2007 Haddock Workshop: Recent Advances in Haddock Separation Technology

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Introduction

The National Marine Fisheries Service (NMFS) in 2005 implemented a pilot Eastern U.S./Canada Area Haddock Special Access Program (SAP) for the limited access Northeast multispecies fleet that required the use of a haddock separator trawl. The separator trawl gear mandate was employed to reduce fishing mortality on a stock of concern, Georges Bank cod, while allowing access to other relatively healthy stocks, particularly Georges Bank haddock. This mandate was initiated through a trawl workshop held at the NMFS Northeast Regional Office on May 27, 2004, that solicited input from fisheries researchers with a range of trawl gear expertise and identified gear that could be used to minimize the capture of cod. This meeting concluded that, if used properly, haddock separator trawl gear could substantially reduce the amount of cod caught while maintaining commercial catch rates of haddock. The resulting creation of the SAP is an example of the use of innovative, conservation-oriented fishing gear for the benefit of fishery resources as well as the fishing community.

Currently, a haddock separator trawl that employs a horizontal separation panel is the only type of trawl gear that can be used in the SAP. Over recent years, seven cooperative gear research projects have been conducted or are under way to test haddock separator trawls with horizontal separation panels as well as to develop other types of trawl gear modified to target haddock and reduce cod catch. On April 3, 2007, a workshop was held at the University of New Hampshire (UNH) to discuss and evaluate these gears for applicability in the Northeast multispecies trawl fishery.

The objectives of the workshop were to:

- Identify current haddock separator strategies.
- Discuss the current state of the technology (limitations, data analyses, future research).
- Recommend appropriate methods as "industry ready" for pilot testing by commercial fishermen.
- Identify topic-specific research needs.

The meeting was convened by several of the gear researchers involved in the cooperative research, including Pingguo He and Ken La Valley of NH Sea Grant/UNH, Laura Skrobe of RI Sea Grant/University of Rhode Island (URI), Paul Winger of the Marine Institute of Memorial University, Catherine Salerno of the Gulf of Maine Research Institute (GMRI), and Michael Pol of the MA Division of Marine Fisheries (DMF). The meeting was attended by regional scientists involved in haddock separator gear research, their cooperative research industry partners and research grant administrators.

Seven experimental gear designs tested on Georges Bank and in the Gulf of Maine were presented and discussed. Projects conducted by UNH, URI, GMRI and DMF as well as projects led by Chris Glass of UNH/Manomet, Dana Morse of Maine Sea Grant/University of Maine (UME), and David Martins of the School for Marine Science and Technology (SMAST), University of Massachusetts-Dartmouth, were presented. Paul Winger presented a summary of haddock harvesting research recently conducted in Canada.

Bycatch Reduction in the Directed Haddock Bottom Trawl Fishery

Laura Skrobe *and* ***David Beutel,*** *University of Rhode Island, RI Sea Grant*

Laura Skrobe discussed the effects of employing a large mesh-faced (top, bottom, side panels and wings) bottom trawl on the reduction of cod and other bycatch from the directed haddock bottom trawl fishery. The project was designed to investigate the quantity and catch composition of bycatch, particularly cod and flounder, of the currently regulated trawl net for the groundfish fishery and the experimental net, named the Eliminator Trawl. The difference in bycatch between the regulated trawl net and the experimental net was evaluated. The experimental net was designed by Jon Knight of Superior Trawl Co. and fishermen Phil Ruhle Jr., Phil Ruhle Sr. and Jim O'Grady. Fisheries staff at URI/RI Sea Grant developed the project proposal and conducted the scientific field tests. Scientists from the NMFS/ Northeast Fisheries Science Center were instrumental in the data collection.

The goals of the project addressed:

- The effectiveness of using a large mesh-faced bottom trawl to reduce the catches of cod and other bycatch in the targeted haddock fishery.
- The use of B Days-at-Sea (DAS) as proposed in Amendment 13 to the Northeast Multispecies (Groundfish) Fishery Manage-

ment Plan (FMP) and the development of an SAP.

- The need to provide fishermen with the ability to harvest had dock without impacting the cod stock, thus allowing the fisher men to continue fishing for haddock and to reach the total allowable catch (TAC).
- To promote collaborative research directed by fishermen.

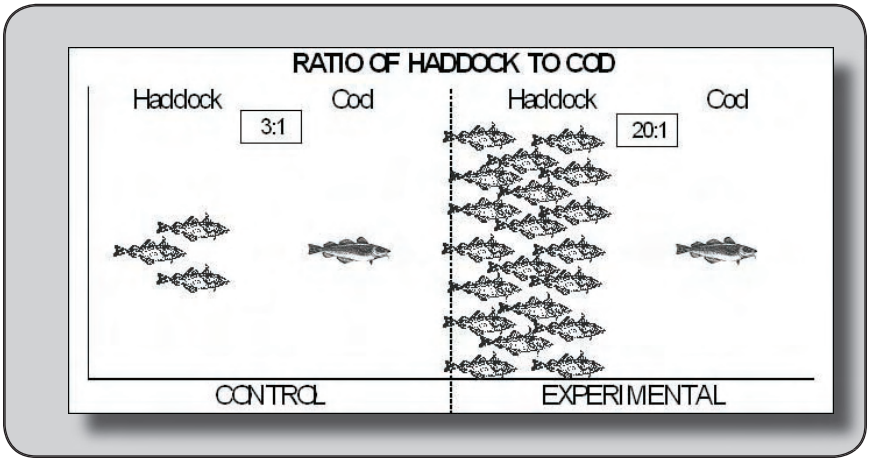
Design Characteristics

The four-seam control net was constructed using legal six-inch polyethylene webbing with a fishing circle of 392 x 6 in. and a hanging line length of 3,600 cm. Twenty-fathom ground cables and 20-fathom bridles were used in the control trawl protocol. Vertical lift was achieved by using 72 eight-inch center hole floats on the headrope. The sweep consisted of two 16-inch rockhopper discs and five 16-inch floppy discs per bight in the center, with the wing sections having two 14-inch rockhopper discs and five 14-inch floppy discs per bight. The four-seam experimental net was constructed with large mesh (240 cm) jibs, wings, bunts and first bottom belly. The square and second bottom belly were constructed of 80-cm webbing with each section followed by 20-cm webbing sections. The last top and bottom bellies were constructed of six-inch webbing. Similarly, the side panel mesh sizes were the same configuration as the top sections. The fishing circle was 315 x 40 cm and the hanging line was 3,600 cm. Twenty-fathom ground cables and 30-fathom bridles were used with the experimental net. Vertical lift was attained by using a three-panel kite with each panel having an area of one square meter. Electronic measurements determined that headrope heights were between five and six fathoms. The rockhopper sweep was constructed with one

16-inch disc per bight in the center, one 14-inch disc per bight along the wings in the quarters, and one 12-inch disc per bight throughout the wings.

Results

In 2005 and 2006 the investigators conducted four research trips and completed more than 100 side-by-side comparison tows of the experimental and control nets. Two vessels, *F/V Iron Horse* and *F/V Sea Breeze*, conducted side-by-side comparison hauls with one vessel towing the control net and the other towing the experimental net. After catch analysis the researchers observed no significant difference in haddock catch rates between the Eliminator Trawl and the control net. Differences were observed for landings of Georges Bank (GB) cod, GB yellowtail flounder, GB winter flounder, witch flounder, American plaice, monkfish and skate. Catch weights were also compared using ratios of haddock, the target species, to a particular discard species. For example, the ratio of haddock to cod from the Eliminator Trawl was 20:1 as compared to 3:1 for the control net. Flounder species were considerably reduced in the experimental net. In particular, the ratio of haddock to yellowtail flounder was 13:1 and 151:1 for the control and experimental nets, respectively. The winter flounder ratio was 1:1 for the control net and 19:1 for the experimental net. In addition, skate were substantially decreased in the experimental net. For the control net, the number of skate was greater than



the number of haddock with a 0.66:1 ratio whereas for the experimental net, the ratio was 56:1. The final report is available online at: http://seagrant.gso.uri.edu/fisheries/haddock/haddock_report.pdf.

Next Steps

The results for the Eliminator Trawl suggest some important possibilities for the fishing industry when trying to exploit healthy stocks while avoiding stocks of concern. These involve the inclusion of the Eliminator Trawl in a B DAS program and an SAP. The net was effective in reducing the catch of all the stocks of concern encountered, including GB cod, GB yellowtail flounder, GB winter flounder, witch flounder, American plaice and white hake. Catch data for the Eliminator Trawl falls within the restrictions under the Regular B DAS Program and should be considered an alternative to the separator trawl. In addition, the data suggest that this net should be seriously considered for an SAP for all of Georges Bank.

Future research will include the testing of a scaled-down version of the Eliminator Trawl. The net has been redesigned to fit on vessels with horsepower between 250 and 550. Testing will begin in September 2007 in the Gulf of Maine if funding can be obtained.

The Five-Point Haddock Trawl: Results and Refinement

Michael V. Pol *and* ***David Chosid,*** *Conservation Engineering Program, MA Division of Marine Fisheries*

David Chosid presented and discussed the experimental Five-Point Haddock Trawl, which was developed by the MA Division of Marine Fisheries in cooperation with Reidar's Net Manufacturing (New Bedford, MA). Similar to the strategy of separator panel nets, this design exploits the different stratification behaviors between Atlantic cod and haddock during a mobile gear encounter, but with reduced contact with many non-target species and the sea floor.

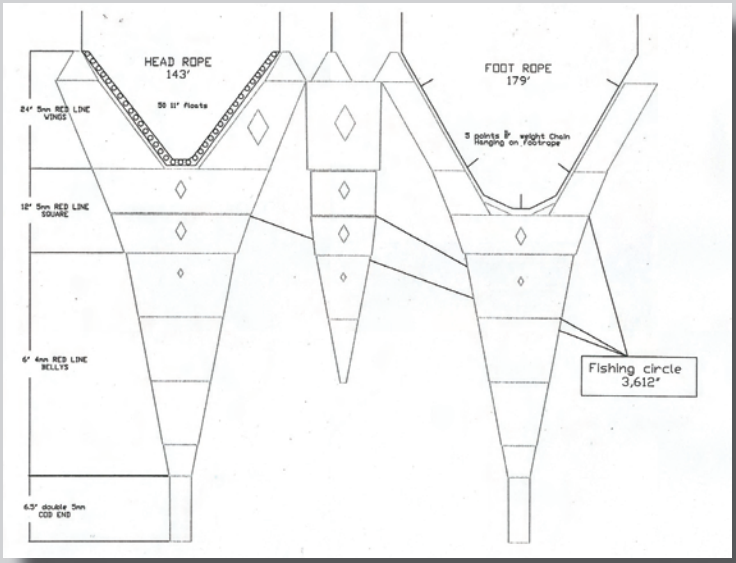
The major goal of the project was to design a semi-pelagic trawl that would harvest haddock while avoiding Atlantic cod.

Design Characteristics

The Five-Point Trawl was modeled after a sweepless raised footrope trawl. The net is a semi-pelagic design and fishes approximately one to two meters off the bottom.

This net features:

- Four seam box trawl with 660 mm (26 in) knot-to-knot mesh on top, 330 mm (13 in) on bottom, and 165 mm (6.5 in) extension.
- Headrope: 43.2 m (142 ft); footrope: 54.8 m (180 ft).
- Five 15.9-mm (3/8-in) x 3-m (10 ft) drop chains – bottom contact limited to "Five Points".
- 2:3 bridle setup.



Results

Field testing comparing the Five-Point Haddock Trawl and a standard trawl net was conducted in June-July of 2006 and consisted of 91 combined twin trawl and alternate trawl tows on Georges Bank. Results indicated that cod catches were reduced to very low levels compared to the standard net (98% reduction) and no significant differences were detected for the haddock catches. Haddock results varied greatly, apparently based on factors such as sea floor structure and localized abundances.

Next Steps

Research was extended to address these issues at different times of the year and over multiple groundfish vessels. The continued work compares the experimental net's efficiency to a standard separator net. Three trips were planned for February-May 2007. The first trip was conducted on the *F/V Illusion* in February 2007 and resulted in 28 alternate trawl tows with very low catches of haddock retained in both nets. Thirty-five additional alternate hauls in the second trip by the *F/V Megan Marie* identified problems with the stability of the net over large ranges of depths and bottom types. Modifications to improve stability are planned for the experimental net and include the addition of large rock-hoppers and cookies on ground gear between the doors and the net wings. The results of these modifications will be monitored through net sensors, underwater imaging and diver efforts within MA inshore waters.

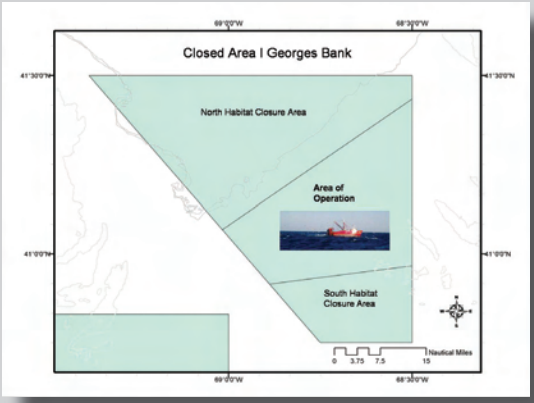
Cooperative Industry-Based At-Sea Experiment to Test the Performance of a Haddock-Separator Trawl in Closed Area I – Georges Bank

David Martins, Adam Barkley, Sally Roman *and* ***Steve Cadrin,***
NOAA/UMass Cooperative Marine Education and Research Program School for Marine Science and Technology

Separator trawls have been shown to separate cod and haddock effectively in the northeast Atlantic, but information on the performance of separator trawls is relatively limited in U.S. northwest Atlantic waters. The haddock resource on Georges Bank has undergone rapid rebuilding but the recovery of Georges Bank cod has been slow, in part because of the difficulty in avoiding cod in multispecies fisheries. Development of a more selective fishing gear is necessary to harvest haddock without jeopardizing the recovery of cod.

David Martins presented the results of field experiments designed to examine the feasibility of using a net panel or haddock separator placed inside a trawl to reduce the bycatch of cod in the Georges Bank haddock fishery.

The goals of the project were similar to those evaluated by the Gulf of Maine Research Institute's haddock separator trials. Specifically, the cooperative research efforts focused on:



- Evaluating the feasibility of an SAP to gain access to the abundant haddock resource using a haddock separator trawl inside of Closed Area I on Georges Bank.
- Characterizing the behavior of haddock and cod in response to a mobile gear encounter.

Design Characteristics

The experimental net was a modified standard two-seam haddock-cod trawl used by New Bedford fishermen on Georges Bank. A horizontal separator panel was added approximately four feet above the belly of the net.

Fishing Vessel	Headrope Len.	Footrope Length	Ground cable length	# meshes Fishing circle	mesh size of fishing circle	mesh size of panel	mesh size codend	codend shape
Isabel S	129'	143'	240'	410	6"	6"	6.5"	Diamond

Results

The expected behavioral patterns of the two species, in which haddock rise when encountering the separator panel and cod swim down, was examined using video technology. Behavioral ethogram analysis confirmed this largely accepted behavioral response, as video showed

cod moving down while haddock typically moved upwards to avoid capture by the mobile fishing gear. The field results showed a significantly reduced cod-to-haddock ratio (11%) in the experimental trawl compared to the control net (43%). However, there was also a concurrent 42% reduction in the catch of haddock in the separator trawl, which represents an important economic loss and is an industry concern. Catch per haul was significantly less in the experimental trawl for all other commonly caught species, including winter flounder, monkfish, yellowtail flounder and lobster.

Conclusions

- The separator trawl was able to release cod and catch haddock.
- The release of cod does not come without a cost; we observed a reduction of approximately 42% in the catch of haddock when using a separator trawl as compared to a normal trawl.
- Flatfish catches are highly reduced and are more pronounced for winter flounder than yellowtail. However, fishermen are likely to exceed the 500-lb flatfish trip limit even when a separator trawl is used as intended.
- Discussions with colleagues in Norway revealed that haddock catches might be improved by positioning the leading edge of the separator panel farther back in the net to allow more

time for cod and haddock to separate and increasing the mesh size of the panel from 6.0" to 8.0." Video footage from Norway recorded large haddock that were initially caught beneath the panel pushing through the panel meshes and being captured.

A Collaborative Program to Test the Use of a Cod/Haddock Separator Panel in Trawl Nets

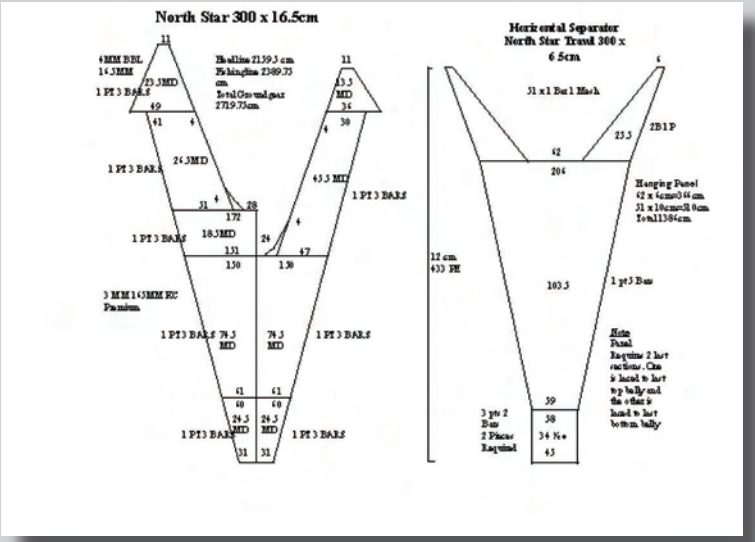
Christopher Glass, *Northeast Consortium, Durham, NH*

Since 1994, the New England groundfishery has been subject to a strict management regime. As a result, the status of many stocks and, in particular, GB haddock and GB yellowtail has improved dramatically. In contrast, improvement in GB cod has been slowed by recruitment failure. One of the challenges faced by the industry is to be able to harvest haddock without further depleting cod.

The project reported by Chris Glass was designed to test the effectiveness of using separator trawl gear in New England waters to separate cod from haddock and to assess its potential to reduce bycatch of cod and other species while maintaining haddock catches.

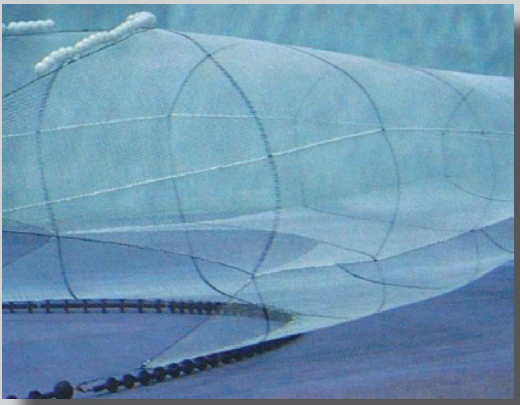
Gear Characteristics

The study was conducted on four commercial trawlers, the *F/V Olympia*, *F/V Capt'n Jake*, *F/V North Star* and *F/V Joanne A*. In order to meet size-related specifications for these vessels, two different nets were built. The separator trawls were constructed by Nordsea (Halifax, Canada). Complete nets were constructed and modified from the original net by inserting a four-inch (small mesh) separator panel dividing the trawl into an upper and lower codend.



Results

The investigators evaluated the selectivity of the gear by using a separation index that compared the total catch within both codends to the difference between the top and bottom condend landings. This approach to selectivity analysis provided an additional option for fishing gear technologists to consider during net performance investigations. Following analysis, the results indicated a substantial and significant separation of cod between the top and bottom codends. These results were observed for both size classes of vessels. Although cod were not separated exclusively into



the bottom codend, the results demonstrated that cod capture could be significantly reduced (if not totally eliminated) by fishing such a net with no codend on the lower portion. Furthermore, inadvertent capture of many other species of concern such as skates, monkfish and dogfish, would also be reduced, thereby substantially lowering bycatch and discard overall.

Conclusions

Haddock did not separate into the top codend as expected, but instead were evenly distributed in both top and bottom codends. This may be explained in part by the low numbers of haddock encountered during the study. The investigators identified the low haddock abundance as a critical factor in evaluating the potential of the trawl for a directed fishery.

Design and Test of a Rope Separator Trawl for Haddock

Pingguo He, *Ocean Process Analysis Laboratory of the Institute for the Study of Earth, Oceans and Space and NH Sea Grant, University of New Hampshire*

Carl Bouchard, *F/V Stormy Weather, Hampton, NH*

Pingguo He described the design and sea trials of a rope separator trawl intended to target haddock and release cod as well as other demersal species in the Gulf of Maine multispecies trawl fishery. This project was funded by the NOAA Northeast Cooperative Research Partners Program.

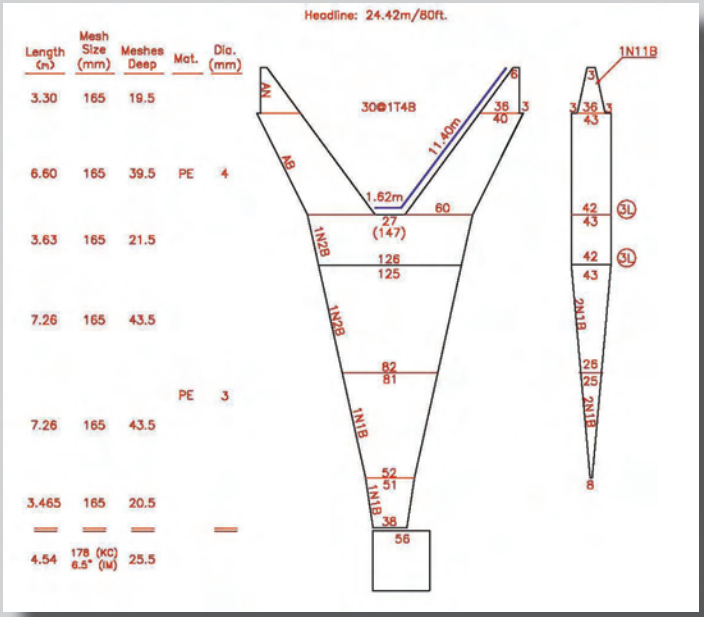
The research objectives were to:

- Design and evaluate the effectiveness of a horizontal rope panel in separating haddock from other non-target species.
- Compare catch rates between the experimental gear and control gear.
- Determine the feasibility of experimental gear for use as part of an SAP.

Design Characteristics

The experimental net is not a modification from the existing gear but an entirely new design. Key to the designs of the new gear are:

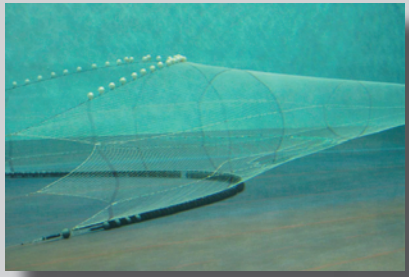
- The steep taper in the lower belly (approximately 30 degrees compared to a more typical 10 degree taper) from the fishing line to the extension piece.
- A large exit opening at the belly.
- Parallel ropes used as a separator.

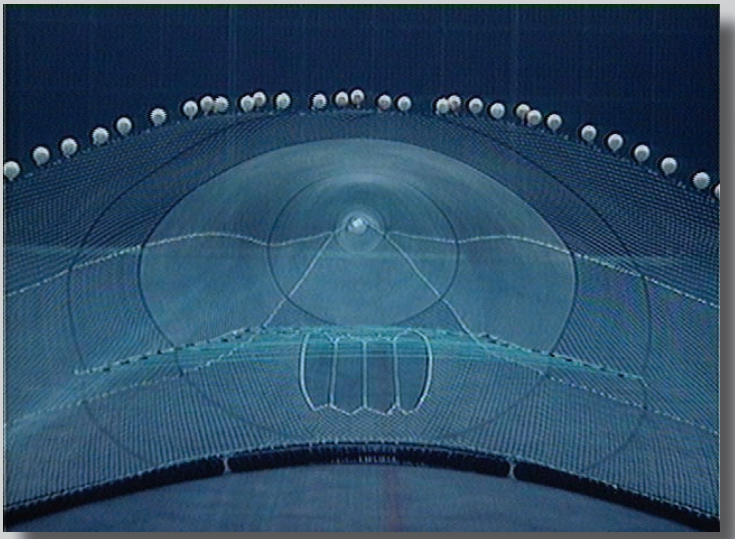


This exaggerated angle allowed for an easier exit by those species near the belly. The rope separator was composed of 18 ropes attached from the leading edge of the square. The first 12 ropes were about 24" apart and the remaining six ropes were 12" apart. The rope separator works under the same principle as horizontal mesh panel; however, the use of rope would not result in the mixing of fish in the separator, which is common in conventional net separators.

Results

The rope separator was compared to a traditional control net under commercial harvesting conditions during two fishing seasons. Results from structured comparative fishing showed that commercial catch rates





of haddock (218 kg/hr) can be obtained using the new rope haddock trawl. The new trawl reduced cod catch by 61% to 82%, with an associated reduction in haddock of 16 to 38%, both in numbers. The catch of flounder was virtually nil in the new trawl. There was also substantial reduction in other commercial and discard species such as dogfish, wolffish, lobsters and skates using the new rope separator trawl. On average, 85% of all catch in numbers were haddock when using the new trawl compared with 52% when using the commercial control trawl. Fish behavioral observations revealed that the rope panel enhanced species separation by allowing haddock to swim up and cod to swim down the rope panel.

Next Steps

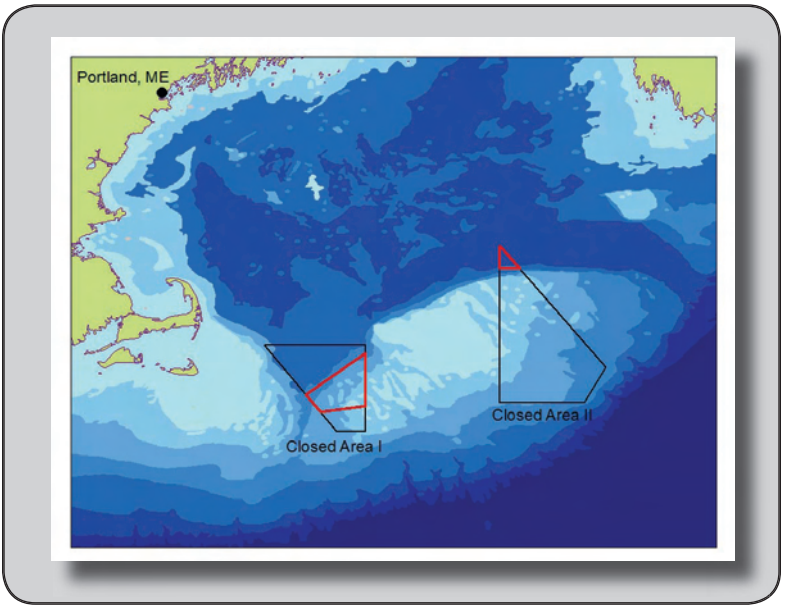
The rope separator trawl was practical in terms

of handling and operation. It has potential for use in SAPs targeting haddock with a much-reduced cod catch and eliminated flounder catch. In addition to an SAP scenario, the separator trawl would be a useful option for those fishermen interested in B DAS use.

Evaluating the Performance of a Haddock Separator Trawl in Reducing Cod Bycatch in Selected Areas of Georges Bank

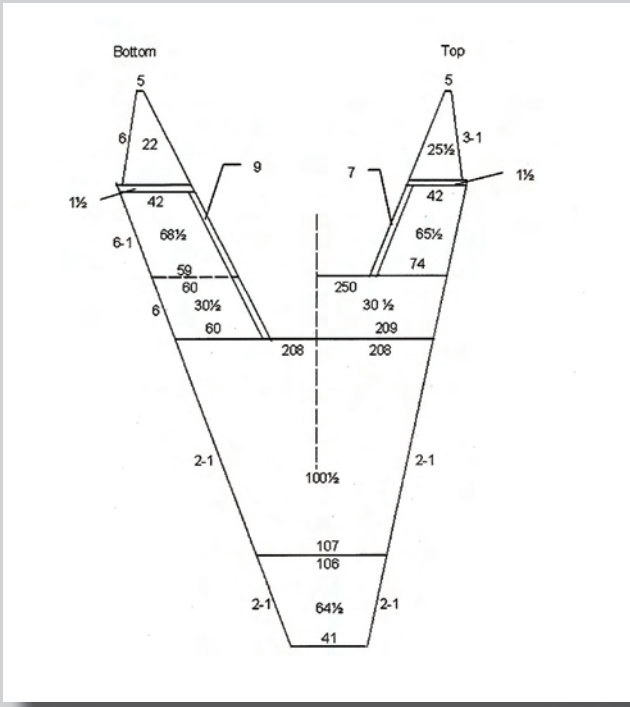
Catherine Salerno *and* ***Laura Taylor Singer,*** *Gulf of Maine Research Institute, Portland, ME*
Christopher Glass, *Northeast Consortium, Durham, NH*
Jim Odlin, *Atlantic Trawlers, Inc., Portland, ME*

Catherine Salerno described a comprehensive field experiment co ordinated by the Gulf of Maine Research Institute to evaluate the ability of a haddock separator trawl to target haddock and reduce the bycatch of Atlantic cod and other groundfish species in selected areas on Georges Bank. This was an industry-initiated project with a goal to provide managers and fishing communities with information to design and implement management measures that will allow the industry to harvest the healthy Georges Bank haddock stock without jeopardizing the recovery of other stocks.



Specific research objectives of the project were to:

- Document and analyze catch and bycatch rates of commercially important species in the study area, especially the extent to which cod and haddock are separated in the catch across seasons.
- Describe the fine-scale distribution of haddock and other species in the study area across seasons.
- Evaluate the potential for a haddock SAP in Closed Area I.



Design Characteristics

Standard commercial groundfish trawl:

- Simple two-seam design approximately 130 feet long.
- Headrope 118 ft; footrope 147 ft.
- Designed and built by Jeff Flagg, Portland, ME.

Modified by the addition of a horizontal mesh separator panel:

- Sewn to the gore lines of the net, extending throughout the net body and ending in two codends (both 6.5-inch diamond mesh), one on top of the other.
- Built to standards for a haddock separator trawl identified in the Northeast Multispecies Fishery Management Plan as of May 2005.
- Three 60-inch chains connected the leading edge of the separator panel to the footrope.

Results

Eight experimental fishing trips were conducted in the study area between June 2005 and May 2006. Over this time period a total of 158 20-minute tows were conducted. Most of these tows occurred inside Closed Area I (145), and the remaining tows (13) were conducted inside Closed Area II. Results indicate that this haddock separator trawl design significantly reduced the bycatch of cod and virtually all other demersal species, including many other regulated species. Overall by weight, 94% of Atlantic cod were captured in the bottom codend versus 6% in the top. Ninety-nine percent of all winter flounder, monkfish and skates by weight were captured in the bottom codend. Similarly, 97% of yellowtail flounder were captured in the bottom codend. However, more than half of the overall potential haddock catch was also captured in the bottom codend (55%).

Over the duration of this study, haddock catch rates in general were surprisingly low, although there was high variability in catches both temporally and spatially. Overall by weight, haddock accounted for only 12% of the catch in both codends combined. Mean haddock catch per unit of effort (CPUE) in the top codend was very low (26 lbs/hour). Catch per unit effort was generally higher in summer months, with highest catch rates achieved in June (117 lbs/hr). In contrast, cod catch rates remained consistently low across time and space, irrespective of haddock catch rates. Overall mean CPUE in the top codend was 1 lb/hr.

Limited testing of the gear (22 tows) with minor modifications aimed at reducing the effective fishing height of the panel (i.e., shortening the chains connecting the panel to the footrope from 60 in to 36 in) was conducted. This resulted in acceptable catch rates of haddock (83% in top codend), but unacceptable bycatch rates of cod (38% in top codend).

Conclusions

- Haddock SAP in Closed Area I is not economically viable at this time using the experimental design.
- High densities of haddock would be necessary for this separator trawl design to be economically viable.
- Performance in high densities of intermingled cod and hadock is unknown and should be evaluated.
- Additional experiments that explore the effects of separator panel height from the footrope may be warranted to test if better catch rates of haddock can be achieved while at the same time excluding an acceptable proportion of cod bycatch.

Experiments in "How Not to be Caught" for Haddock and Other Would-Be Trawl Escapees in the Gulf of Maine

Dana Morse, *University of Maine Cooperative Extension, Maine Sea Grant, Darling Marine Center, ME*
Kelo and Gale Pinkham, *F/V Jeanne C., Trevett, ME*
Claudia Coffin, *F/V Bad Penny, Edgecomb, ME*
Bill Lee, *F/V Ocean Reporter, Rockport, MA*

Dana Morse discussed two approaches to minimizing cod and non-target demersal species landings for a directed haddock fishery. Both projects have their roots in ideas from industry (from K. Pinkham and C. Coffin). Both projects were funded in prior iterations by the Northeast Consortium and granted follow-on funds to continue the investigation of these approaches. Each project is in the initial stages of field trials and both have had positive results.

Building on a Promise: Continued Investigation in Using a Four-Seam Bottom Trawl to Improve Escapement of Small Haddock and Cod

Traditionally, enhancement of selectivity in trawl nets has focused mostly on the codend. Much of the escapement of finfish species occurs in that part of the net, although not exclusively, and good examples exist of such modifications that reduce bycatch and discards. An innovative approach in this vein was tested in 2004 and showed excellent initial results.

2004 Results

A two-seam trawl was converted to a four-seam trawl with square mesh side panels. Fishing trials revealed excellent rates of escapement for sub-legal cod and haddock. Rates of escapement of legal fish were high for haddock and moderate for cod. The taper of the belly was increased with the anticipated benefit of retaining a higher number of legal-sized fish. However, increasing belly taper added no extra benefit in escapement of small cod and haddock. Both trials resulted in too much loss of the legal catch of cod and haddock to expect industry adoption.

Design Modifications to Date

Video footage from the 2004 field trials suggested that landings of legal-sized fish may be increased by altering the side panels. To examine this approach, side panels of 5.5" square mesh will be placed in the trawl with the expectation that more legal-sized escapees will be retained while allowing sub-legal fish to escape.

The Use of Positively Buoyant Ground Cables and Sweep to Reduce Seabed Contact and to Enhance Species Selectivity

The aim is similar to other gear arrangements: to reduce catches of flatfish in hauls for cod and haddock and also to reduce catches of flatfish and cod in haddock sets.

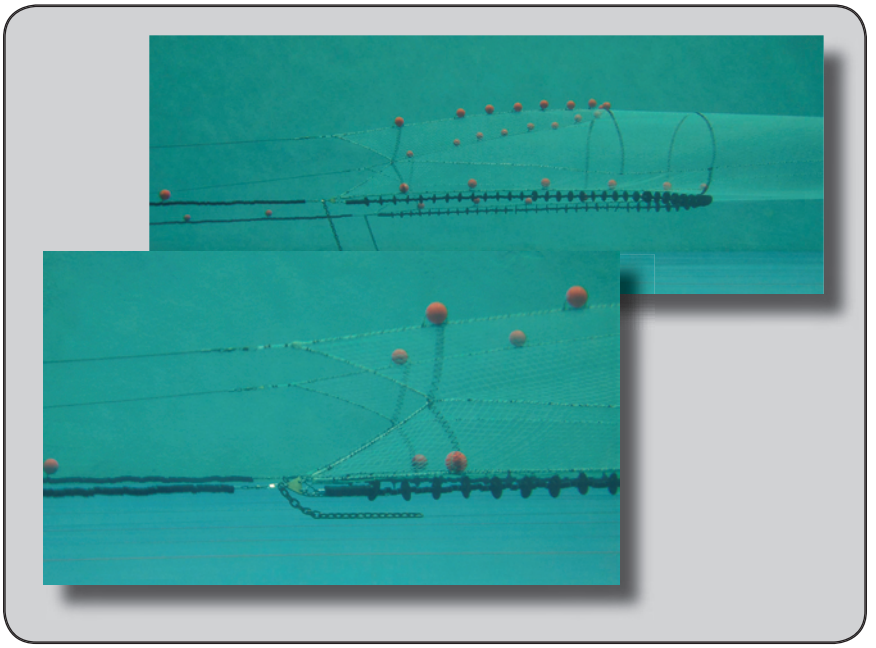
However, there are two main elements with the experimental rig (referred to as the "floaty frame') that differ from prior gear:

- The net is rigged with a full sweep to enable fishing in areas

where the bottom is rocky and where frequent turns are required. Sweepless trawls and dropper-chain rigs are more likely to tear up on turns, where the netting drops to the bottom.

- The ground gear (in this case, the lower leg) has flotation attached. The only point of contact is with a dropper chain at each wing end. This aids in early escapement of flatfish species (sight vs. touch as stimulus).

To date, a scale model has been tested at the Memorial University Flume Tank; and fieldwork will commence in spring and summer of 2007. The goals of this project are to reduce flatfish (and sometimes cod) catches in mixed-species areas and to develop an effective trawl that can be fished on hard bottom, both with minimal bottom contact.

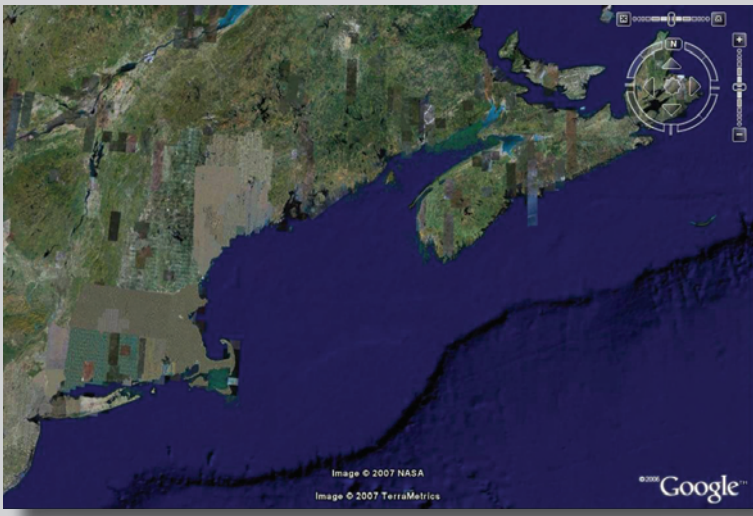


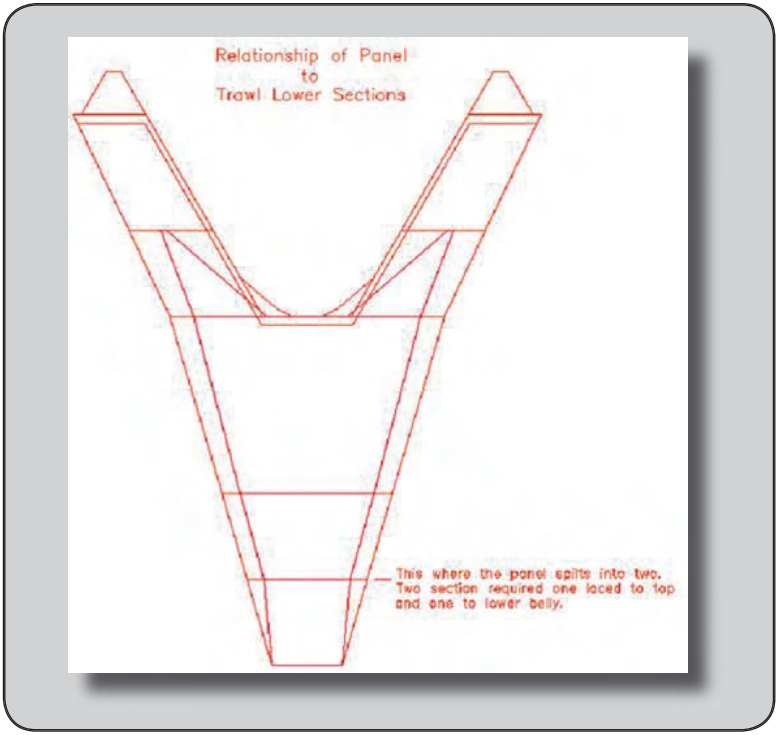
Canadian Use of Separator Panels on Georges Bank

Paul Winger, *Center for Sustainable Aquatic Resources, Fisheries and Marine Institute of Memorial University of Newfoundland*

Paul Winger presented a history of the Canadian trawler fleet fishing on Georges Bank as it relates to the incorporation of the haddock separator trawl by industry and subsequent regulation changes.

The Canadian fleet currently fishing out of southwest Nova Scotia is made up of 30-40 trawl vessels ranging in size from 45 to 65 ft. All vessels are individual owner-operated. Currently, all fishing vessels use a separator panel to exclude cod while fishing for haddock. Separator panels have been in use for the last eight to nine years and were made mandatory over the last three to four years. Gear use is regulated by adding restrictions to the commercial fishing license mandating their use in specific areas. Condition of licence stipulates the minimum height of the panel, location and mesh size; however, fishermen are permitted to adjust panel height to optimize for their allowed cod





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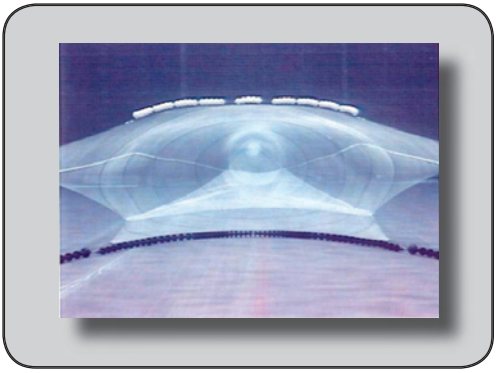
quota. Separator panels are currently mandatory for all vessels fishing in area 5Z and are expected to become required in area 4X. Government enforcement is extensive with 100% observer coverage during the winter fishery and 20% observer coverage in the summer/fall fishery. Most vessels achieve less than 5% bycatch of cod.



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Summary and Conclusions

Separation Strategies

The net designs were in various stages of development and their corresponding investigators gave detailed presentations that covered field trial status and data analysis. Separation strategies varied from project to project. One design (GMRI) seeks to describe spatial and temporal separation of cod and haddock by surveying potential fishing areas. The DMF design attempts to elevate the trawl mouth to pass over cod, while one UME design uses a positively buoyant sweep and ground cables to pass over cod. The URI trawl allows escapement of cod through large meshes in the trawl mouth, and another UME design uses square mesh side panels to allow cod to escape. The UNH rope separator uses ropes instead of a netting panel to direct cod out of the lower half of a trawl. In addition, both GMRI and SMAST presented research documenting the performance of the currently mandated separator design.

State of the Technology

The group generally agreed that horizontal separator panels can successfully separate intermingled cod and haddock and that panel height above the seafloor was a critical factor. Increasing the height of the panel decreased cod catches in the top codend while also decreasing haddock catches. Adjustment of panel height is easy to do in the field and has both negative and positive implications on the performance of the gear. It was determined that most of the experimental designs presented will require further field testing due to limited data from a combination of low haddock and cod catch rates and low level of species mixing, which may have been the result of seasonal and geographical effects. Of the seven designs, only the UNH rope separator trawl was tested on relatively high concentrations of intermingled haddock and cod and produced a cod reduction rate of 60-80%, a haddock loss between 16-35% and a flounder reduction of nearly 100%.

Gear that employed strategies other than horizontal separator panels were also successful in reducing cod capture. The URI Eliminator Trawl provided a 20:1 ratio of haddock total weight versus cod total weight, a 15:1 ratio of haddock to yellowtail flounder and a 19:1 ratio of haddock to winter flounder. The DMF Five-Point sweepless raised foot-rope trawl provided up to a 98% reduction in cod with no significant reduction in haddock landings during 91 experimental tows; however, subsequent field trips did not produce equivalent results. This difference may be the result of low haddock catches and discrepancies in net geometry.

The group recognized that the desired degree of separation of cod and haddock varied between interested parties. For example, managers might favor 100% separation of cod and haddock while industry members might view the loss of all cod as a loss of vital income. It is highly unlikely that any gear would be able to achieve 100% separation between these two species when both are present in any given area. However, industry participants indicated that they could "make the gear work" given clear goals, such as B-day use requirements.

Recommendations

• The conveners acknowledge that there will not be one gear design that will work in every situation. Different habitat types (mud, sand, gravel/rock) will favor different gear types. The conveners recommend that a variety of gear be immediately identified for pilot use by the industry and are confident that industry members have the necessary experience to employ the most efficient gear for their harvest areas and bottom types.

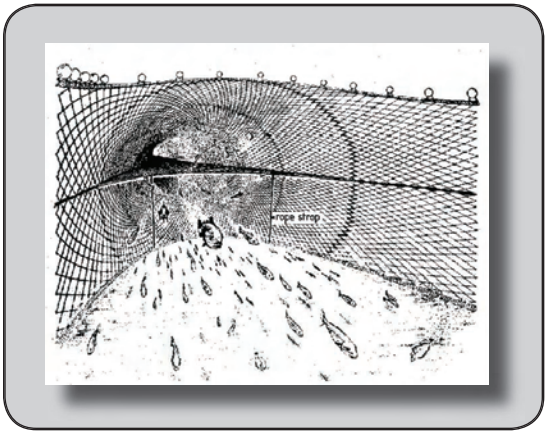
• The conveners recommend that the URI Eliminator Trawl and the UNH Rope Separator trawl be considered for pilot-scale use by the industry in the Eastern U.S./Canada Area SAP and/or the Regular B DAS Program. Data collection on landings, discard and catch rates should be required for participation in these programs to confirm expected gear performance under commercial conditions.

• The conveners recommend further consideration of the DMF Five-Point Trawl once additional stability testing is completed.

• The conveners request that NMFS and/or the New England Fishery Management Council develop more specific gear requirements and performance standards necessary to gain authorization for use in a haddock SAP and the Regular B DAS Program.

Suggested Future Research

• Investigate seasonal effects on experimental gear performance. Some of the variation in gear performance may be the result of seasonal changes in groundfish distribution. A better understanding of seasonal changes in performance may allow managers to identify specific time/area combinations in which an SAP may be approved for specific conservation gear.



• Evaluate time/area avoidance of cod. Are there areas of predictably low cod abundance in which separator trawls could be used to meet the discard limitations of an SAP and/or the Regular B DAS Program? To answer this question, an improved understanding of migratory patterns and specific habitats favored by species of concern is necessary.

• Industry-based pilot programs. Haddock separator technologies should continue to be evaluated in areas of high and low species mixing and abundance. This objective could be realized through the use of industry-based pilot programs or experimental fisheries.

• More behavioral work. Fish will behave differently under various conditions (i.e., haddock tend to stay closer to the bottom when there are low densities of

conspecifics but will utilize more of the water column when higher densities of conspecifics are present). What other types of behavioral variation occur under different conditions and how does this affect performance of these types of gears?