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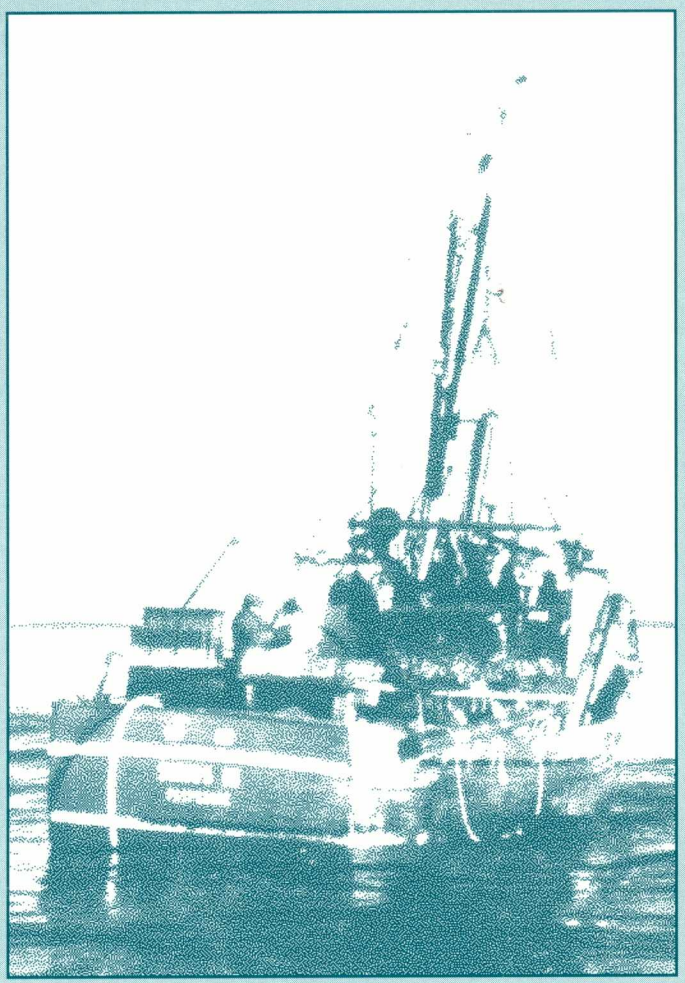
FISHING GEAR SELECTIVITY PROGRAM ATLANTIC CANADA



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FISHING INDUSTRY SERVICES
SERVICES À L'INDUSTRIE DE LA PÊCHE

Canada

FISHING GEAR SELECTIVITY PROGRAM ATLANTIC CANADA

1992/93 ANNUAL REPORT

INSTITUT MARITIME DU QUÉBEC
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Forward by:

David Balfour
Director, Fishing Industry Services
Department of Fisheries and Oceans (DFO)

Declining fish stocks and a growing awareness of delicacy of the marine eco-system are giving rise to a philosophy of sustainable development in the fishing industry in Canada.

The Department of Fisheries and Oceans (DFO) is playing a leadership role in the promotion and development of a philosophy of responsible fishing. But this is a shared obligation. Industry-government consultation and collaboration are key.

In the past, mesh size and by-catch regulation have been the methods used to lessen harvesting pressure on the resource. A move, under the 1993 Atlantic Groundfish Management Plan, to the mandatory landing of all regulated species and to protective measures for immature fish has heightened interest in improving the "selectivity" of commercial fishing gear.

This involves reducing the incidental capture of non-target species and immature fish, i.e., their exclusion, protection, or automatic release from fishing gear during harvesting operations. Selectivity research is being conducted on a full-partnership basis with commercial fishermen and the organizations which represent their interests.

Selective technologies have been the subject of experimentation by the Department for some time. These new technologies must prove themselves, however, not only in terms of their ability to increase the selective capacity of conventional fishing gear, but by providing some expectation of payback for the costs or acquisition and operation. Another criterion is that they easily integrate into normal fishing operations.

In 1992/93, the DFO Fishing Gear Selectivity Program in Atlantic Canada consisted of 32 approved projects valued at over $3 million. Coordination was facilitated by industry advisory committees and the Atlantic Technical Fish Capture Working Group, which fulfils an advisory, review and coordinating function for all projects conducted under the program.

One of the outcomes of this body of research is the revision and improvement of fisheries regulation. Several sectors are now required to submit conservation harvesting plans acceptable to the Department—plans taking into consideration the selective characteristics of fishing gear and harvesting methods, before fishing can commence. Yet another outcome involves gear conversion, mandatory or voluntary. Conversion programs by the industry have been, and will continue to be, subsidized on occasion by government.

A major project now being undertaken by the Department at the instruction of the Minister is a complete review of all fishing gear and harvesting technology in Atlantic Canada. Assessments and reports generated through this process will be made public and serve as the basis for ongoing industry consultations during the course of this three-year project. The final outcome will be an industry-agreed technology strategy for the future.

Throughout, the overall objective of the Program will remain—to design, test, demonstrate and deploy more environmentally-friendly harvesting technology to achieve a sustainable fishery.

Introduction

The Fishing Gear Selectivity Program in Atlantic Canada in 1992-93 involved 24 research projects funded under the Atlantic Fisheries Adjustment Program (AFAP) and eight under the Quebec Federal Fisheries Development Program (QFFDP). While they have similar objectives, these programs are separately administered and are, in part, a response to the realization that we now face serious resource problems in the fishery. Projects conducted this year by the Department of Fisheries and Oceans represent a total investment of $3,179,755 directed toward improving the selectivity of all types of gear used in the commercial fishery.

For those unfamiliar with the term, fishing gear selectivity is defined as follows:

> The ability to target and capture fish by size and species during harvesting operations, allowing by-catch i.e., small (or juvenile) fish and non-target species to escape unharmed.
>
> Selectivity means abandoning our traditional emphasis on quantity and making a definite shift to sustainable harvesting practices. It means catching those fish we want, releasing unharmed those we don't want, thus reducing overall pressure on the resource.

Selectivity, however, is not simply a technological issue, and it should not be regarded as a technological panacea. It is ultimately a matter of human behaviour—a responsible fishing philosophy supported by innovative technology. Improved selectivity will require significant changes in current practice and attitude.

Interestingly, it has been found that selectivity projects not only help to reinforce responsible fishing practices, but even introduce certain efficiencies. Fishermen

have found, as they become more environmentally aware, that it is still possible to fish selectively and to optimize returns. Improved gear selectivity can mean greater efficiency, improved yield and reduced costs for fishermen and processors.

There is now general agreement that it is preferable to sort the catch by size or species, leaving small fish and non-target fish unharmed in the water, rather than to take them onboard. Changing attitudes are being reinforced in some sectors by the Department through mandatory landing regulations which require that everything caught be brought to shore rather than simply returned dead or injured to the sea. Even here, however, we must be careful so that a dumping or discarding problem at sea does not become a disposal problem on shore.

A sustainable fishery is characterized by responsible fishing practices and selective methods and technologies. Improvements in harvesting capability and the resulting impact on traditional species have virtually dictated more selective technologies, methods and practices, and our research effort is beginning to show results.

Technological solutions to resource shortages, however, must not only be biologically viable but functionally and economically feasible. They must also respond to environmental concerns and must be based on both technological principles and fish behaviour, albeit with emphasis on the former.

The current situation in Canada, as in many of the world's fishing nations, is characterized by:

- relatively low levels of investment in research and development (R&D);

- government-funded research, little industry participation (other than consultative and contractual);

- emphasis is on the transfer and adaptation of offshore technologies;

- funds invested are often not leveraged as they are in other sectors e.g., tax credits, matching grants, etc.;

- industry reluctance to innovate, BUT

- significant results/progress nevertheless.

In the future, the fishing industry must be integrated more completely into the decision-making and evaluation processes with regard to selectivity research. This should include sharing the burden, including financial responsibility, of ensuring that appropriate R&D takes place. Until now R&D investment by the private sector has been low which, in part, explains its marginal involvement in the process.

Finally, there is a need for a sustained program of education to reinforce the notion of responsible fishing. Public and industry awareness of the issues surrounding resource sustainability is essential.

Technological research and development must be aligned with the promotion of responsible fishing and the formation of a true spirit of cooperation between industry and government. It is our hope that this publication will be another step in that direction.

Action Plan – 1992/93 Fishing Gear Selectivity Program

DFO is proceeding on the basis of full consultation with the Atlantic fishing industry.

Results/data from the 1992/93 selectivity experiments will be used to:

- continue to inform the consultative process;
- help fishermen adjust to changing circumstances;
- prove/disprove current notions concerning selectivity and its impact(s) on fish stocks;
- develop fishery management plans; and
- determine, in consultation with the industry, the course of future work to be conducted in this area.

In an effort to maintain the positive momentum, the Department has been working with the fishing industry in Atlantic Canada to deliver the program of gear selectivity research described in this publication. The program is supported by the Atlantic Canada Fishing Gear Selectivity Technical Working Group which fulfils an advisory, review and coordinating function for all projects conducted under the program.

The 1992-93 Program, by region, consists of the following:

REGION	PROJECTS	BUDGET
Atlantic Region	4	$313,015
Newfoundland	6	$714,800
Scotia-Fundy	9	$514,800
Gulf	5	$377,000
Quebec	8	$1,260,140
Total	**32**	**$3,179,755**

1 ATLANTIC PROJECTS

1.1 INDUSTRY CONSULTATIONS

The implementation of a Fishing Gear Selectivity Program involves a number of projects which cannot be carried out in one of the five fishing regions. The projects include consultations and workshops which communicate the latest technological developments to the industry, environmental assessment studies affecting the entire Atlantic Region, the implementation of an international development program, and a Review of Fishing Gear and Harvesting Technology used in the fishery. All these projects are considered Atlantic Fishing Gear Selectivity Projects, and are described in the section which follows.

1.1.1 Mobile Gear Selectivity Workshops

Mobile Gear Selectivity Workshops –
St. John's, April 27/28, 1992 / Halifax, April 30/May 1, 1992

The purpose of these industry consultations was to communicate the results to fishermen, processors and other stakeholders of gear selectivity experiments being conducted in Atlantic Canada and provide the opportunity for an examination of similar work being carried out in Europe. An attempt was made to achieve consensus on the direction of future gear selectivity research and to set the stage for the subsequent introduction of actual gear conversion programs in Atlantic Canada.

Summary Reports (Proceedings) and Technical Reports were produced for distribution to participants and industry/government opinion leaders, and are available upon request.

1.2 Studies and Discussion Papers

1.2.1 Ghost Net Study – Atlantic Region

The Department of Fisheries and Oceans has made several attempts over the years to address the ghosting issue. The results suggest that the continued capture of fish by lost/abandoned nets is minimal in shallow water. On the other hand, nets in deep water (below the photic zone) continue to fish for two years or longer. The current moratorium provides a clear opportunity to concentrate on determining the current size and scope of the problem, on costing and mounting ghost net retrieval projects in the most-fouled areas and on examining ways to prevent ghosting in future.

Aquaprojects Ltd. was contracted to conduct an assessment of the problem, to engage in industry consultations on the subject and to review the options available for treating the ghost fishing problem. At the same time, an associated assessment/report was done on crab pot ghosting in the Gulf of St. Lawrence.

The project has produced, in the form of a draft discussion paper and action plan, a concrete plan for the management, containment and eradication of ghost fishing, including:

- identification of worst (most fouled) areas
- terms of reference for the development of non-ghosting gear
- guidelines for possible new regulations
- assessment of gear marking technology
- an information/education strategy

A pan-Atlantic proposal has been put forward for consideration next year.

1.2.2 Dumping/Discarding – Atlantic Region

Widespread dumping and discarding of fish by domestic (and foreign) fishing fleets on Canada's east coast is a longstanding problem. In combination with mis- and/or non-reporting of catches, the potential for damage to fragile fish stocks is significant.

The 1993 Groundfish Management Plan introduced mandatory landing requirements for all regulated species, and similar regulations are being considered in other fisheries, e.g. northern shrimp.

However, mandatory landing requirements cannot be the end of the story. Our strategy must extend beyond simply requiring fishermen to land by-catch and small fish, or else we simply convert the problem of dumping at sea to disposal on shore.

A discussion paper has been prepared and is available to serve to focus any future examination of the dumping/discarding/disposal problem in Atlantic Canada.

1.3 Review of Fishing Gear and Harvesting Technology – Atlantic Region

The Minister has requested a complete review of fishing gear and harvesting technology on the east coast. In addition, he mentioned the need to increase gear efficiency and selectivity to bring harvesting capacity into balance with resource potential. In response to the Minister, Fishing Industry Services put forward a proposal for funding under the Atlantic Fisheries Adjustment Program (AFAP) to conduct the review. Phase 1, a detailed Work Plan is already complete.

General deliverables will include:

1. A techno-economic analysis, including baseline data.

2. Options and alternatives by fleet sector.

3. Case studies (pilot projects) by fleet sector.

4. Overall analysis/results reporting - scenarios for wider interpretation.

5. Industry consultation - draft strategy.

6. Final (industry-agreed) technology strategy (May 1994).

The next phase will directly involve all sectors of the industry and the provinces.

1.4 International Development

Funding over two years (1992-94) has been approved under the Atlantic Fisheries Adjustment Program for the development, in conjunction with industry, of a series of specific action plans designed to exploit potential international development opportunities for the fishing industry in Eastern Canada which includes the export of related fishing gear selectivity technologies.

In early 1993, Canadian Ocean Resource Associates Inc. (CORA), with support from DFO, undertook an initiative to identify international opportunities in the fishery which could provide business and employment opportunities for the Newfoundland industry, while also serving the needs of the host countries. This has involved overseas missions to develop and

broker joint-venture and partnership arrangements including the export of fisheries-related services, assets and technologies from Newfoundland to a number of countries around the world. Four international project assessment missions have been completed—Russia/Eastern Europe, Asia, Alaska and the Caribbean—and a large number of firm joint-venture opportunities identified.

The project has already resulted in specific regional and sub-regional plans for the involvement of Newfoundland companies and individuals in exploiting opportunities which have been identified through this process. A series of progress reports on the results to date is available. At issue is the availability of additional federal funding and other forms of ongoing support, where required.

A similar project involved the Alliance des pêcheurs professionnels du Québec (APPQ) and the Newfoundland Fishermen, Food and Allied Workers Union (NFFAWU). The Indian government recently expressed interest in developing its offshore fisheries, and its National Institute of Agriculture proposed a joint-venture between our two countries. They suggested that a feasibility study could be the first step towards using Canadian equipment and expertise in India's fisheries.

The APPQ and the NFFAWU agreed to conduct a feasibility study in India to investigate joint-venture opportunities in the harvesting, processing and marketing of Indian underutilized species. Following approval of the project, a consulting firm examined the possibility of sending Canadian fishing vessels to India, carrying out harvesting and processing operations there and importing whole fish back to Canadian processing plants. The APPQ and the NFFAWU would direct and coordinate operations with Canadian third parties, fishermen and processors. In India, the National Institute of Agriculture will direct and coordinate the project.

The project is being conducted over a two-year period and includes the following steps:

- identification of project concept;
- evaluation of project potential and identification of decision centres;
- identification of partners in harvesting, processing, marketing and finance;
- joint-venture agreement on action plan between various partners;
- production of a detailed strategic action plan (feasibility report).

Industry representatives and the consulting firm visited India in March 1993 and a report on this phase of the project was completed.

2 GROUNDFISH SELECTIVITY PROJECTS

Groundfish stocks, consisting primarily of cod, haddock, pollock and flatfish (flounder, plaice, etc.), traditionally support approximately half of the 140,000 jobs in the fishery and represent approximately 50% of total fish landings in Atlantic Canada.

In spite of the steadily declining biomass and the recent moratorium on northern cod and drastic quota reductions or closures of other fisheries, research must continue to ensure that the industry will be viable when fishing resumes. To this end, the Department conducted a series of experiments aimed at improving size and species selectivity in a number of fisheries directing for groundfish in 1992/93.

2.1 MOBILE GEAR EXPERIMENTS

2.1.1 Separator Trawls

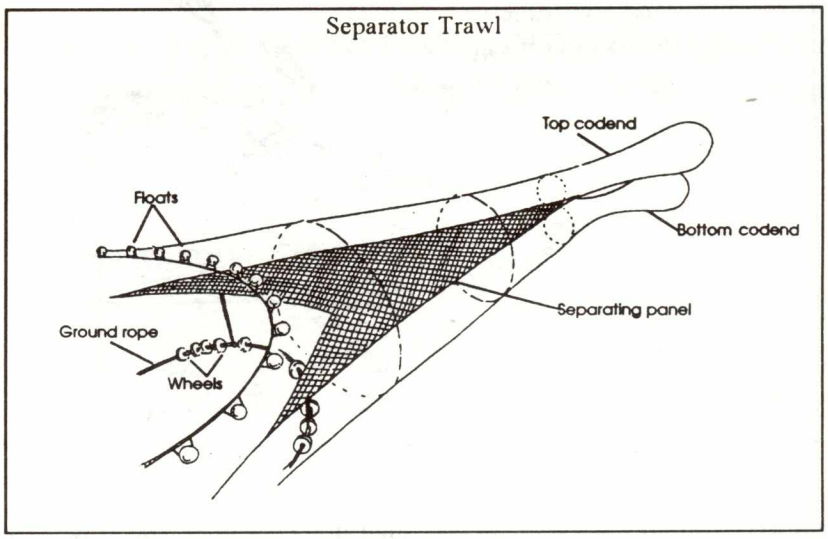
The use of separator panels in conventional trawls, as a means of reducing the by-catch of non-target fish has met with some success since the concept was introduced into Canada. Underwater observations have shown that horizontal separation panels of netting, rigged at the correct height inside the net with independent codends, will separate different species as they enter the net.

Experiments have been conducted in Canada to separate different species however, as in many other countries, these experiments are ongoing. The objective is an acceptable level of separation, together with a net design simple enough to be easily repaired and therefore acceptable to the commercial sector.

In 1992/93, two experiments designed to modify the technology for groundfish using separator trawls were undertaken.

Offshore Trawl Selectivity Horizontal Panel – Newfoundland Region

A project to investigate the effectiveness of a horizontal panel to reduce the catch of cod while directing for flounder was carried out on an offshore stern trawler. The vessel's traditional 96 ft flounder trawl was modified to accommodate a panel extending from the front of the trawl to a trouser extension dividing the codend into two sections. The panel was rigged so its height could be adjusted to allow the gear technicians to determine the most selective modification. Four separate heights were tested. A stationary underwater camera and Scanmar sensors were used to record the results.

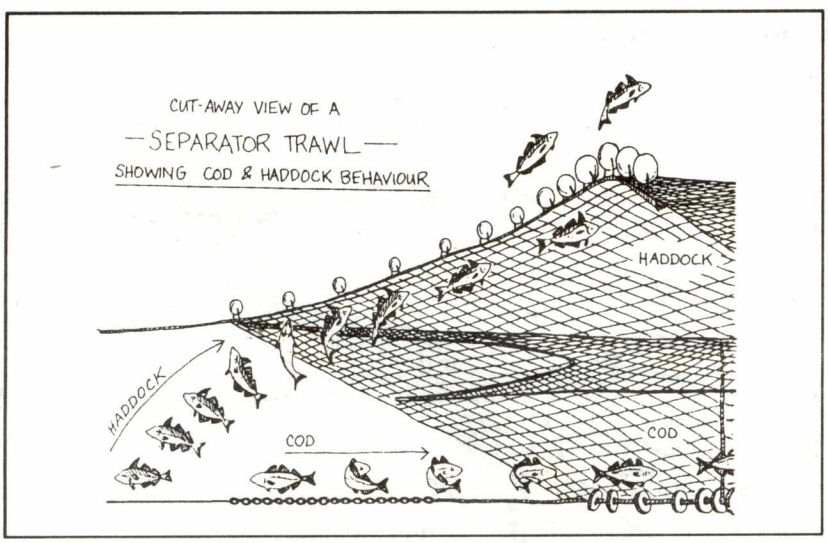


A total of 28 sets were made of which 26 were successful. Unfortunately, the camera did not perform satisfactorily, and the Scanmar height readings were unreliable for short distances. It was impossible to get accurate readings of the panel height above the footrope. Nevertheless, the experiment continued with the panel set at approximately the heights intended.

Preliminary results show that fish length is not a factor in separation. Comparison of the percentages for top and bottom codends per tow were similar for all length groups and for all species. It was thus concluded as a result of this experiment that the horizontal panel did not appear to be effective in separating cod from American plaice.

Cod/haddock Separator Trawl – Scotia-Fundy Region

In 1992, Inshore Fisheries Ltd. approached the Department with a proposal to commercially test a separator panel on a 65 ft vessel. Their goal was to separate flounder from haddock, allowing their vessels to direct for flounder without catching haddock.



The experiment commenced onboard the *Carmelle No. 1* in August 1992. Five trips were made, the first two without the aid of an underwater camera. Camera footage on the third trip showed that the panel needed to be modified. Following modifications, the vessel performed a number of tows to "tune" the panel to optimum height for haddock/flounder separation.

As can be seen from the chart below, after tuning, good separation of haddock/flounder occurred at 2.5 ft.

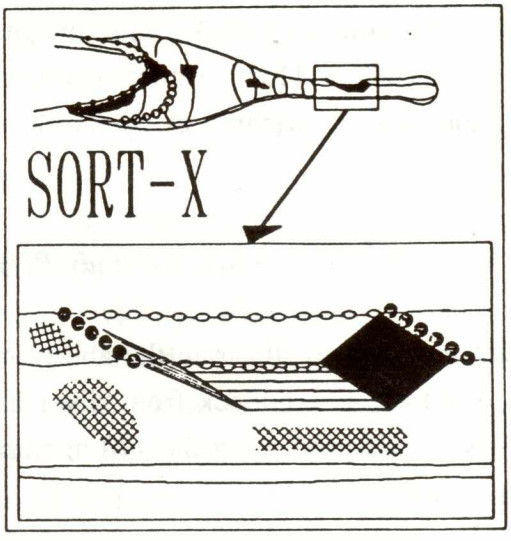
	Haddock		Cod		Winter Flounder	
Rope Height	Top (%)	Bottom (%)	Top (%)	Bottom (%)	Top (%)	Bottom (%)
1.5	99.5	0.5	64.6	35.4	17.9	82.1
2.5	89.1	10.9	33.3	66.7	2.2	97.8
3.5	83.7	16.3	13.2	86.8	0	100

Two trips directing for flatfish were completed and results are being analyzed. Further tests are planned for 1993/94.

2.1.2 Sorting Devices

Testing of Sortex Grate – Scotia-Fundy

A project using a National Sea Products (NSP) offshore groundfish trawler to determine the effectiveness of the Norwegian Sortex system on small cod in NAFO Sub-division 4VN, in comparison with a square mesh codend, was conducted in February 1993.



Data is being analyzed and preliminary results indicate that the Sortex device performed most effectively on cod at low to moderate catch rates. During periods of heavy concentrations, the effectiveness of the system in releasing undersized cod decreased. However, when the vessel was fishing for redfish, Sortex appeared to perform effectively, even when catch rates were high.

Although by itself the Sortex System was no better than square mesh in releasing small cod, the possibility remains that a dual system employing Sortex in combination with a square mesh codend might handle large concentrations of small cod.

Trollex Sorting Device – Quebec Region

A project to adapt the Trollex sorting device to the small inshore trawl fishery in the Gulf of St. Lawrence was conducted in an effort to reduce the number of immature cod being caught.

The performance of the device was tested in conditions with low and high concentrations of fish. In low concentrations, 36 tows were made over a 24-day period and 5,000 kg of cod were caught. The Trollex system excluded 84% of the cod less than 41 cm in length, while excluding 28% of commercial size cod (> 41cm). Under conditions where a high density of fish was found, the performance of the Trollex device deteriorated.

Silver Hake Separator Trawl – Scotia-Fundy Region

An experiment designed to illustrate the ability of a separator grate to separate cod, haddock, and pollock from silver hake was undertaken in June 1992. It was conducted using the 170 m stern trawler, *Cape Verde* (National Sea Products).

A total of 32 valid sets under a variety of conditions was completed. It was found that a grate with a bar spacing of 40 mm and set at an angle of 40-45° can effectively separate silver hake from cod, haddock, and pollock. Using this grate, 95.7% of the pollock, 95% of haddock, and 92% of cod escaped unharmed.

Shortly after completing the experiment, the Cuban fleet fishing for Blue Wave Fisheries Ltd. expressed an interest in experimenting with the grate. In the experiment which followed, the separator grate gave positive and promising results. The Cubans have expressed an interest in attempting another experiment in 1993/94.

2.1.3 Mesh Size and Square Mesh

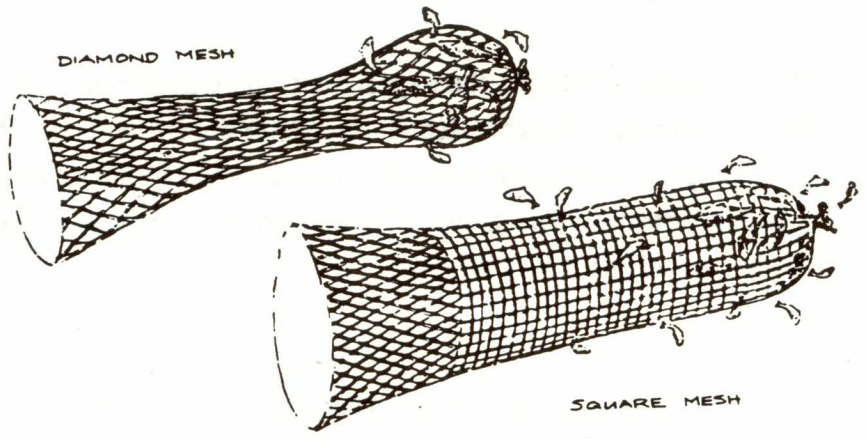
Previous studies on mesh sizes and shapes (square versus diamond) over the past ten years have demonstrated that the modifications of mesh can significantly affect the selectivity of trawls. In 1992/93 a number of projects were undertaken to determine the optimum mesh configuration for the various gear types.

Offshore Trawl Selectivity, Large Square Mesh – Newfoundland Region

A project to test the effectiveness of large square mesh in trawls for reducing the catch of cod while directing for flounder (American plaice) was carried out on an offshore commercial stern trawler. The vessel's traditional 96 ft flounder trawl was modified to accommodate twin codends and a 44 mm vertical divider panel which extended from the headrope and footrope back to twin codends. The experimental codend on one side had a 183 mm square mesh, while the control codend had 44 mm diamond mesh. To record the results of the experiment, an underwater video camera was used. In addition, the trawl was rigged with Scanmar sensors

which provided measurements of headline heights, temperatures, and door and wing spreads.

Square mesh and diamond mesh codends



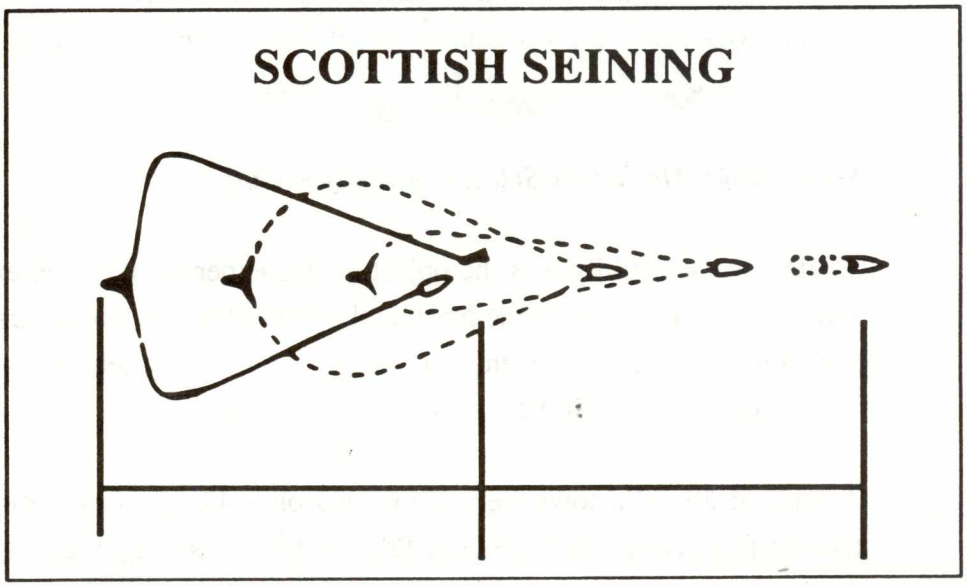
A total of 31 tows were made, of which 28 were successful. The catch of cod in the large square mesh codend represented 27% of the total catch of cod. The average length of the cod was 84 cm, while the average cod length in the control codend was 32 cm. The catch from each tow in the large square mesh codend usually consisted of 10 to 20 large cod (>80 cm), while the catch of cod in the small mesh codend averaged 10 to 20 large cod and several hundred small cod.

Preliminary analyses indicate that the 183 mm square mesh releases the majority of cod, however, some of commercial size flatfish species also escape. It is recommended that a smaller square mesh, possibly 165 mm, be tested to reduce the loss of commercial flatfish.

Scottish Seine with Square Mesh – Scotia-Fundy Region

In 1991/92 an experiment was performed using two commercial seiners to obtain selectivity data on Scottish (Fly) seines. The experiment was of

limited success because the vessels used in the experiment had to be separated a considerable distance, consequently, their targeted fish populations were different. In 1992, a new experiment using only one seiner with a divided seine and two codends was undertaken so as to avoid the problems of the 1991/92 project.



Over 28 sets were completed, but again the results were of limited value. Video footage of the experiment revealed that both sides of the net were not fishing equally. It appears as a result of this experiment that the only way in which selectivity results can be obtained for Scottish seines may be by using covers. However, these covers must be carefully designed to ensure masking of escapement does not occur.

Redfish Mesh Size (76 mm vs 130 mm) – Scotia-Fundy Region

In January 1993, National Sea Products Ltd. requested technical assistance in conducting an experiment to determine the effect of 130 mm versus 76 mm diamond mesh codends in midwater trawls on the catch of redfish. A modified haul method was planned, whereby two sets would be made using the smaller mesh codend followed by two sets with the larger.

The experiment was undertaken in January and February of 1993, aboard the NSP trawler *Cape Lance*. Bad weather and transducer problems, however, allowed only 15 tows to be completed; 12 of these with the 76 mm codend, and 3 with 130 mm codend. Little difference was recorded in the size range and quantity of redfish caught by the two codends. One disadvantage of the 130 mm codend was found to be that some fish escaped when the strain was taken off the trawl during retrieval.

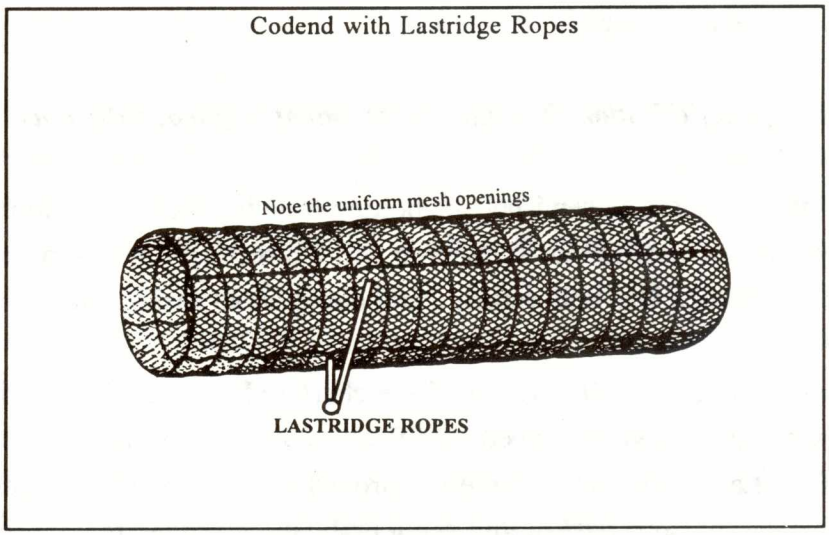
White Hake Mesh Size Selectivity Study – Gulf Region

White hake selectivity was the object of this experiment which examined a variety of mesh sizes in the Northumberland Strait. A trouser trawl with a 40 mm mesh control codend was used to compare the selectivity rates of 108, 120 and 130 mm mesh in the second codend.

A total of 59 valid tows were completed on a 42 ft inshore commercial trawler from Beach Point, Prince Edward Island. Results indicate that the mesh size currently in use (108 mm) retained only a small fraction (5.7%) of non-commercial hake (<41 cm) and permitted the escapement of hake in the size range from 41-50 cm. Any increase in mesh size, therefore, would have a minimal impact on the volume of fish discarded but would considerably reduce short term yield when fishing populations are composed of four and five year-old hake.

2.1.4 Lastridge Ropes

During harvesting operations, the tail section of the codend swells and the remainder of the netting stretches tight as fish accumulates in the codend of the trawl. As a result, diamond meshes either close or are reduced in size and immature fish cannot escape. Using lastridge ropes, meshes can be made to remain open and selective.



In 1992/93, an experiment to assess the effect of lastridge ropes was conducted in the Gulf of St. Lawrence.

Assessment of Lastridge Ropes in Bottom Trawls – Quebec Region

The effectiveness of a conventional bottom trawl with lastridge ropes installed to reduce the by-catch of small cod while directing for summer flounder was examined in this project. Lastridge ropes, set at a hanging ratio of 72% in the codend was compared with results obtained from a 130 mm diamond mesh codend without lastridge ropes.

A total of 137 tows were completed, 68 testing the codend with lastridge ropes and 69 using a standard codend. Results indicate that when using the lastridge ropes, the average catch composition was 95% plaice, and 5% cod. The mean length of cod was 50 cm; only 2% were 41 cm or less. With the regular gear, 12% of the catch was cod and 45% were 41 cm or less. Based on the results of this project, the benefits of using lastridge ropes in this fishery appear to have potential. Results were sufficiently promising that further research is planned.

2.1.5 Semi-Pelagic

Semi-pelagic Bottom Trawling Assessment – Quebec Region

A project to assess semi-pelagic bottom trawling technology to reduce the by-catch of flatfish and snow crab while directing for cod in the Gulf of St. Lawrence was undertaken using commercial inshore stern trawlers.

Over a period of 60 days, the three chartered vessels completed 40 valid tows with a trawl developed specifically for the midshore fleet of the Gulf of St. Lawrence. While the trawl proved to be successful in reducing the by-catch of both flatfish and snow crab, the considerable expense of the trawl and the cost of training crews to use it, coupled with the decline in stocks in the Gulf of St. Lawrence in 1992 makes this technique a non-viable proposition at this time.

2.2 FIXED GEAR EXPERIMENTS

2.2.1 Longlining

Longlining, as the name implies, involves the use of a "long line" with a series of baited hooks spread along the ocean floor. Initially retrieved manually, longlines systems (Mustad) are now mechanized and use automatic baiting, shooting and hauling mechanisms.

As with other types of gear, there is room for improvement in the selective capability of longlines. In an attempt to increase the selectivity of this sector, two projects were undertaken in 1992/93.

Longline Hook Selectivity – Newfoundland Region

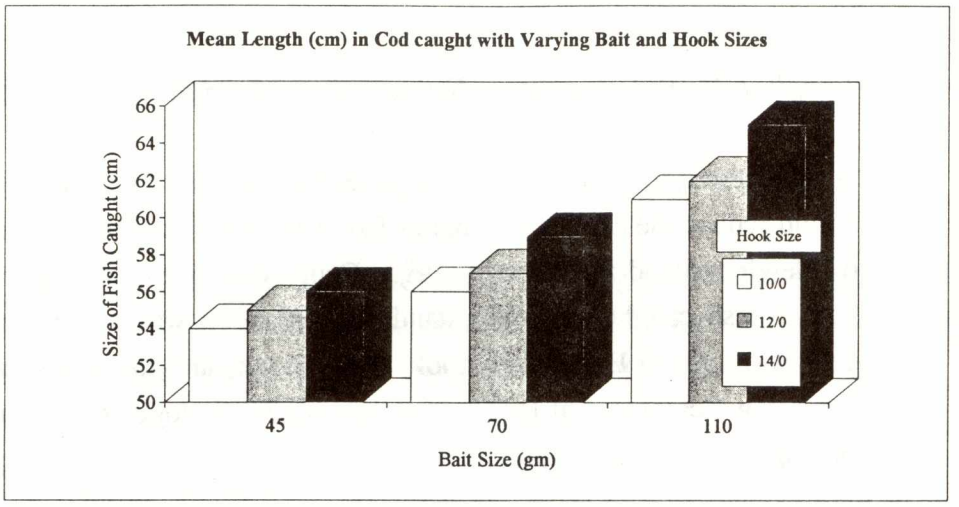
A project designed to determine whether various sizes and shapes of hooks would reduce the capture of smaller fish was undertaken on the south coast of Newfoundland in February 1993. Four hook sizes were studied. The size of fish caught using the standard #6/0 hook was compared to fish caught on #12/0 E-Z Baiter hook, #14-J hook, and the #14 Gravitation hook. Two commercial longline vessels operating together completed 35 fishing days in eight inshore areas.

While there was a significant difference between the smallest (#6/0) and the largest hooks (#12/0), there was little difference in the average size of fish caught. As one can note from the graph illustrated below, hook size has little effect on average fish size.

Hook Sizes	#6/0	#14 Gravitation	#12/0	#14-J	Total & Averages
Number of Hooks	21,308	21,308	21,308	21,308	85,232
Number of Fish	2,900	2,558	1,709	1,243	8,410
% of Catch by Number	35%	30%	20%	15%	100%
% of Catch by Weight	33%	31%	21%	15%	100%
No. of Fish <41cm	1,032	787	481	377	2,677
% of Fish <41cm	36%	31%	28%	30%	32%
Catch Weight per Hook (lbs)	0.256	0.237	0.164	0.11	0.194
Average Weight of Fish (lbs)	1.88	1.98	2.05	2.05	1.97

Size Selection of Groundfish Longline Gear – Scotia-Fundy Region

An experiment to analyze the effects of hook size and bait size on the size of cod and haddock caught in the Scotia-Fundy Region longline fishery was implemented in 1992. In particular, this experiment, the second in a series, attempted to determine the impact of bait size in determining fish size selection. A chartered 82 ft commercial longliner, used circle-hook sizes of 10/0, 12/0, and 14/0 with bait sizes of 45, 70, and 110 g so that there were nine combinations of hook and bait sizes.



For cod, the results indicated that bait size played a much larger role than hook size in determining the size of fish caught. Large bait sizes increased average length by 7-9 cm for any one hook size, whereas large hook sizes changed average length by only 2-4 cm for any one bait size. Catch rates, however, decreased when bigger baits were used with smaller hooks. Results for haddock were inconclusive because all haddock caught were in a very narrow size range.

3 SHRIMP SELECTIVITY PROJECTS

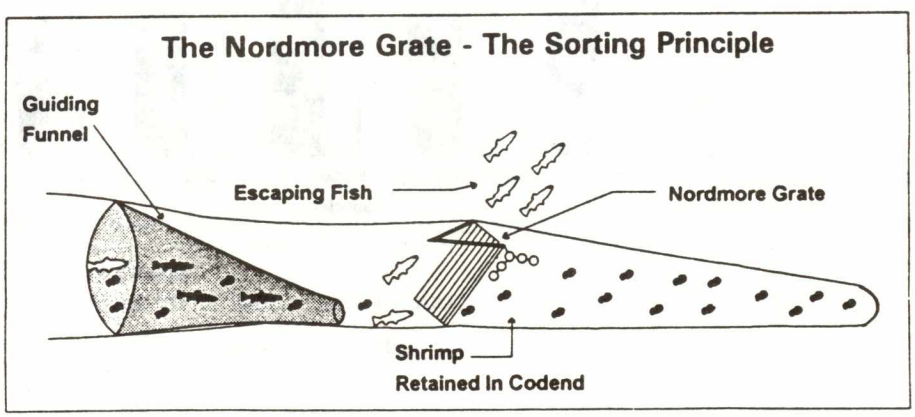
Developing effective methods of preventing the harvest of industrial (small) shrimp and the by-catch of other species has always been a problem in the shrimp fishery. Equally problematic has been our inability to release small shrimp without incurring unacceptable losses of market-sized shrimp.

The use of a variety of selectivity devices using grates and square mesh as a means of reducing the by-catch of non-target species has proven to be an area of increasing interest in recent years. In 1992/93, six projects designed to test the viability of a variety of designs were undertaken.

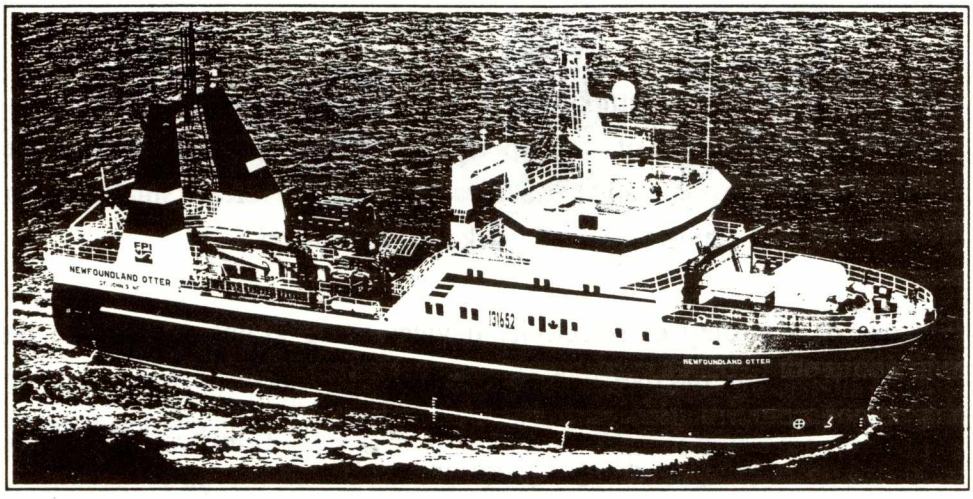
3.1 NORTHERN SHRIMP EXPERIMENTS

Fish By-Catch Selectivity – Newfoundland Region

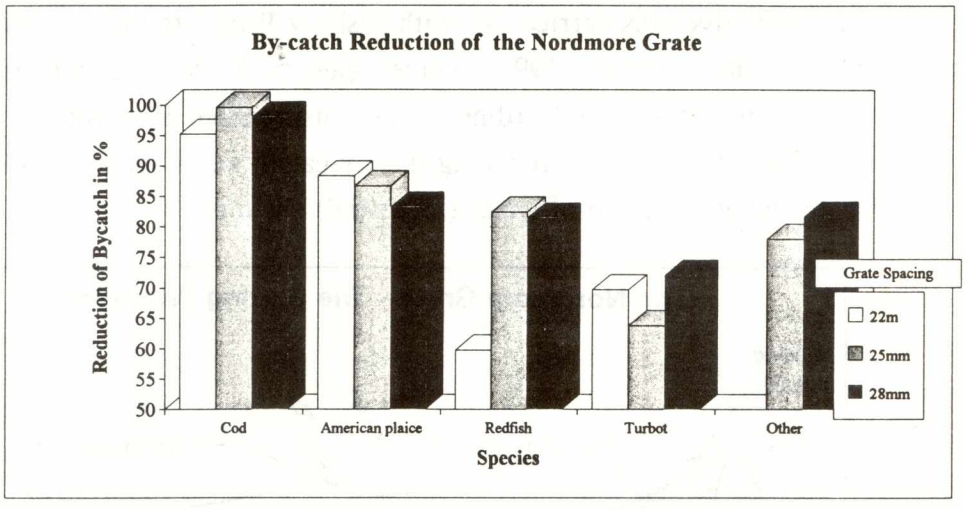
This initiative was carried out with Fishery Products International (FPI) from January to March 1993, to investigate, under commercial conditions, the effectiveness of the Nordmore Grate, using three different bar spacings (22, 25 and 28 mm), in reducing fish by-catch, and a square mesh codend in reducing the catch of small (industrial) shrimp.



A 60 m FPI shrimp trawler, the *Newfoundland Otter*, was used in this experiment which took place in NAFO Sub-divisions 2J and 3K.



The results confirm the effectiveness of the Nordmore Grate in reducing the by-catch of cod, turbot, American plaice, redfish and other species. With the largest bar spacing (28 mm), loss of shrimp was less than with the 22 and 25 mm grates.



In addition, the square mesh codend was found to be more selective than its diamond mesh counterpart, releasing more small shrimp from the catch.

Mesh Size and Industrial Shrimp By-Catch - Atlantic and Quebec Regions

Two selectivity initiatives designed to address the selectivity issue in the northern shrimp fishery are also planned for 1993/94. Diamond mesh of various sizes, lastridge ropes and selectivity devices will be tested at sea under commercial conditions.

The results of the three experiments are to be presented to the industry at the Northern Shrimp Selectivity Workshop scheduled for St. John's, Newfoundland, July 6-7, 1993.

3.2 GULF OF ST. LAWRENCE SHRIMP SELECTIVITY EXPERIMENTS

Separator Grate – Gulf Region

A project designed to demonstrate the use of a plastic separator grate, rather than one made from aluminum, was undertaken. Successful sea trials were completed on the shrimp trawler *Lady Gloria*, from Caraquet, New Brunswick.

The grate allowed 96.6% of by-catch (cod, American plaice, turbot, and redfish) to escape unharmed. This resulted in reduced crushing of the shrimp catch and improved overall quality. The halibut release rate recorded was 100%, and the shrimp loss was 1.5%.

Similar sea trials were also conducted successfully on the shrimp trawlers *Jean Colette*, from Caraquet, and the *Michael J. II*, from Port-aux-Choix, Newfoundland.

Separator Grate Conversion Program – Quebec and Gulf Regions

In 1992 the shrimp fishery in the Gulf of St. Lawrence underwent a mandatory conversion to the Nordmore grate. Shrimp fishermen in Western Newfoundland, the North Shore of Quebec and New Brunswick were each provided with a grate (19 mm bar spacings) and attended training seminars.

Following the introduction of the mandatory conversion program, fishermen complained that they were experiencing an unacceptable loss of commercial shrimp when fishing in heavy biomass concentrations. This resulted in a Departmental decision to allow them to use a grate with a larger grate area and bar spacings (25 mm), thus eliminating the problem.

Since that time, the grate has gained wide acceptance among fishermen. The increased bar spacing and the use of a larger grate area has substantially increased the quality of the catch. The total loss of commercial shrimp has decreased to under 5%, and total yields have increased by 20-30%. This is a result of the fact that less broken and bruised shrimp are being found in the catch.

Another significant benefit to arise from the grate is that it enables captains to operate their vessels using two crew members instead of three. This allows them to rotate and rest their crews even at the height of the fishing season.

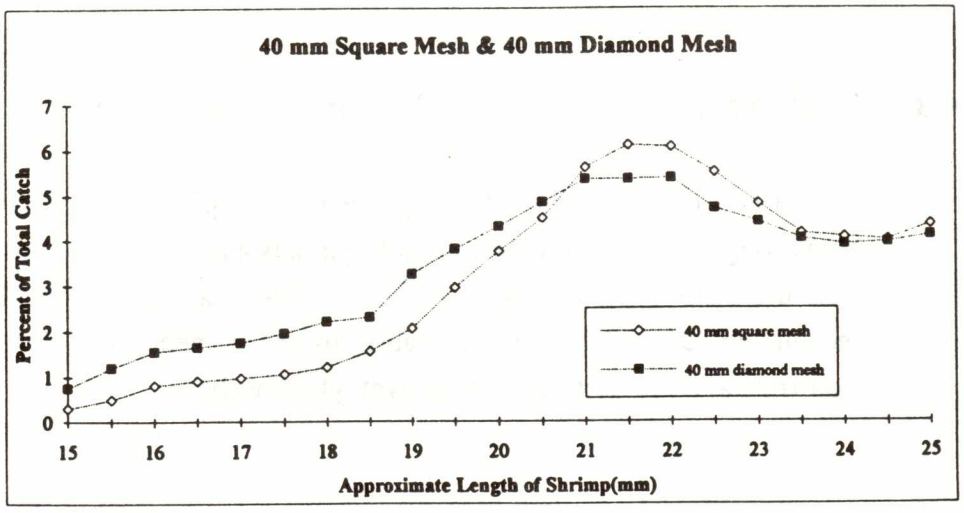
3.3 SCOTIA-FUNDY SHRIMP EXPERIMENTS

Square Mesh Codend – Scotia-Fundy Region

Shrimp are currently harvested in the Scotia-Fundy Region using 40 mm diamond mesh codends. One of the criticisms of this type of gear is that it captures quantities of small shrimp, which reduces the commercial value of the catch. Following recent successes by Iceland trawlers which used square mesh codends in decreasing the by-catch of shrimp, a demonstration project was conducted to study this type of gear.

For comparative purposes, the effectiveness of both a 40 mm diamond mesh codend and a 40 mm square mesh codend was tested. A total of 16 tows, eight for each codend, were completed by the commercial shrimp trawler *Charger 1*.

Although it would be imprudent to draw any concrete conclusions from such a limited project, the results are suggestive. Results from this experiment indicate that the 40 mm square mesh codend release greater quantities of small shrimp than the 40 mm diamond codend. (See graph below).



4 CRAB SELECTIVITY PROJECT

Commercial fishing for snow crab on the Atlantic coast of Canada began in 1967. By 1979, landings had reached nearly 30,000 tonnes with a landed value of nearly $20 million. Since 1979, the crab fishery has consistently ranked among the six most lucrative fisheries (herring, scallop, cod, lobster and flatfish).

The crab fishery is characterized by a wide geographic distribution of the resource, a relatively long season, a high percentage of individually-owned vessels and a labour intensive processing industry. Fishermen in all five Atlantic provinces participate in the crab fishery with the highest landings being recorded in Newfoundland, New Brunswick, and Quebec.

Despite the success of the fishery, there is concern about the degree of selectivity achieved by the traditional fishing gear used in the sector. As a result, the harvesting and discarding of undersized, soft-shelled and female crabs remains a problem which has to be addressed. In an effort to address the problem, a project was undertaken to study the selective characteristics of a variety of modified conical crab traps in the Scotia-Fundy Region.

4.1 Crab Trap Experiment – Gulf of St. Lawrence

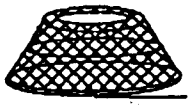
Since 1970, the crab fishery has expanded very rapidly in Eastern Canada. Many longliners which have used only gillnets and purse seines in the past now use crab traps with great success. Crab traps are of three types: rectangular, conical or nordic. Crab traps are framed with 1/2" diameter iron rods and are covered with polyethylene webbing.

Selectivity Study of a Crab Trap – Gulf Region

The snow crab fishery in the southwestern Gulf of St. Lawrence depends almost exclusively on annual recruitment of snow crab newly moulted to commercial size. The fishery is therefore extremely sensitive to yearly fluctuations in the number of crab reaching minimum legal size. The protection of undersized juveniles and females is a prerequisite for rebuilding the depressed stock. If a selective mechanism can be installed in conventional traps, the effort to protect soft, undersized juvenile and female crab can be greatly enhanced with lesser resources.

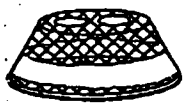
A project undertaken in the Gulf region demonstrated that the number of soft and undersized crab caught in the modified conical traps generally decreased with the increased integrated panel height. Also, the catch per unit of effort of commercial size crab increased for the modified 1/2 length on the vertical (LV) and 2LV traps compared with the normal conical traps. The mean size of legal size crab did not change with panel height, except for the 3LV trap which caught significantly larger crab than the other types.

(See illustration on the following page).

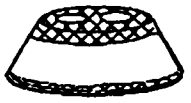


Conventional Conical Trap

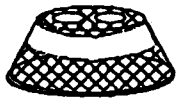
1991 - First Experiment
ILS* Angle panel of 12.5 cm equalling 25% of the morphometry length from tip to tip of the locomotive legs from a male crab of minimum legal size (95 mm).



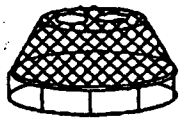
1991 - First Experiment
2LS* Angle panel of 25 cm equalling 50% of the morphometry length from tip to tip of the locomotive legs from a male crab of minimum legal size (95 mm).



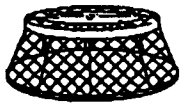
1991 - First Experiment
3LS* Angle panel of 37.5 cm equalling 75% of the morphometry length from tip to tip of the locomotive legs from a male crab of minimum legal size (95 mm).



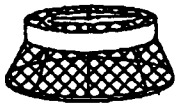
1991 - First Experiment
Angle panel relocated in the upper part of the angle slope of the conical trap.



1991 - First Experiment
Elevated conical trap with adjustable legs to vary its height.

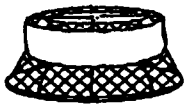


1992 - Second Experiment
1/2 LV* Vertical panel of height 6 cm.



1992 - Second Experiment
1 LV* Vertical panel of height 12 cm.

1992 - Second Experiment
2 LV* Vertical panel of height 18 cm.



1992 - Second Experiment
3 LV* Vertical panel of height 24 cm.

* LV = Length on vertical

Type of traps tested in the 1991 and 1992 gear selectivity project.

5 MARINE MAMMALS BY-CATCH PROJECT

Gillnets are used throughout Atlantic Canada to catch many species of fish, especially groundfish and pelagic, and such anadromous species as salmon, smelt and gaspereau. They are constructed principally of monofilament mesh and may be either secured to the bottom of the ocean using weights or left to drift in the water table. Fish are caught as they attempt to swim through the webbing, entangling their gills.

In an attempt to avoid the inadvertent capture of porpoises by gillnets, a project to study porpoise dive behaviour was undertaken in 1992/93.

5.1 Bay of Fundy Gillnet Experiment

Harbour Porpoise By-Catch – Scotia-Fundy Region

In the Bay of Fundy and the Gulf of Maine the majority of harbour porpoises which are inadvertently captured in commercial fisheries are taken in groundfish gillnets. In an effort to reduce this number, a study was commissioned to determine whether restricting the depths to which gillnets are set would allow a greater number of the porpoises to escape capture.

The diving behaviour of harbour porpoises was investigated using time-depth recorders (TDRs). TDRs were successfully attached to three porpoises which had been previously captured in herring weirs in the Bay of Fundy. They were released and tracked for periods of time averaging between 17 and 28 hours, after which the recorders were released and floated to the surface for retrieval.

Unfortunately, there were a number of complications. Since only one vessel was used to track the porpoises it proved difficult to locate their position with any degree of precision. Most data was collected at night when porpoises are least active, and possibly do not dive as deeply during the day. The stress of capture might also have affected their diving habits.

Finally, of those porpoises captured none were fully grown. Since dive depth and duration are contingent upon body mass, it is reasonable to assume that larger porpoises would have gone deeper. More extensive work is required in this area.

6 TOWARDS SUSTAINABLE HARVESTING

Conventional fishing gears and harvesting practices employed in Atlantic Canada are very efficient, but there are problems with the state of the resource. Perhaps ironically, these problems represent a unique opportunity to re-orient our priorities and to learn to fish on a more sustainable basis using selective methods and technologies, and to use responsible fishing practices.

Fishing gear selectivity, however, is not simply a technological issue not be regarded as a technological panacea. It is ultimately a matter of human behaviour—a responsible fishing philosophy supported by innovative technology—which will require significant changes in current practice and attitude.

Fishing gear selectivity work must be judged on the broadest possible basis. Rather than reacting to the success or failure of a given project, the entire program should be assessed in terms of how far it moves, in partnership with the industry, towards an overall sustainable harvesting objective. What matters is that all the pieces come together, whether the proper dynamics have been established, and whether there have been concrete results, positive or negative.

It must be remembered that, in research and development, negative results move us forward. They add to the industry data base. They can objectively eliminate from the range of possible options those which do not prove viable, leaving us with only workable approaches.

Finally, public and industry awareness of the issues surrounding resource sustainability is essential. In the future, technological research and development must be aligned with the promotion of responsible fishing and the formation of a true spirit of cooperation between industry and government.

7 FUTURE DIRECTIONS

Before any sustained program to modify or convert commercial fishing gear is introduced, research must be undertaken to objectively establish the effects, positive and negative, of the various gear types being used by fishermen in Atlantic Canada.

The gear now being tested has been designed to reduce:

1) the incidental capture of non-target species; and

2) the incidental capture of immature fish—especially cod, haddock, and pollock i.e., to exclude, protect, or automatically release them from fishing gear during harvesting operations.

The Department of Fisheries and Oceans has taken the lead role in partnership with the fishing industry in the development, demonstration and promotion of more responsible (selective) fishing methods. It will:

- provide a common level of understanding and appreciation for the volume and type of selectivity work currently being conducted nationally and internationally.

- communicate the results to industry of recent gear selectivity projects carried out in Canada, Europe, and elsewhere.

- examine the implications of recent developments from an economic, biological, harvesting and processing perspective.

- help build consensus regarding appropriate future directions for selectivity research and development activities.

- move towards defining a strategy to introduce codes of conduct for responsible fishing and to ensure a sustainable commercial fishery.

- take the lead in gear selectivity research and development, encouraging responsible fishing practices and providing resource management adequate to ensure a sustainable fishery.

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