within legislation” (Anon. 2004). The shape and condition of the panel may change with towing speed and trawl door functioning. Any change of the door spread or wing spread may cause slack netting in the panel, resulting in meshing of fish.

Alternative to the separator trawl, fishing lines may be raised off the seabed so as to retain only the top part of the separator trawl. This design has tested and applied in shrimp trawls (Hannah and Jones, 2000; P. Walsh, pers. comm). In the Newfoundland shrimp fishery, fishing lines are raised as much as 3' through the use of long drop chains or toggle chains (H. DeLouche, pers. comm.). Raised footrope whiting trawls (McKiernan *et al.*, 1999) have been used for harvesting whiting in New England to reduce the catch of flounders. Similar sweep arrangements have been tested in squid trawls (Glass *et al.*, 1998; Glass, 2000). It is therefore feasible to test similar, but even higher raised footrope trawl for haddock and pollack to reduce flounders and cod in the regulated mesh fishery in Gulf of Maine.

Goals and Objectives

The goal of the proposed research is to design and develop a practical trawl suitable for “B” DAS targeting haddock and pollack and to reduce or eliminate cod and flounder catches in the inshore

western Gulf of Maine. The specific objectives are:

- to design a haddock/pollack trawl with high headline height and long drop chains to raise the footrope to reduce catch of cod, flounders and other benthic species while retaining haddock and pollock;
- to conduct flume tank tests and full scale sea trials to demonstrate its success in species selection, and suitability and practicality for commercial operations;
- to disseminate means and methods of species selective fishing technologies through a close partnership with the fishing industry, and through UNH Cooperative Extension and NH Sea Grant Extension.

Project Plan and Experimental Design

Conceptual design of a high rise haddock trawl. The conceptual design of a trawl for haddock and pollack utilizes differences in behavior between haddock/pollack and other groundfish species. Exploiting the behavior that haddock and pollack tend to escape upwards at the mouth of the trawl and cod stays relatively low when exhausted, we designed a high vertical opening trawl. The design consists of long drop chains between the fishing line and the sweep (raised footrope), creating a space for cod, flounders and other benthic animals to escape or fall under the fishing line (Fig.1). The trawl will incorporate large meshes in the wings and belly to reduce drag of the net and allow the same vessel to tow a high opening trawl. Trawls with large mesh belly windows were demonstrated to reduce catch of benthos in the Belgium flatfish beam trawl fishery (Fonteyne & Polet, 2000). Our design will be expected to reduce benthos and trash catch in the codend, reducing potential effect of trawling on the

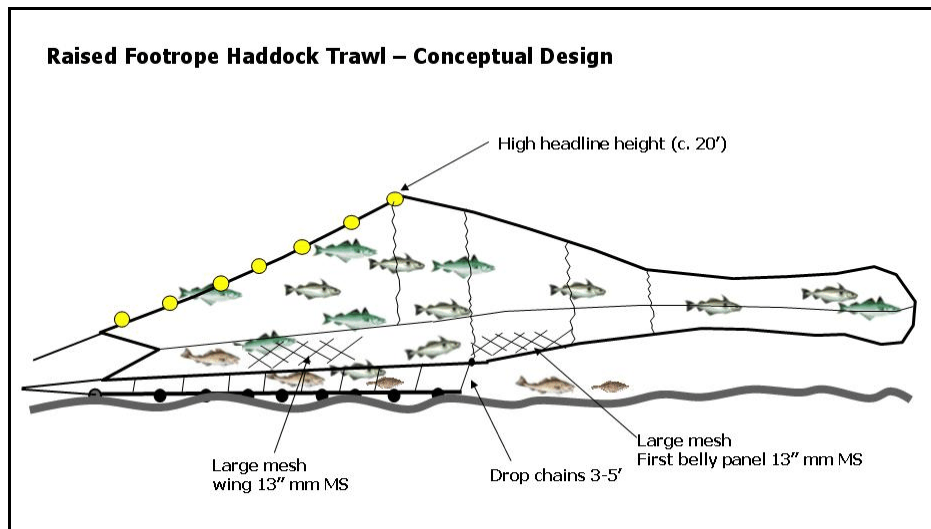


Figure 1. Conceptual drawing of the raised footrope haddock trawl.

benthic organisms.

The length of the drop chains is one of the major factors to be tested during sea trials. Recent separator trawl tests in Scotland indicated good separation of haddock to the upper part of the trawl using panels 0.8 m (31") directly above the sweep line (R.S.T. Ferro, pers. comm.).

Flume tank tests. Design and rigging of the haddock trawl was tested in a flume tank at the Memorial University of Newfoundland in Canada, where geometry and rigging were determined. The length of the drop chains tested in the flume tank was 5'. Both Industry partners participated in the flume tank tests, along with the principal investigator, in December 2004.

Sea trials. Sea Trials started in the Fall of 2005. F/V "North Star", a 45' trawler based in Portland, ME was used for the first year of the sea trials. During the second year, F/V "Persistence", also a 45' vessel based in Portland ME, will be employed for comparative fishing alongside F/V "North Star".

Underwater monitoring of fish and the fishing gear. Sea trials will involve remote underwater video observations of fish and fishing gear interactions, acoustic gear geometry monitoring, as well as comparative fishing experiments using the alternating haul method. Fish behavioral knowledge gained during the sea trials will be incorporated into design modifications of the new species selectivity fishing gear.

A low light underwater video camera (SuperCam 5000, DeepSea Power & Light, San Diego, CA) and a time-controlled digital video recording unit (Mac Marine Instruments, Brier, WA) are available at the University of New Hampshire. These underwater video equipment will be installed at various positions near the selectivity device to record fish behavior and the functioning of the selectivity device.

Gear geometry will be monitored with an acoustic gear monitoring equipment (NetMind, Northstar Technical Inc. St. John's, NF) during sea trials. NetMind uses a hydrophone and sensors attached to the gear to measure door spread, winged spread, and headline height in real time. A temperature recorder will be attached to the trawl to record bottom water temperature during each tow. Temperature data will be analyzed to determine whether it affects catchability of different species.

Data collection and analysis. The catch of commercial species and bycatch species will be sampled

from each tow. Weight of haddock and pollack, and that of cod and flounder species will be determined from the control and experimental tows. Other commercial species and trashes will be noted and total weight recorded. Catches of each species from comparative tows will be analyzed using suitable statistical methods such as paired t-test.

Work Completed to Date

The following items have been completed:

- Conceptual design of the raised footrope haddock trawl
- Trawl model construction and flume tank tests involving industry partners
- Design modification and full scale net plan production
- Full scale trawl construction
- Sea trials started
- Assessment of gear operation and practicality

The following items will be carried out:

- Sea trials on board F/V “North Star” continued (2006)
- Underwater observation
- Comparative fishing involving F/V “North Star” and F/V “Persistence” (2006)

Results to Date

Gear design and test.

A high opening haddock trawl 268 x 165 was designed. The net plan of the post-test full scale trawl is attached in Appendix I. Twelve rigs were tested in the flume tank, including 5' drop chains with and without a rockhopper sweep, no drop chain (Fishing line tied to the sweep), variations in bridle rigging, use of kites, addition and subtraction of floats, and variations in towing speed. Photographs showing various

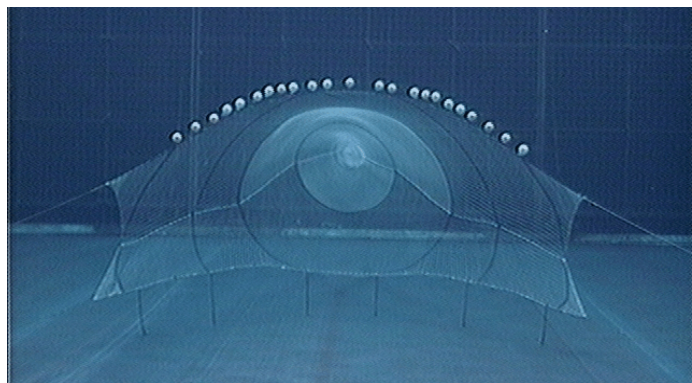


Figure 2. The raised footrope haddock trawl without a sweep (sweepless) but with 5' drop chain as seen in the flume tank.

designs tested in the flume tank are shown in Fig. 2 and 3. Test results is shown in Fig. 4. Rig. 2 was the final rig used in full scale construction.

Full scale trawl construction.

A full scale trawl was constructed by D & E Enterprise of Scarborough, ME. The full scale gear was based on the tank test results with modifications after testing.

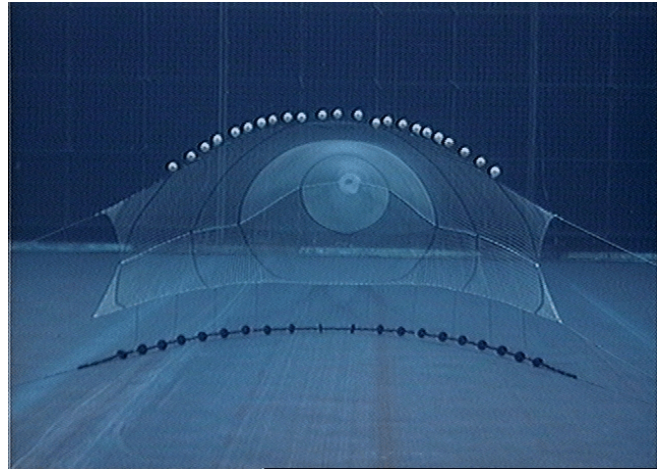


Figure 3. The raised footrope haddock trawl with 5' drop chain length as seen in the flume tank.

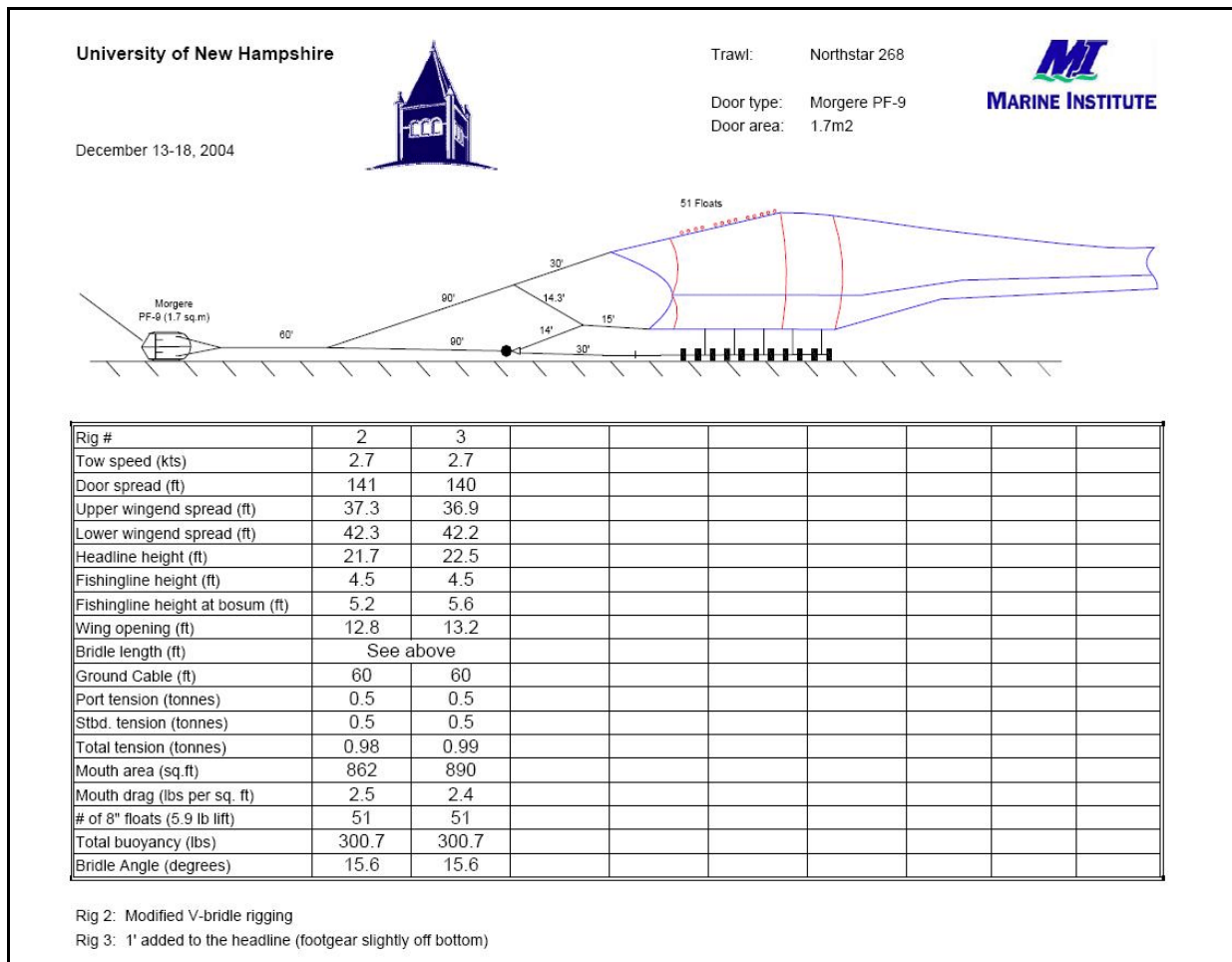


Figure 4. The raised footrope haddock trawl with 5' drop chain length as seen in the flume tank.

Sea trials.

Sea trials with F/V “North Star” started in the Fall of 2005, and are continuing at this point. Comparative fishing trials involving both F/V “North Star” and F/V “Persistence” will be carried out in the Fall of 2006.

Three fishing days were completed in October, 2005. Fishing was very poor and sea trials were terminated. The gear operation was very satisfactory with no operational difficulties using usual deck machinery. A few pollack were caught. No cod were caught in the trawl.

Another three days were fished at the end of April 2006. Fish was again very poor with no substantial catch of all species, except tow which caught 99 lbs of cod and 5 lbs of haddock. Sea trials were again suspended.

Fishing trials are continuing at this moment. By 06/23/06, another three fishing days were completed. Fishing was more encouraging with catch amounts of major species listed in Table 1. Catch rates of a pollack as much as 862 lbs. per hour tow ere obtained with the new trawl. This high catch rate of pollack was not seen by the industry partner for many years.

During this period we also tried to compare the same net with the chains tie-down to represent regular sweep fishing gear (Tow 13). While “tied-down” net does seem to catch more cod, much more comparative fishing will be carried out. In addition, a large number of pollack was meshed in the square, indicating they did escape through large meshes. It is planned that the large mesh panels in the front part of the net will be replaced with regular 6" netting before further sea trials in the fall.

Table 1. Catch of major groundfish species in pounds during June 2006 trials.

| Date | Tow | Cod | Haddock | Pollack | Comment |
|----------|-----|-----|---------|---------|--|
| 06/17/06 | 1 | 438 | 71 | 26 | 5' chain raised footrope |
| | 2 | 118 | 42 | 195 | |
| | 3 | 48 | 20 | 133 | |
| | 4 | 14 | | | |
| | 5 | - | - | - | |
| 6/19/06 | 6 | 5 | | 55 | |
| | 7 | 16 | 26 | 862 | a large number of pollack gilled in the square |
| | 8 | 28 | 29 | 14 | |
| | 9 | 84 | 6 | 11 | chain tied-down |
| 6/23/06 | 10 | 21 | | 63 | |
| | 11 | 13 | 11 | 47 | |
| | 12 | 37 | 18 | 26 | |
| | 13 | - | - | - | |

Partnership between Fishermen and Researchers

This project is a joint effort between two commercial fishing vessels from Maine and the University of New Hampshire, with participation of Memorial University of Newfoundland. There were numerous opportunities for cooperation and collaboration between scientists (from UNH and MUN) and fishermen from the start of the proposal stage, to gear design and flume tank testing in Newfoundland. Fig. 5 shows Capt. Vincent Balzano rigging a model bridle at the flume tank shooting deck.



Figure 5. Capt. Vincent Balzano, the industry partner working on a model trawl wire at the shooting deck of the flume tank.

Impacts and Applications

The outcome of the project will be a haddock trawl design which retains only haddock and pollock, with minimal retention of cod and other controlled groundfish species. Successful outcomes from the project would allow the gear to be used for “B” DAS use under the fisheries management plan. The use of a raised footrope trawl may also reduce catch and dislocation of benthic organisms, thus reducing bottom impact of trawling.

The end-users of the project will include fisheries managers including NEFMC and NMFS who are striving to identify technical modifications on gear designs to reduce cod mortality, and implement “B” DAS gears for the multispecies trawl fisheries. The project will benefit the trawl industry in potential utilization of “B” DAS which otherwise will not be able to utilize, and fishing industry as a whole through healthy recovery of fish stocks.

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