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Conservation Council

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K1A 0E6

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CONSERVATION ASPECTS OF GROUNDFISH GEAR TECHNOLOGIES IN EASTERN CANADA

A FRCC DISCUSSION PAPER
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Additional copies of this report, and information on other conservation issues in the fisheries, can be obtained from:

Fisheries Resource 'Conservation Council
Station 1554
200 **Kent Street**
Ottawa, Ontario
K1A 0E6

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EXECUTIVE SUMMARY

The Fisheries Resource Conservation Council (FRCC), an advisory body which makes formal recommendations to the Minister of Fisheries and Oceans on various matters, has created a subcommittee to examine the conservation consequences of harvesting gear technology. The subcommittee has commissioned an independent and objective study on the state of our knowledge of conservation implications of the major fishing gears used in Eastern Canada, based on existing literature and relevant experience. The research has resulted in this paper, which the subcommittee may use in a public consultation process.

The paper examines the five major gear types employed in the Eastern Canadian groundfish fishery: the otter trawl, Scottish seine, gillnet, cod trap and hook and line gears. For each of these gears the following four conservation issues have been investigated: selectivity and post-selection mortality; environmental impacts; manageability and potential for abuse, and options to improve conservation. It is noted that each gear performs differently from region to region; for example, one gillnet fishery may be marked by serious by-catches, while another reports none whatsoever.

The Otter Trawl. The otter trawl, which accounts for a majority of groundfish harvested in Eastern Canada in recent years, is a widely used gear, prized for its efficiency, mobility and suitability in all seasons. The technology's ability to select for size has been shown to be significant; its ability to select for specific species, however, is lacking. In recent years, this fault has been lessened by the use of various devices, such as lastridge ropes, horizontal panels, Nordmore grates and square-mesh codends; specific techniques, such as slower towing speeds and shorter tows, have been shown to increase selectivity as well. The post-selection mortality of fish escaping the otter trawl is not conclusively understood, but experiments indicate good levels of survival of some escaping species, including cod.

It is known that bottom trawls affect the seabed by introducing both positive and negative changes to it, but the extent of these changes is not well understood. As the gear is not susceptible to loss, ghost-fishing is not considered a problem.

The potential for abuse in using this gear is significant. The use of liners, adjustments to the gear's geometry and tows of long duration may all lead to decreased selectivity. At this time, regulations to enhance the gear's conservation qualities are restricted to minimum mesh sizes. Options suggested for consideration include introduction of' regulations concerning the use of selectivity-enhancing devices and designs and implementation of fishery closures when by-catches exceed limits.

The Scottish Seine. Another mobile gear, the Scottish seine, is suited to the capture of slow-swimming, bottom-dwelling fishes such as **flatfishes**. The selectivity of the seine is believed to be better than that of the otter trawl, but its ability to release fish unharmed is not known. As for its effects on the environment, the seine affects the seabed far less dramatically than the trawl for a number of reasons. Furthermore, its potential for **ghost-**fishing is negligible.

Like the otter trawl, the seine is regulated only in so far as minimum mesh sizes are enforced. As misuse of this gear is also possible, options for improving and ensuring selectivity are considered, including adoption of devices such as Nordmore grates, lastridge ropes and square-mesh **codends**.

*The **Gillnet**.* One of the most common gears used worldwide, the **gillnet** is very **energy-**efficient. Used for **groundfish,** it has been found to be highly size-selective, but poor in species-selectivity in many regions. The post-selection mortality characteristics of this technology have not been adequately studied and no conclusions in this area can be made.

While the gear does not disturb the seabed significantly, its potential for ghost-fishing is legendary. This environmental hazard, along with the gear's poor species-selectivity, results largely from a number of identified misuses, including setting more gear than can reasonably be handled and setting gear in adverse conditions.

Several options for improvement are suggested for consideration, including locating and scaring devices, limits on the number of nets used per vessel and imposition of a regulation governing the tending of nets.

*The Cod **Trap**.* The cod trap, a stationary gear used almost exclusively in the province of Newfoundland for harvesting cod, is very effective in efficiently harvesting inshore migrating fish. The poor size-selectivity of the gear is its major drawback, as a large percentage of the fish caught in the trap fishery is small. Salmon and sea trout by-catches are also a concern with traps, in certain regions. Conclusions cannot be drawn on the post-selection mortality of the gear, however, as this aspect of the gear has not been studied. Since the gear is stationary, its effects on the environment are minimal and losses of the gear, except in the case of sea mammal collisions, are rare.

Options for improving the selectivity of the gear include a change to the regulated minimum mesh size used in the trap to 102mm (4"); and the imposition of limits on the number of traps fished and the maximum size of trap allowed.

Hook and Line Gem. Hook and line gears, including handlines and longlines, are considered to be size-and species-selective gears in most situations. The selectivity of the gear, however, is due largely to the type of the bait that is used, rather than the type or size of the hooks. Again, the post-selection mortality associated with hook and line gears is not well studied, but there are reports that indicate high mortalities amongst fish that escape during hauling. The environmental effects of hook and line gears tend to be minor; even the loss of gear may be of little concern as they stop fishing as soon as the bait deteriorates.

It is felt that longline gear may have the least potential for abuse. Nevertheless, it is believed that improvements in the management of the fishery could be made, possibly through effort control, and regulations on the size and type of bait, to be used in the fishery.

It is hoped that the contents of this document will furnish the basis for an objective analysis of the conservation aspects of groundfish gear technologies in eastern Canada.

1.0 INTRODUCTION

1.1 The FRCC and the G-ear Technology Subcommittee

The Fisheries Resource Conservation Council (FRCC) was formed as a partnership of government, the scientific community and industry, to make formal recommendations to the Minister of Fisheries and Oceans on Total Allowable Catches and other conservation measures for the Atlantic Canadian fishery. The Council also advises the Minister on scientific research and assessment priorities and methodologies..

While the FRCC recognizes that direct management issues, including the selection of fishing gear, are beyond the FRCC's mandate, it is also clear that there are conservation consequences associated with harvesting gear selection. As a result, among the subcommittees established by the Council was a working group to address the conservation consequences of gear technology. More specifically, the subcommittee was formed to determine, for each harvesting technology, the conservation implications, optimum manner of usage and relative desirability from a resource conservation perspective. This investigation is based on an objective analysis of historical experience and current evidence concerning habitat impact, gear selectivity, inherent manageability, the potential for improvement or abuse of the technology, and any other relevant considerations.

In the first phase of its work, the Fishing Gear Technology Subcommittee was empowered to commission an independent and objective study on the state of knowledge of conservation implications, of the major fishing gears used in Atlantic Canada, based on existing literature and on relevant experience. This work has been conducted in collaboration with the Canadian Centre for Fisheries Innovation in St. John's and the Fishing Services Branch of the Department of Fisheries and Oceans in Ottawa.

From the results of this study, the FRCC has prepared this public discussion paper which describes each gear's conservation-related advantages and disadvantages, including size- and species-selectivity, environmental and/or habitat impacts, manageability implications, and the potential for abuse.

It is planned that this Subcommittee will study this discussion paper and may organize a public consultation process so that it can be discussed. Ultimately, the Subcommittee will deliver to the FRCC appropriate recommendations concerning gear technology or gear-oriented regulatory measures required for conservation of the resource.

1.2: The Paper

This document examines the following five major gear types employed in the Eastern Canadian groundfish fishery:

* Otter trawl
* Scottish seine
* Cod trap
* Gillnet
* Hook and line gears - longline and handline

The major groundfish stocks of commercial importance in Eastern Canadian waters that are harvested by these gears include the following:

* Family Gadidae: cod, haddock, hakes, pollock, whiting
* Family Pleuronectidae: flounders, plaice, soles, turbot, halibut
* Genus Sebastes: redfishes

Not all fishing gear types are being used for all the above fish stocks. This reflects the fact that gear performance varies from species to species and from region to region. Table 1 below illustrates the usage of each gear for each groundfish species harvested in Eastern Canada. It shows that otter trawl technology is highly effective in harvesting groundfish and for certain species such as redfish, there are no practical, cost-effective alternatives. At the other extreme, cod traps are effective only in the harvesting of cod. Other fixed gear technologies, including gillnets and hook and line are also primarily used for cod, although hook and line is known to be very effective in a direct fishing effort for halibut. Cod may be harvested by all gears.

Information on catches is presented in detail in Table 2, which gives landings by gear type in 1991. It shows that, in that year, otter trawls accounted for most of the landings of groundfish in each province for a total of 65% overall. Referring to Table 3, the downward trend in overall groundfish catches is evident during the period. Total Atlantic Canadian groundfish landings dropped almost 15 percent from 752 thousand tonnes in 1984 to 621 thousand tonnes in 1991. In 1992, landings fell again dramatically to 462,253 tonnes; in that year, the moratorium on northern cod fishing was instituted and contributed significantly to the noted decline.

TABLE 1

Degree of Usage of Each Major Gear Type for Each Major Groundfish Species

Harvesting Technology	Otter trawl	Scottish seine	Cod trap	Gillnet	Hook & line
Species					
Cod	*****	*****	*****	*****	*****
Other Gadidae species	*****	****	-	***	***
Halibut	***	*	-	**	*****
Other flatfishes species	*****	*****	-	****	**
Redfishes	*****	-	-	*	-
Grenadiers	*****	-	-	-	-

***** most commonly used, * least commonly used, - not used,
Hook & line include : longline and handline

TABLE 2

Groundfish Landings by Gear Type and Province (1991)

GEAR TYPE	PROVINCE (TONNES)					TOTAL TONNES	%
	Nfld	N.S.	N.B.	P.E.I.	Que.		
Otter Trawl	155,117	198,632	7,367	14,807	30,898	406,821	65
Scottish/ Danish Seine	4,719	11,232	3,550	1,120	1,977	22,598	4
Gillnet	39,899	14,382	2,226	1,197	4,068	61,772	10
Cod Trap	41,743					41,743	7
Longline	17,168	46,838	475	522	2,873	67,876	11
Handline	12,256	7,039	733	343	729	21,100	3
TOTAL	270,902	278,123	14,351	17,989	40,545	621,910	100

(Estimated; there may be some inaccuracies - subject to verification by DFO Statistics)

TABLE 3

Trend in Atlantic Canada Groundfish Landings by Gear Type

GEAR TYPE	1984		1986		1988		1990		1991		1992	
	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%
Otter trawl	459,543	61	512,287	66	457,136	63	366,110	57	406,821	65	311,890	67
Scottish/ Danish Seine	26,538	4	30,735	4	25,201	3	26,897	4	22,598	4	21,919	5
Gillnet	100,579	13	89,969	12	99,526	14	95,118	15	61,772	10	40,407	9
Cod Trap	45,070	6	41,967	5	46,048	6	51,190	8	41,743	7	6,247	1
Longline	88,128	12	82,394	11	76,336	10	73,091	11	67,876	11	66,194	14
Handline	32,429	4	23,988	3	24,506	3	29,144	5	21,100	3	15,596	3
TOTAL	752,287		781,340		728,75		641,550		621,910		462,253	

(Estimated; there may be some inaccuracies - subject to verification by DFO Statistics)

Up to 1991, significant decreases in catches were shared by all gear sectors, the hardest hit being handlines (a decrease of 35 %), longlines (a decrease of 23 %) and gillnets (a decrease of 23 %). The least affected of the gear sectors was the cod trap fishery, which experienced a slight drop in catches. This relatively minor drop in catches may have been due to a significant increase in effort by that sector during that period.

This document's examination of each fishing gear type will focus on the following four conservation issues:

*Selectivity and post-selection mortality
*Environmental impacts
*Manageability and potential for abuse
*Options to improve conservation

1.2.1 Selectivity and Post-Selection Mortality

"Fishing gear selectivity" refers to the degree of discrimination of a gear as regards species and sizes caught. Highly selective fishing gear primarily catches only the target species in a narrow size range, while non-selective gear is non-discriminatory, thus yielding catches composed of species or sizes that are undesirable from either a market or conservation perspective. It should be noted that traditional thinking on size-selectivity is changing. Recently many have come to agree with the argument that it may not be beneficial to select only large fish. In the turbot fishery in particular, selecting out large (and productive) female turbot is considered damaging to the stock. In fact, to safeguard at least some large and productive fish may be just as important as saving the very small fish.

"Post-selection mortality" refers to the death 'of fish resulting from contact with and escape from fishing gears. It has been shown that this type of mortality may be significant in certain fisheries.

The true selectivity of a gear can only be measured by examining the degree to which it allows non-target sizes and species to escape and the degree of post-selection mortality. This is complicated by the fact that in both the size/species selectivity and post-selection mortality of any particular gear there may be very wide variations. For example in the South West Nova gillnet pollock fishery the catch is over 99 percent pollock in the desired sizes, while in other areas the by-catch from gillnets can be significant.

1.2.2 Environmental Impacts

The environmental impacts of gear may include changes to the physical and chemical properties of the seabed, disruptions in the ecological balance of bottom fauna and flora, and the potential for "ghost-fishing" of lost fishing gears. Physical and chemical changes to the seabed may include physical scars, changes in grain size of surface sediment, changes in the chemical fluxes between sediments and the overlying water column, and changes in the erosion of surface sediment. Ecological effects may include dislocation

of organisms from their preferred habitat, changes in the availability of food, changes in species diversity, and changes in bottom vegetation which may provide food and shelter to other species. The ghost-fishing issue will be examined in light of the likelihood of gear loss and the capacity for and duration of continued fishing while lost. While the effects of some of these changes are not yet fully understood, it is felt that conservation oriented fishing gears should pose the least effect on the physical, chemical and biological properties of seabed and near-seabed organisms.

1.2.3 Manageability and Potential for Abuse

Ideally, fisheries management regulations should meet at least the following four criteria:

* They are understandable by fisherpersons and enforcement officers;
* They are difficult to evade;
* They are simple to enforce; and
* They are uncomplicated for the courts to interpret.

Different fishing gears naturally exhibit different degrees of manageability. Commonly, mesh sizes are regulated in net gears while hook sizes are regulated in hook and line gears. Even though research has often indicated the potential for better conservation of fisheries resources through changed gear designs, devices or operating practices, many of these modifications have been ignored due to difficulties in enforcement.

1.2.4 Options to Improve Conservation

For each major gear type, new and modified fishing gear technologies and management measures that could improve resource conservation will be presented. Gaps in our knowledge that hamper conservation will be identified and ways to address them will be suggested. In each chapter on a specific gear type, only those technologies and measures that could be applied realistically in the near future will be included. In Chapter 7, technologies that require significant R & D (and a great deal of time and perhaps money to develop) will be suggested for further consideration.

1.2.5 Other Factors Influencing Conservation

While this paper concentrates on the conservation aspects of fishing gear technologies, it must be remembered that fishing is only one of the factors affecting stock abundance. Other important factors include changes in environment and ecosystem. Physical and chemical properties of the ocean such as water temperature, and inter-species relationships such as the availability of food species and the population of predator species, can greatly

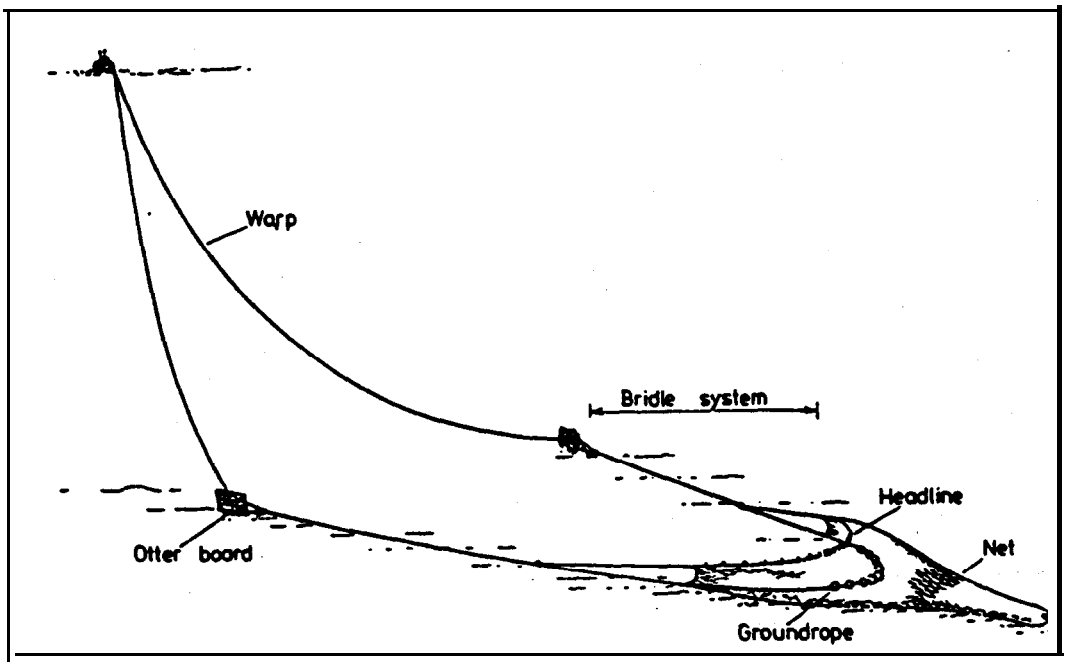
affect spawning, growth, recruitment and natural mortality of fish. Furthermore, inaccurate estimates of stock abundance, misreporting of catches, by-catch dumping and over-capacity can contribute greatly to overfishing and stock depletion.

Perhaps most significantly, over-capacity. in the industry, (that is, too many boats and people) regardless of the fishing gear types employed, seriously threatens the resource. Over-capacity also exacerbates the other "people problems" noted. Without a solution to this challenge, the issue of gear-related conservation problems is practically irrelevant.

Technological change also affects both conservation and capacity. In virtually all fleet/gear sectors, the ability to fish has increased through use of new fishing materials and electronic or hydraulic equipment advances. Today's trap skiff can easily fish four to six large cod traps per day through use of better hauling equipment. Only 10 to 20 years ago, trap crews could handle only two traps of smaller size and they required more crew members. Advances in other fixed gear technology permit gillnetters to deploy 400 or more gillnets up to 200 miles from shore. Similar advances in trawling technology permit today's small dragger vessels (45-65 feet) to use trawls that only "offshore" vessels used 10 to 15 years ago, and large stern trawlers can now fish in almost all weather conditions and seasons, utilizing the latest fish and gear monitoring technologies available. In all cases, electronic equipment, particularly high powered sounders (hydra-acoustics) ensure that the fish have nowhere to hide. Advances in technology must be factored into the analysis of fishing- gear conservation and capacity. The challenge lies in arriving at mechanisms for measuring and managing technology.

Beyond the use of advanced electronics, acoustics and hydraulics, today's fishing vessels have considerably greater distance/weather capabilities than their predecessors of comparable size. What would have been regarded previously as inshore/nearshore vessels today fish to the full reaches of Canada's continental shelf, including those areas which extend beyond 200 miles. Vessel design improvements, new construction materials and technologies as well as technological advances in anti-roll tanks and stabilizers all contribute to the construction of larger capacity vessels even when regulatory restrictions limit the overall length of the vessels.

2.0 OTTER TRAWLS



2.1 Introduction

Trawling has been carried out since the Fourteenth Century, when small sail-powered vessels from the northeast of England began using trawls in the North Sea. Today, otter trawls are cone-shaped nets which are towed along, or just above, the ocean bottom, or in mid-water, and are capable of catching almost all groundfish species in Eastern Canada. Trawls towed on the bottom are called bottom trawls; those just off the bottom, semi-pelagic trawls; and those towed in mid-water, pelagic or mid-water trawls. The advantages of otter trawls are found in their efficiency, high mobiity and suitability for year-round operation. Furthermore, trawls can operate at almost any depth where commercial quantities of fish exist and even in harsh weather conditions.

In single-boat trawling, by far the most popular method in Atlantic Canada, otter boards or doors are used to spread the connecting wires and hold the net open horizontally. The vertical opening of the net is maintained by weights on the bottom, floats on the top, and the water pressure generated from towing. The net traps fish in the end of the bag-like section or "codend". Resides the doors, the ground wire, lower bridles and footrope are

all in contact with the bottom. The sides of the net are extended in front to form wings to guide fish into the mouth of the net. The trawl may consist of either two or four panels which create the top, bottom and sides.

Once the fish have been herded between the otter boards and guided towards the mouth of the net along the bridles, they turn to swim with the trawl in front of the footgear. If the towing speed is sufficiently high, the fish will have to swim at speeds above their maximum sustainable speed and will quickly become exhausted. As they become exhausted, they usually turn and swim down the trawl towards the codend. Some fish may escape under the footgear or over the headline. Small fish become exhausted more quickly than larger fish due to differences in their swimming ability. Some fish arriving at the codend escape through opening meshes, but a significant portion may still die due to exhaustion and physical damage. After a period of towing, usually two to three hours, the trawl is winched up to the vessel, the codend untied and the catch released onto the vessel' s deck.

2 . 2 Selectivity and post-selection mortality

A trawl catches fish through a combination of guiding and exhausting fish in its way and filtering water through the meshes. The selectivity properties of this gear are largely confined to size and are effected by the size of the mesh through which small fish escape the codend. Trawls generally exhibit good size selection. In the 1988 2J3KL cod fishery, for example, only 7.7% of the total catch of otter trawls were age 5 or under (<45cm). However, the trawl does not select well for species especially when the non-target species have a similar or larger size than the target species. For example, in shrimp trawls in Newfoundland waters, a by-catch of 1.38 kg fish per 1 kg of shrimp caught has been recorded' and in the winter redfish fishery, off the south coast of Newfoundland in 1993/94 there were several closures as a result of excessive by-catches of cod. (In the case of shrimp trawling in the Gulf of St. Lawrence, the use of Nordmore grates has become quite widespread because of these by-catches.)

A number of improvements in selectivity have occurred with otter trawls over the years. Increases in mesh size, square mesh panels and complete square mesh codends have been introduced to separate target from non-target species and to release juveniles from the catch. Measures such as selectivity grates (a rigid window with parallel bars), and shortened lastridge ropes (ropes attached to the longitudinal seams of the codend) can further improve the size selectivity of trawls.[2] Species selectivity of trawls is being greatly improved by the use of horizontal panels in North Sea trawls and good results are being obtained with this technology in Scotia Fundy Region.

In trawling, size selection occurs in various parts of the net. For small 'fish, codend mesh size selection is more important. Clogging of meshes by fish caught earlier, high towing speeds which distort the meshes, and the impregnation of meshes by sand or silt, are factors which reduce the selective properties of trawls.

It has become clear that trawl design features other than mesh size, such as the length of the net and the circumference of the codend and extension, can also influence selectivity, as does the use of stiffer twines which have low elasticity and stretch (known as "flexural rigidity"). The retention of small fish in diamond mesh trawls can be increased simply by adding more mesh openings to the circumference or by adding "lengthening pieces" to close mesh openings. It should also be noted that while square mesh codends increase the size selection of groundfish they actually decrease size selection in flatfish trawls.[3] Furthermore, square mesh codends are not as flexible as traditional diamond mesh codends.

Survival of fish following escape from the gear is the key factor which translates selectivity into conservation. Studies on the post-selection mortality of trawl escapees have indicated generally that mortality varies with species. Most recent reports on gadoid post-selection mortality indicate zero mortality in cod escapees, 4% in saithe (pollock), ll-52% in haddock and 14-48% in whiting.[4,5] Furthermore, small haddock escapees in one study were found to have a higher mortality than larger haddock and whiting.[5] In addition, post-selection mortality may vary with gear design and operation, fish density as well as environmental conditions. It is clear that research is needed on these factors. Survival of species in Pastern Canada has not been well investigated. In fact only one survival study, on halibut, has been conducted in this region in the past 25 years.

2.3 Environmental impacts

Bottom otter trawls have a direct effect on the seabed wherever the otter boards, bridles, or foot gears contact the bottom. In contrast, pelagic or semi-pelagic trawls do not touch the seabed and therefore have little influence on its physical and chemical properties. Semi-pelagic trawls, which operate with the net positioned just off the bottom and the otter boards touching the seabed may affect the bottom, but probably not as extensively as the bottom otter trawl. Possible impacts (both beneficial and damaging) of bottom otter trawling include the following:[6,7]

Changes to the physical and chemical properties of the seabed:

* Physical marks which are detectable from side scanning sonar. These marks are short-lived (lasting days) in shallow water and in high energy environments, but they may persist for a long time (decades) in deep waters or low energy areas;

* Changes in the texture of the sediments and chemical fluxes between sediments and the overlaying water column;

* Increasing rates of pelagic/benthic nutrient flux which stimulate phytoplankton production in shallow waters or well mixed areas;

* Sediment re-suspension which affects the quality of food of filter feeders;

* Re-suspension of sediments containing toxic contaminants (ie. heavy metals) which may cause mortality and may affect the quality of the catch. This is an important concern in the vicinity of marine dumping sites and coastal industrial regions.

Alterations to the ecological balance of the flora and fauna on the bottom:

* The incidental mortality of bottom animals run over by the gear;

* The dislocation of animals from their original habitat, causing a wider distribution of the species;

* The loss of other species which provide food and shelters; and

* The impact of the gear being towed through a spawning aggregation is not yet known. (This also applies to pelagic and semi-pelagic trawls.)

Trawlers appear to affect only a relatively small area of the fishing banks. Analyses of side-scan sonar records from Georges Bank and the Scotian Shelf, for example, show that less than 2% of the records contain any evidence of physical disturbance from mobile gear. On the Grand Banks, less than 10% of the records showed any evidence, however slight, of disturbance caused by otter trawls.

Parts of the North Sea, which have'been fished predominantly with beam trawls since the 1920's, show a- decrease in the diversity of molluscs and crustaceans, but an increase in

polychaetes. There are indications that the increase in polychaete populations in some areas has actually resulted in an increase in the productivity of flatfish populations. Therefore, the effects of trawling along the bottom may not be as damaging as some have suggested, but they are still difficult to interpret.[8] Clearly, more research is needed in this area.

The potential for ghost-fishing of lost trawls is almost negligible. In fact, the loss of an entire trawl occurs rarely. Lost gear or parts of gear may foul the seabed, but their impact on resource conservation is considered negligible.

2.4 Manageability and potential for abuse

The otter trawl is a complex assembly of netting, ropes and accessories. Slight changes in rigging can often alter selective properties of the fishing gear. Due to its great fishing efficiency, it can harvest a large amount of undersized fish or non-target species in a short time if improperly used, causing great wastage to the resource. Even though it has often been demonstrated that improved selectivity can be effected by certain designs and devices such as larger codend mesh size, square-mesh panels or codends, the use of codend lastridge ropes, the reduction of the number of meshes in the codend, and the use of selectivity devices, e.g. Nordmore Grate, only the minimum mesh size regulations is enforced. Other measures either produce inconsistent results or are difficult to enforce.

The misuse of trawls which can affect selectivity includes the following:

* Using "liners" of small mesh netting inside codends of legal mesh size, which blocks the escape of small fish;

* Adjusting the geometry of the trawl in order to close meshes, especially towards the codend; and

* Towing for excessively long periods results in large catches, which can cause clogging of the mesh by fish caught early in the tow. This hinders the escape of small fish caught later.

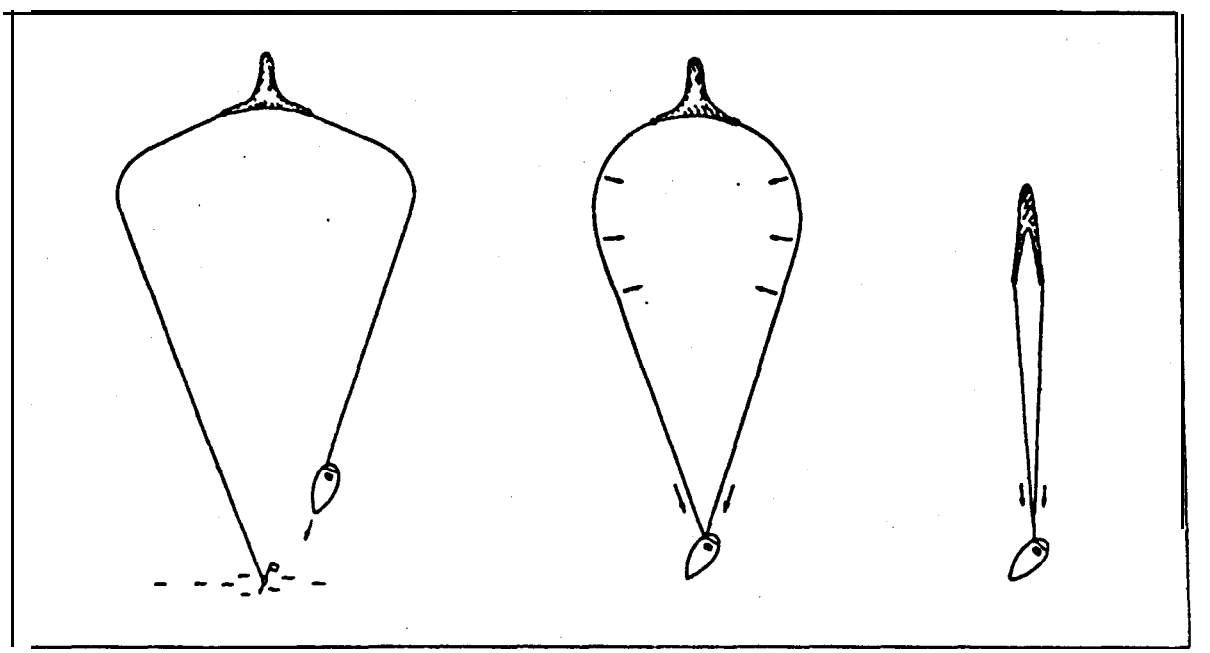
2.5 Options to improve conservation

A number of readily available options requiring little research may be employed to enhance the conservation of species:

An increase in sire- and species-selectivity through:

* The adoption of designs and devices which improve size and species selectivity such as square-mesh codends, lastridge ropes in the codend and Nordmore grates;
* Examination of regulations on selective designs and devices and their enforceability; and
* The limiting of by-catches and small-fish catches through fishery closures when limits have been exceeded (this can be accomplished through dock-side monitoring, on-vessel observers or research vessel sampling).

3.0 SCOTTISH SEINES (FLY DRAGGING)



3.1 Introduction

The seine technique had its origins in Denmark, where in 1848 anchor, or Danish, seining was first recorded. By the 1920's the technique had been adopted by the Scottish, who abandoned the use of an anchor in the process, replacing it with a hyflyer. The Scottish seine has since become a common groundfish gear, and is considered to be very efficient in catching slow-swimming, bottomdwelling species such as flatfishes.

The operation of a Scottish seine is very complicated and needs considerable experience and skill. At the beginning of the operation, a hyflyer is thrown with a rope attached to it. The seiner moves away from the hyflyer at a direction based on current and seabed conditions and changes its direction at some stage while paying out a rope as long as 1800 m (1000 fathoms). The end of the rope is attached to one of the wings of the seine while the other wing is attached to another rope which will be paid out after the net is shot. The vessel changes direction towards the hyflyer when the second rope is paid out. The

ropes and the net usually form a pear shape just before hauling. At the end of shooting, the hyflyer is picked up and both ropes are winched in while the vessel slowly steams forward. The ropes and net are gradually closed up as hauling progresses. Proper winch speed is controlled to ensure a good seabed contact of the ropes.

3.2 Selectivity and post-selection mortality

The first underwater observation of fish behaviour and fishing gear was done in a Scottish seine in 1952 when small flatfishes were observed escaping through the codend of a seine.[9] These observations led to minimum codend mesh size regulations in both seines and trawls.

Most research findings in otter trawl codend selectivity can be applied to seines. Seines, however, may in fact have better selective characteristics than comparative otter trawls. This may be the result of slower (l-2 knots) towing speeds, which distort the mesh far less, as well as the shorter duration of tows (actual fishing time is one-half hour). As mentioned earlier, seines are most suitable for flatfishes. When used for these species therefore the Scottish seine will not exhibit better size selectivity with square mesh in the codend.

Studies on the post-selection mortality of fish escaping from seine codends are scarce. Recently published literature indicated zero mortality in cod escapees and 3-7% mortality amongst haddock escapees. [10]

3.3 Environmental impacts

Like the otter trawl, the Scottish seine is towed along the seabed. However, the effects of the seine on the seabed may be less significant due to the absence of otter boards, the slower towing speed and the shorter tow duration. Nevertheless, the physical and chemical changes due to the dragging of seine ropes across the bottom are not understood. The magnitude of the impact is not known.

The potential for ghost-fishing of lost seines is almost negligible. In fact, the chances of losing the entire gear are very low. Lost gear or parts of gear may foul the seabed, but their impact on resource conservation would be negligible.

3.4 Manageability and potential for abuse

The only fisheries regulations imposed on Scottish seines regulate minimum codend mesh sizes. Nevertheless, other measures may be adopted to improve selectivity, including codend lastridge ropes and increased size of mesh in the codend. However, the enforceability of such measures would have to be investigated before they were applied mandatorily.

Misuse of the gear may include the use of net liners and adjustments to the geometry of the net so that the mesh narrows and the net becomes less selective.

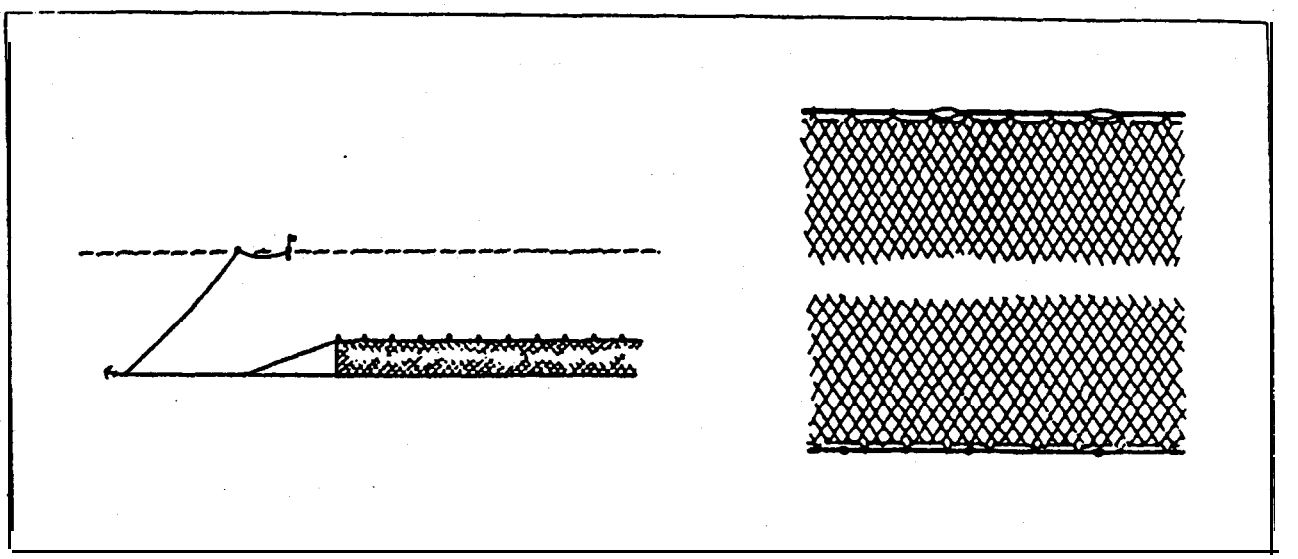
3.5 Options to improve conservation

As in the case of otter trawls, options that are readily available to enhance the size- and species-selectivity in seines include the following:

* Adoption of designs and devices which improve size- and species-selectivity, e.g. square mesh codends, codends with lastridge ropes, and Nordmore grates.

* The limiting of by-catches and small-fish catches through fishery closures when limits have been exceeded (this can be accomplished through dock-, side monitoring, on-vessel observers or research vessel sampling).

4.0 GILLNETS



4.1 Introduction

A **gillnet** is a sheet of netting hung vertically in water to catch fish swimming in its path. It has been fished for thousands of years, and is one of the most common gears used worldwide to catch many different species. Monofilament **gillnets** have been used increasingly in Eastern Canada since the 1960's. Today, typical **gillnets** used in the region are **50** to 60 fathoms long and 25 meshes deep with mesh sizes ranging from 140 to 203 **mm (5 1/2** - 8"); they are employed mainly to catch flatfishes and gadoids, and are fished usually from vessels under 20 m (65 ft). **Gillnets** are effective in catching mobile fish regardless of bottom conditions. They are energy-saving and can be operated from vessels of all sizes.

Earlier gillnets, which were made of natural fibres, were heavy, highly visible in water and poor in durability compared with synthetic fibers. **Gillnet** fleets greatly expanded when monofilament **gillnets** were introduced to Eastern Canada in the 1960's. Initially, they were used in inshore waters, but in recent years, they have been used at all depths. A **mechanised** gillnetter may fish 400 nets or more, as is done in the offshore **Newfoundland** turbot fishery. It should be noted, however, that regulations in many other locations limit the number of **gillnets** permitted per vessel. In the Scotia-Fundy region, for example, a limit of 40 nets per vessel cannot be exceeded legally.

Gillnets can be buoyed by headline floats and sunk by footrope weights. They are normally fished in fleets of 10 to 20 nets with mooring ropes, surface buoys and hyflyers at each end. Groundfish gillnets are anchored on the seabed. For catching flatfish, gillnets are set on the bottom, without headline floats. As a result, the lower part of the netting lies loosely on the seabed, tangling bottom-living fish and shellfish coming in contact with it.

Fish are captured by gillnets when they attempt to swim through the mesh. The mechanisms of gillnet catching fish include wedging, gilling and tangling.

4.2 Selectivity and post-selection mortality

Gillnets are highly size-selective if properly rigged and used. In the 1988 2J3KL cod gillnet fishery, for example, the number of harvested fish at age 5 and under was less than 6%.[11] However, gillnets are known to be poor in species selectivity in many areas, and non-targeted fish and shellfish species, sea birds, seals and whales are often caught in gillnets. This is not the case everywhere, as gillnet selectivity in the South West Nova region is reportedly very good.

By-catches of sea birds and marine mammals by gillnet are a concern. A review by Lien[12] revealed the extent of the by-catch. An estimated 27,000 birds per year were incidentally caught in Eastern Newfoundland between 1981 and 1984 and by-catches of harp seals were estimated at 10,700 in Western Newfoundland in the spring of 1988. Between 1979 and 1987, an estimated average of 24 humpback whales per year were entrapped in gillnets while as many as 182 per year collided with the gear.

Information on the post-selection mortality of groundfish gillnet escapees is not known. The most relevant information on the subject was collected on gillnet-caught striped bass which were found to be in poorer physiological condition than bass trapped in fykes (winged traps usually employed in river estuaries)". It is known that the mortality of fish which have wriggled through or dropped from the mesh during hauling can be high, but further investigation is needed in this area.

4.3 Environmental impacts

Gillnets are fixed gears and do not disturb bottom sediments or benthic communities in the way that the mobile gears do. Lost gillnets, however, not only foul the seabed but, more seriously, may also continue to fish for a long time. The probability of loss increases with water depth, distance offshore, the number of nets used, the severity of adverse weather and sea conditions and length of time between haulings. It is not surprising that where appropriate tending laws are enforced, as in Nova Scotia, the incidence of gillnet loss is relatively low.

4.4 Manageability and potential for abuse

In the case of gillnets, minimum mesh sizes are regulated as is the maximum number of nets per vessel in some areas.

The misuse of gillnets includes the following:

- Setting more gear than can reasonably be handled;
- Setting gear under adverse conditions, resulting in the loss of nets. Such conditions include strong currents, extreme weather and rough seabottoms (causing entanglements);
- Setting gears in the migrational paths of other species, such as salmon, resulting in by-catches;
- Letting nets "soak", that is, sit in the water with fish in them, for long periods of time; and
- Setting gear in very deep water, without ropes of sufficient strength or anchors of sufficient weight.

4.5 Options to improve conservation

The main conservation concerns in gillnet fishing are the capture of non-target species including birds and mammals, and the ghost-fishing of lost gillnets. Therefore the following conservation strategies are suggested:

To prevent the loss of gillnets or their disposal and to retrieve lost gillnets:

- Limit the number of nets allowed for each fishing vessel (with consideration given to the size of the crew and vessel);

* Impose the use of markers with radio transmitters and light emitting devices, where applicable. This will help the owner locate gear as well as reduce gear conflicts;
* Impose the use of acoustic transmitters which can be located by an acoustic receiver for easy retrieval of lost gears;
* Set up a used gear recycling and depository system;
* Regularly retrieve lost gears at "hot" spots where large numbers of gear are known to have been lost; and
* Impose a "tended" net requirement such that vessels must not return to port with gear remaining in the water. This would virtually eliminate gear losses and discards of spoiled fish.

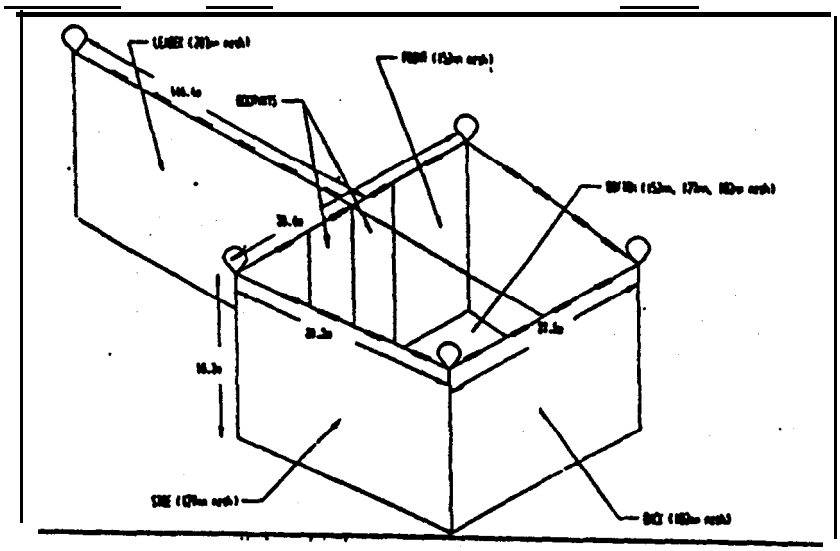
To reduce the fishing power of lost gillnets (ghost-fishing):

* Impose the use of biodegradable materials in parts of the gear, (e.g., biodegradable twines for fastening floats), rendering the gear ineffective after a certain period underwater.

To reduce bird, mammal, fish and shellfish by-catches:

* Restrict fishing near seabird breeding colonies;
* Impose use of acoustic warning devices to deter mammals and sea birds;
* Close fishery when by-catch limits have been exceeded (this can be accomplished through dock-side monitoring, on-vessel observers or research vessel sampling); and
* Install adequate flotation on the headline to reduce slack netting near the bottom in order to reduce by-catches on the seabed.

5.0 COD TRAPS



5.1 Introduction

The cod trap is basically a room with four walls and a floor made of netting; it has an opening at the front and may have a roof. Extending outward from the centre of the doorway is a long wall of netting which, because of its function of leading fish into the trap, is called "the leader". The trap is kept upright in the water by floats placed along the top of the walls; lead weights secure the bottom. It is held on location by a system of comer ropes anchored to the ocean floor. The leader, likewise buoyed and weighted, is tied to the trap at one end and made fast to the shore or to shoal-water rocks by ropes and anchors. A typical trap measures 100 to 140 m (55 to 75 fathoms) on the round and 18 to 30 m (IO to 16 fathoms) deep. It is typically set in water of less than 36 m (20 fathoms) in depth. The length of the leader depends on the bottom topography and may be up to 180 m (100 fathoms). The trap is typically attended by vessels in the 8 to 10 m (28 to 35') length range. One trap vessel may attend up to 10 traps.

This gear is very effective for harvesting inshore migrating fish. Operating cod traps requires relatively little fuel and can be employed from small vessels. Furthermore, most trapped fish are alive before transfer to the vessel and in the recent past have been a good source of cod for farming operations.

The cod trap was developed from the cod seine in the late 1860's by Capt. W. H. Whiteley, a Newfoundland skipper operating off the coast of Labrador. His trap fished so successfully that within a few decades it became a major fishing gear for fisherpersons along the coast of Labrador. Cod traps were in wide use on the Island of Newfoundland by 1911. It was not until the 1960's that major modifications to the traditional cod trap were made with the introduction of the Japanese trap. The Japanese trap had a roof and a porch, and was more complex in design than the traditional trap. At that time as well, another trap, called the "Modified trap", was developed which combined elements of the traditional trap and the Japanese trap. The traditional trap, the Japanese trap and the modified trap are now the three most common traps in use in the Newfoundland cod trap fishery. By 1991, the modified trap had become the most popular trap design in that province, where they made up 35% of all traps.[14] An estimated total of 5,000 traps were in use in 1991 compared with a peak of 6,500 traps used in 1911.

Typically, the mesh size of the front part of the trap and the leader ranges from 127 to 178 mm (5" - 7"), while that of the rear part (called "the drying twine") and the bottom ranges from 89 to 102 mm (3 1/2" to 4").

Cod traps in Newfoundland catch migrating feeding schools of cod in summer months. The swimming fish are intercepted by the leader and guided into the trap through the entrances. Once inside, the fish swim in circles, sometimes escaping through the entrances. They rarely escape through the mesh when the trap is stationary. In one research trial, over the course of 130 hours, only one fish was observed exiting through a trap's large-mesh front panel during fishing conditions[15]. Size selectivity does not occur until the trap is hauled, when the volume of the trap becomes smaller. During hauling, fish panic and swim through the small meshes in the drying twine, some becoming meshed. Fisherpersons transfer fish from the trap to the vessel using a scoop net. Daily catches of 10 tonnes in one trap were possible prior to 1991.

5.2 Selectivity and post-selection mortality

The cod fishery has traditionally harvested small fish. Between 1984 and 1989, 14% to 53% of cod under 43 cm (17 in) was landed by cod trap crews operating in NAFO Areas 3KL.[16] The proportion of small fish caught in these traps varied by location along the coastline of Newfoundland and Labrador.

The large proportion of small cod caught in traps is related to the large percentage of small fish present in the schools that migrate inshore to Newfoundland and Labrador. Numerous studies have shown that the small fish catch can be reduced by increasing the mesh size in cod traps. Use of 102 mm (4 in) mesh in the cod trap drying twine may reduce the small fish catch by 15% to 59%, depending on the area.[16] In most parts of Newfoundland, however, a large increase in mesh size would drastically reduce commercial catch levels and present serious socio-economic difficulties.

Salmon and sea trout by-catch is also a concern with traps in some areas and should provide a focus for future selectivity research with this gear type.

To date, no study has been carried out to determine the mortality of small cod that have escaped through the small meshes in the drying twine. Further studies are required to determine the mortality of cod trap escapees.

5.3 Environmental impacts

Cod traps are fixed gears anchored to the seabed with weights and anchors. Minimal disturbance to the sediments can be expected, but localized damage to vegetation may occur due to chafing of footropes on the seabed. The loss of the whole trap or its parts is rare, except in cases of marine mammal entanglements. During those events, whole traps or portions can be towed away. Unrecovered weights or anchors may foul the seabed, but minimal adverse effects on resources can be expected.

5.4 Manageability and potential for abuse

In the cod trap fishery, the minimum mesh size of 89mm (3.5 in) is regulated. In 1993 regulations were instituted to provide for the closure of the inshore cod fishery when a limit of fifteen percent of the catch on small cod (< 16 inches [4 1 cm]) was reached. By-catches of important species such as salmon and sea trout are supposed to be released as soon as possible as well. The number of traps per licence is not regulated, though there are indications that such limits are needed.

5.5 Options to improve conservation

The main concern in the use of cod traps is species- and size-selectivity. Before the closure of the Northern cod fishery, this problem had been increasing with the steady increase in the number of traps. It is felt that before the fishery is reopened, efforts in the following areas may be warranted:

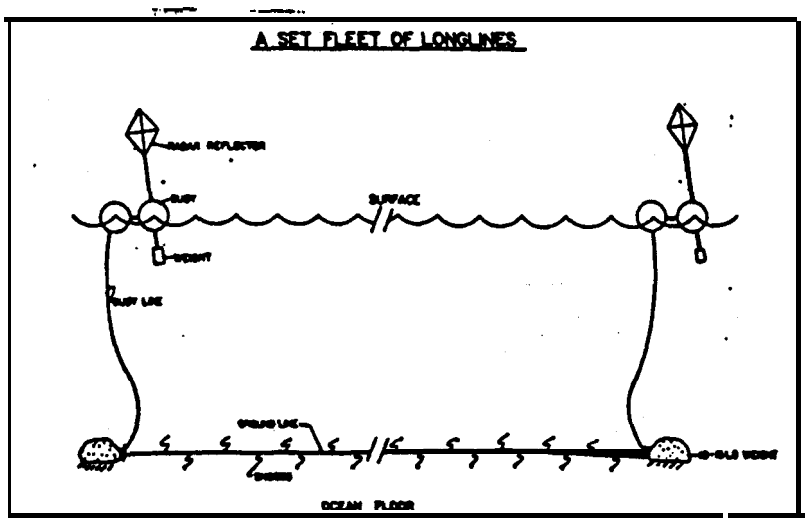
An increase in size of landed fish and a reduction in small fish mortality, through:

- The use of larger mesh in the drying twine, e.g. a minimum of 102 mm (4') mesh;

The control of the fishing effort by:

- Limiting the number of traps allowed for each licence; and
- Limiting the maximum size of the trap.

6.0 HOOK AND LINE GEARS



6.1 Introduction

Hook and line gears include a number of gears known as handlines and longlines. Handlines are the simplest form of hook and line gears, consisting of a hook attached to one end of a line. The longline, a modification of the handline, is composed of many short **handlines** which are attached to a long ground line at regular spacing. **Longline** vessels, which are generally larger than **handline** vessels, are themselves usually less than 20 m (65').

When Europeans began fishing on the Grand Banks about 500 years ago, the single hook and line was the main fishing gear used. During the latter **1800's,** fisher-persons started fishing longlines by tying a series of hooks to a groundline. This basic fishing method did not change greatly until the introduction of powered haulers and synthetic materials in the 1940's. Other major advances in **longline** fishing occurred with the availability of

freezers to store bait, and baited gears. Mechanized systems for longlining have also been available for the past 15 years, but their adoption in Atlantic Canada has been limited because of cost and performance considerations. On the other hand, handlining using a hook attached to a line has changed very little for the past 500 years except that synthetic lines are used.

6.2 Selectivity and post-selection mortality

The longline is regarded by many as a size-selective fishing gear. In fishing trials on the same fishing grounds, the sizes of cod caught by longlines were almost 10 cm longer than those caught by trawls." However, it seems that the size of the bait, rather than the size of the hook, has the greater effect on the size selection of longlines.[18,19] The larger bait catches larger fish due to a linear relationship between predator size and optimal prey size. A large fish may take both large and small baits, while a smaller fish will feed only on a small bait. A reduction in bait size will therefore increase catch rates, but a higher proportion will be of smaller fish. The effect of hook size on size selectivity becomes evident only when hooks are substantially different in size (e.g. 1 0/0 to 1610 circle hooks). Within the range of hook sizes that are relevant to the commercial longline fisheries, there seems to be little potential for size selective effects.'*

Bait type is the most important gear parameter affecting the species selectivity of longlines as different types of bait release different feeding stimulants which may attract one species but not another. For example, in one study, squid was found more effective in catching cod and hake while mackerel was better for haddock.[20] The catch rate of a herring-based artificial bait was 158% that of natural squid bait for haddock, but when used to catch cod, the catch rate was only 18% of the rate of squid.[20] In addition, bait size and hook type also affect the species selectivity of the longlines.

Longlines may reach lengths of as much as 6 nautical miles (10 km) covering large fishing areas and is most suitable for catching scattered fish. Since a scattered distribution is more characteristic of large rather than small fish, longlining may be intrinsically selective toward large fish. Furthermore, competition may occur among fish attracted to baited hooks. Behavioural studies of longlines have shown that large cod frighten smaller cod away from baited hooks and, because of their wider feeding ranges, large fish also have a higher probability of encountering a hook.'*

Longlines sometimes catch seabirds when the lines are still on the surface during setting. This phenomenon also affects the catching power of the longlines as bait is stolen by the birds. Sometimes birds take as much as 70% of the bait.[21] Recently, a seabird scaring device was successfully tested in Norway to solve both problems.

It is believed that jigging, a form of handlining, may have poorer size selection than longlines or handlines as jigged fish are not always hooked on the mouth, but all over the body.

The post-selection mortality of fish that have escaped from longline hooks has not been fully investigated. Fish that escape from baited hooks on the seabed likely have good chances of survival, but fish that escape during hauling probably suffer serious detrimental effects as their swim bladders greatly expand or explode during the process. Such escapement sometimes accounts for 15% to 30% of the number of fish actually hooked in traditional longlines.[22] Use of swivel hooks or other designs may reduce this type of mortality and also increase fishing efficiency.

Another related, but poorly understood, mortality arises from the predation and scavenging of hooked commercial species by other animals. Preliminary results from trials showed that as much as 22% of hooked cod can be destroyed by bottom scavengers when gear is fished overnight.[23]

It is known that fish that have escaped from jiggers and handline hooks, or small fish that have been returned to the water after being landed on deck suffer some degree of physiological damage. The rate of mortality, however, has not been studied in detail.

6.3 Environmental impact

Hook and line gears do not greatly affect the seabed; even fouling of the seabed due to lost longlines may not be a conservation problem. Lost gear quickly ceases to fish as bait deteriorates; at worst, it becomes litter on the seabed.

6.4 Manageability and potential for abuse

At present, longline regulations are restricted to the setting of minimum hook sizes. Longline gear probably has the least potential for use in an abusive or destructive manner. For example, longline gear has a built-in level of saturation and catching capacity established by the number of hooks which can be operated per day.

6.5 Options to improve conservation

The hook and line fishery does not lend itself readily to great improvements in its conservation properties. Nevertheless, since it has been determined that the size of bait does play a part in size selectivity, the industry could be encouraged to use larger baits to select for larger fish. Should by-catches and small-fish catches exceed acceptable limits, the fishery could be closed. As mentioned before, this can be accomplished through dock-side monitoring, on-vessel observers or research vessel sampling.

7.0 SUGGESTIONS FOR FURTHER RESEARCH AND DEVELOPMENT. TO IMPROVE CONSERVATION

As demonstrated in the foregoing chapters, a great gap exists between the current state of our knowledge and the potential for improving conservation in harvesting technology. While options for immediate improvements to the gear have been outlined in the foregoing chapters, other more complicated research and development projects could be undertaken to improve our knowledge base and our ability to promote conservation in harvesting practices. Many of these initiatives. would require a great deal of time and possibly money to complete. The following list of research and development projects is presented for consideration.

Otter trawls and Scottish seines

* Evaluate and determine the effects of fishing on spawning populations;
* Examine measures to regulate selective designs and devices and their enforceability;
* Evaluate mortality of fish escaping from conventional trawl codends and improve trawl design to reduce escapee mortality;
* Evaluate mortality of fish escaping from new designs and devices aimed at improving selectivity, and discard those devices with high escapee mortality;
* Evaluate mortality of trawl discards and improve handling practices to reduce mortality; and
* Evaluate the behaviour of fish (spawning and non-spawning) in the trawl path and codend with the aim of increasing size- and species-selectivity through development of such technologies as species separator trawls, scaring devices in codends to increase escapement, more selective footgears, and the use of airguns to separate species during trawling.

Gillnets

* Evaluate and make use of colours or devices which are highly visible from above to reduce seabird by-catches;
* Test and make use of acoustic devices which ward off birds and/or mammals but not target species;

* Evaluate hang-ratios of gillnets so that the meshes are hung tightly to reduce tangling and non-target species by-catches;

* Evaluate mortality due to fish escapement and discarding;

* Evaluate the behaviour of fish with the aim of developing methods to increase size- and species-selectivity through introduction of such changes as colour of netting material, use of glownets and acoustic devices; and

* Evaluate the use of biodegradable materials to prevent ghost-fishing.

Cod traps

* Test and make use of escape panels or grids in cod traps to improve size-selection;

* Evaluate and make use of designs which keep salmon and trout from swimming into the cod trap;

* Evaluate and make use of acoustic devices to warn whales and other marine mammals from entrapment or collision with the trap;

* Evaluate post-selection mortality of cod escaping from "drying twines" and grids during hauling processes; and

* Evaluate fish behaviour before and after entering the trap to aid in the development of devices to encourage species- and size-selection prior to hauling.

Hook and line gears

* Test and make use of feather hooks or other artificial baits to increase size- and species-selectivity and reduce bait consumption in longlines;

* Evaluate off-bottom fishing techniques to reduce scavenging of hooked fish in longlines;

* Test and make use of new designs which may keep hooked fish alive longer, e.g. swivel hooks, to reduce scavenging in longlines;

* Evaluate the mortality of fish escaped during hauling and reduce escape by using more secure hooks in both longlines and handlines;

* Evaluate the mortality of escaped fish injured by jiggers;

* Evaluate and make use of a scaring device for employment while shooting, to reduce the by-catch of sea birds; and

* Evaluate the behaviour of fish attracted to baits with the aim of understanding size- and species-selectivity.

8. CONCLUSION

The FRCC established the Gear Technology Subcommittee to examine the relative conservation advantages and disadvantages of the various commercial fishing technologies. The Council has been concerned that the intensive and, oftentimes, acrimonious debates on fishing technology have been emotionally charged, especially where the agendas are driven by matters of resource access, vested interests and perceptions. More attention must be devoted to examining the facts and arriving at considered, reasoned judgements. The Council's intention in examining the gear technology issue was to elevate the debate beyond resource access by bringing forward an objective analysis of the various conservation considerations.

The preceding chapters have documented the general operational parameters of the commercial fishing technologies utilized in the Atlantic groundfishery and have demonstrated that virtually all technologies carry downsides with respect to conservation. Notwithstanding documentation of certain undesirable characteristics of these various technologies, it is clear that, for many of the undesirable attributes, there are remedial measures available in terms of technological innovations (such as the Nordmore grate) and revised gear deployment practices (for example, reduced towing speeds or limitations on the quality of gear set).

Opportunities for alleviating or resolving conservation shortcomings through technological modifications and/or revised gear deployment practices will not occur without cost. For fishers, these costs will arise through increased gear expenses, reduced 'operational flexibility and, in some cases, reduced catches.

The pursuit of resource conservation through the proper use of fishing gear technology is fraught with difficulties. As evidenced by the foregoing review, our understanding of existing technologies is incomplete and cannot be substantially improved through further research until after the stocks recover and, even then, only at considerable cost. Furthermore, the increasing pace of technological change will continue to challenge our ability to understand and control it.

What is increasingly evident is that there are no clear, simple solutions to the issues of sustainable harvesting practices. All means of killing fish carry environmental, ecological or economic downsides. The appropriateness of any given technology will vary markedly by species and stock area. The desired approach to addressing this matter is one of consultation and consensus building by stakeholders.

The FRCC is hopeful that the contents of this document will furnish the basis for a thorough debate on, and objective analysis of, the conservation aspects of harvesting technology. The Council believes that the discussion will lead to proper and balanced advice to the Minister of Fisheries and Oceans on this most important matter.

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APPENDIX 1

MANDATE OF THE GEAR TECHNOLOGY SUBCOMMITTEE

GEAR TECHNOLOGY SUBCOMMITTEE

Committee Membership: Victorin Mallet (Chair), Fred Woodman, Sam Elsworth, Frank Hennessey , Maureen Yeadon

Support Staff: Andrew Duthie, Steve Walsh, Darlene Smith

Purpose: Opinions regarding the appropriateness of fishing technology often reflect sector interests. There is less frequently a clear understanding of the conservation aspects of gear use. The purpose of this Subcommittee is to determine, for each harvesting technology, the conservation implications, optimum manner of usage and relative desirability from a resource conservation perspective. This will be based on an objective analysis of historical experience and current evidence concerning habitat impact, gear selectivity, inherent manageability, the potential for improvement or abuse of the technology, and any other relevant considerations.

Operation:

1) The Fishing Gear Technology Subcommittee will work closely with other experts, within and external to the Department of Fisheries and Oceans, involved in research and study of gear technology.

2) A Fishing Technology Advisory Board will be established to provide advice to the Subcommittee and to facilitate an exchange of information; the chairperson of the Advisory Board shall be an ex-officio member of the Subcommittee.

3) In the first phase of its work, the Fishing Gear Technology Subcommittee will:

a) commission an independent and objective study, to be completed by March 1994, of the state of knowledge on conservation implications of fishing gears, based on existing international literature and on relevant experience

b) use the results of this study to prepare for the FRCC a public discussion paper outlining the current state of knowledge on questions of gear technology. This report will describe conservation advantages and disadvantages of each gear technology, including the selectivity of each gear, the effect of stock abundance on the impacts of each fishing gear, the environmental and/or habitat impacts of each gear technology, manageability implications, and the potential for abuse.

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4) In its second phase, the Subcommittee will continue to analyze results from the bove-noted discussion paper, and may organize and conduct "Gear Technology and Fishery Conservation" workshops. The goal will be to bring to the FRCC appropriate proposals concerning gear technology or gear-oriented regulatory measures required for conservation of the resource.