



LONGLINE HOOK SELECTIVITY STUDY
SOUTH COAST OF NEWFOUNDLAND

**ATLANTIC FISHERIES
ADJUSTMENT PROGRAM**



**PROGRAMME D'ADAPTATION DES
PÊCHES DE L'ATLANTIQUE**

NEWFOUNDLAND REGION

GEAR CONVERSION – PROJECT REPORT 1991 – 181

SH
344.6
L55
Y4
1991



Fisheries
and Oceans

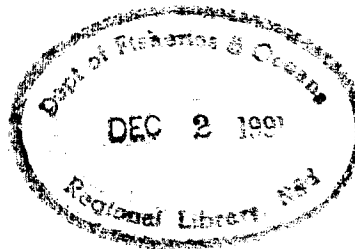
Pêches
et Océans

Canada

204-4-4

LONGLINE HOOK SELECTIVITY STUDY
SOUTH COAST OF NEWFOUNDLAND
JANUARY-MARCH, 1991

Department of Fisheries and Oceans
Fisheries and Habitat Management Branch
Industry Development Division
Newfoundland Region
P.O. Box 5667
St. John's, Newfoundland
A1C 5X1



Larry Yetman
Luke Hogan
Michael Lacey

*Mike from
DCA*

TABLE OF CONTENTS

	<u>PAGE</u>
Acknowledgements	iv
Summary	v
1.0 Introduction	1
2.0 Details of Fishing Area	3
2.1 Areas Fished - Harbour Breton	3
2.2 Areas Fished - Ramea	3
3.0 Fishing Gear and Method of Operation.....	6
4.0 Results	8
4.1 Harbour Breton and Ramea	8
4.2 Harbour Breton	11
4.3 Hook Comparison	14
4.4 The 6/0 Hook	14
5.0 Conclusions	17
6.0 Recommendations	18
7.0 Bibliography	19

LIST OF FIGURES

	<u>PAGE</u>
FIGURE 1: GENERAL AREAS FISHED - HARBOUR BRETON	4
FIGURE 2: GENERAL AREAS FISHED - RAMEA	5
FIGURE 3: FISHING HOOK DESCRIPTION.....	7
FIGURE 4: LENGTH FREQUENCY - TOTAL CATCH	9
(Harbour Breton and Ramea)	
FIGURE 5: CUMULATIVE LENGTH FREQUENCIES	10
(Harbour Breton and Ramea)	
FIGURE 6: LENGTH FREQUENCY - TOTAL CATCH	12
(Harbour Breton)	
FIGURE 7: CUMULATIVE LENGTH FREQUENCIES	13
(Harbour Breton)	
FIGURE 8: LONGLINE HOOK COMPARISON	15
(Harbour Breton and Ramea)	
FIGURE 9: LONGLINE HOOK COMPARISON	16
(Harbour Breton)	

ACKNOWLEDGEMENTS

Sincere appreciation is expressed to the following people for the important roles they played in conducting this project:

Mr. Patrick Snooks, owner and operator of the "TINY BUBBLES"; Mr. Alexander Bowles, owner and operator of the "STACEY S. SABRINA"; Mr. Claude Bishop, scientific advisor with the Science Branch, Fisheries and Oceans; Mr. Gerald Brothers, Project Officer, Fisheries Development Division; Mr. John O'Rourke and Mr. A. Gerard Sullivan, Fisheries Officers; and sincere appreciation is expressed to the people of Harbour Breton and Ramea for their hospitality.

SUMMARY

The purpose of this report is to present the results of a hook selectivity study carried out on the South coast of Newfoundland at Harbour Breton and Ramea. In response to recommendations made by the Implementation Task Force on Northern Cod, Fisheries Development Division, Department of Fisheries and Oceans, implemented this study which extended from January 8 to March 5, 1991. The study examined the relationship between four different hook sizes and the size of fish caught on these respective hooks in two commercial longline fishing operations.

Four sizes of hooks were studied; #16, #15, #14 and #6/0. The project was originally designed to observe only the #16, #15 and #14 hooks, but since #6/0 hooks were used extensively by fishermen in Harbour Breton, this size was also included in the study. Fishermen in Ramea were already using the #16 hook, therefore, no adjustments to the original plan were necessary.

All hooks used were J-hooks produced by O. Mustad and Son. These hooks were arranged on groundlines in successive order and baited with either mackerel or squid so that each hook had an equal probability of catching a fish. In all, 6140 hooks were used during the experiment.

Results indicate that all four types of hooks tend to catch the same amount of large fish but the smaller gauge hooks also catch many small, juvenile fish. The #6/0 gauge hook proved to be the most successful at catching fish of any size, while the #14 caught fewer juvenile fish.

The results of this study confirms that there is a relationship between the size of hook used and the size of fish caught. That is, as hook size increases, the number of small (less than 20") fish caught decreases.

It is recommended that hook selectivities be studied further in other predominantly longlined areas to obtain a larger and more complete sample.

1. INTRODUCTION

It has been recommended by the Implementation Task Force on Northern Cod:

1. That a minimum hook size regulation be established immediately for cod handlines and longlines, and as an initial step this minimum hook size should be set at No. 16 gauge or equivalent.
2. That hook selectivity studies be carried out to determine if an increased minimum hook size is needed in the future.
3. That the regulations be reviewed to ensure that they apply to artificial baited gears and amended, if necessary.

Like many fishing techniques used in the commercial cod fishery, longlining, depending on the area, the size of hooks fished and other factors, may catch more juvenile fish than is desired. This is generally attributed to the size of hook used. Spawning stocks could be enhanced if fewer small fish were taken in the commercial fishery before they had the opportunity to spawn. Hence, as was suggested by the Implementation Task Force on Northern Cod, the Fisheries Development Division, Fisheries and Habitat Management Branch, initiated a project to study the effects of larger hook sizes in an effort to determine whether an increased minimum hook size will be necessary in the future.

This hook selectivity study was carried out along the south coast of Newfoundland between January 8, 1991, and March 5, 1991. The purpose of the study was to determine the relationship between hook size and the size of fish harvested in commercial longline fishing operations. In particular, four types of hooks were studied - #14, #15, #16, and #6/0 gauges. These size hooks were selected as the #16 hook is generally preferred by longline fishermen and were thus compared to two larger hook sizes, #15 and #14 respectively. The #6/0 was included for reasons that will be mentioned later.

To carry out this project Fisheries Development enlisted the services of two crews, one from Harbour Breton and one from Ramea. In Harbour Breton the longlines were rigged with hooks of #14, #15, #16, and #6/0 gauges whereas in Ramea only the #14, #15, and #16 gauge hooks were studied. In both areas gangions were marked for easy identification of hook size and all fish captured were length measured to the nearest centimetre and the size of hook from which it was taken recorded.

The study was undertaken in co-operation with the Groundfish Division, Science Branch, Department of Fisheries and Oceans.

All data collected during the survey is available under separate covers upon request.

2. DETAILS OF FISHING AREA

The communities of Harbour Breton and Ramea were selected as areas in which to conduct the study as fishermen in these communities have traditionally prosecuted the longline fishery.

2.1 Areas Fished - Harbour Breton

In Harbour Breton the general area fished was located approximately 2.8 km (1 3/4 miles) off Sagona Island and 6 km (3 3/4 miles) off Eastern Head (see Figure 1). Fleets of longlines were set in this area in depths ranging from 165-200 m (90-110 fm).

2.2 Areas Fished - Ramea

In Ramea the general areas fished were around Fox Island and on the northern end of the Burgeo Bank (see Figure 2). Fleets of longlines were set in these areas in depths ranging from 128-220 m (70-120 fm).

Generally, only one fleet of gear was fished in a particular area each day.

GENERAL AREAS FISHED - HARBOUR BRETON

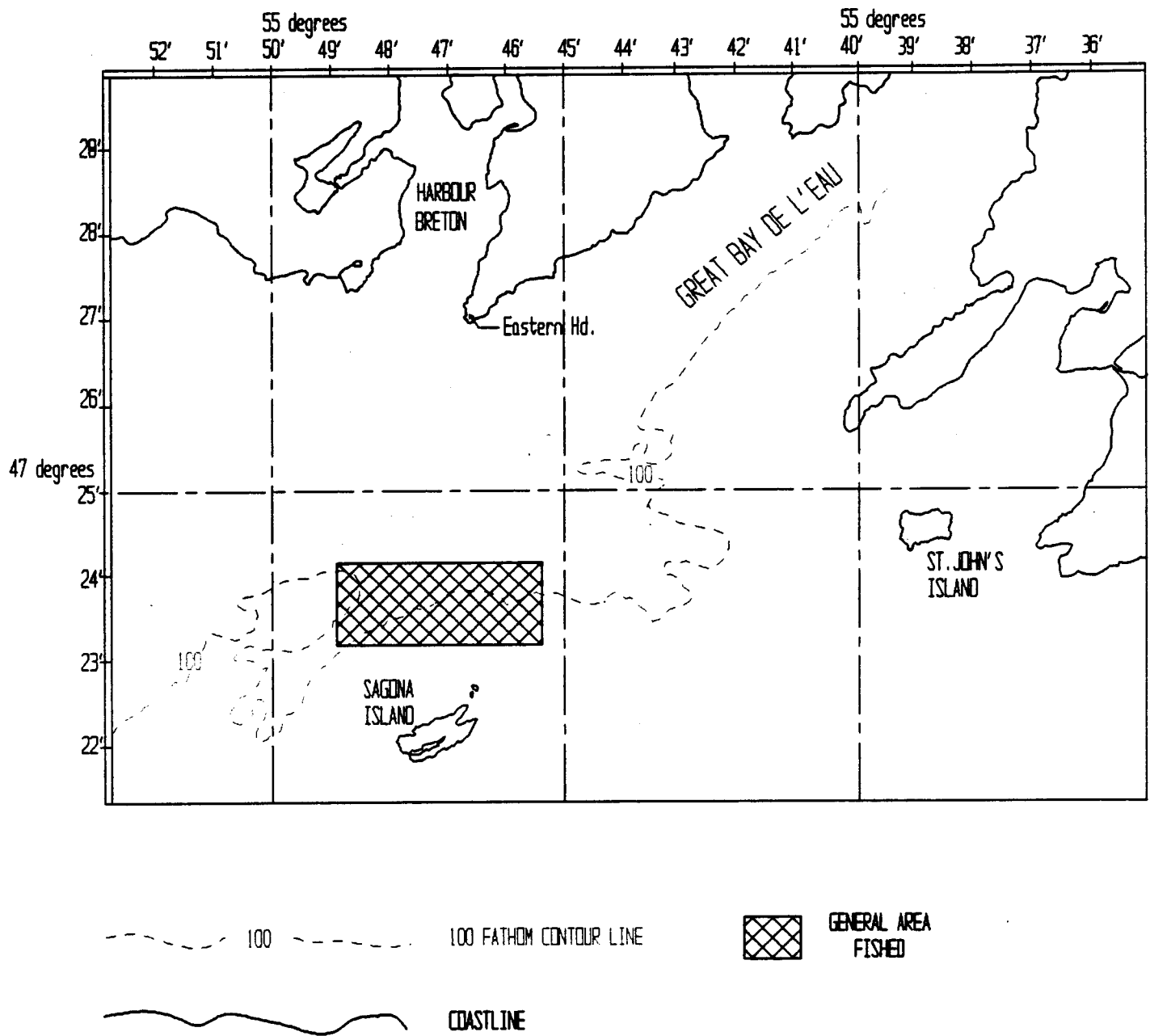


FIGURE 1

GENERAL AREAS FISHED - RAMEA

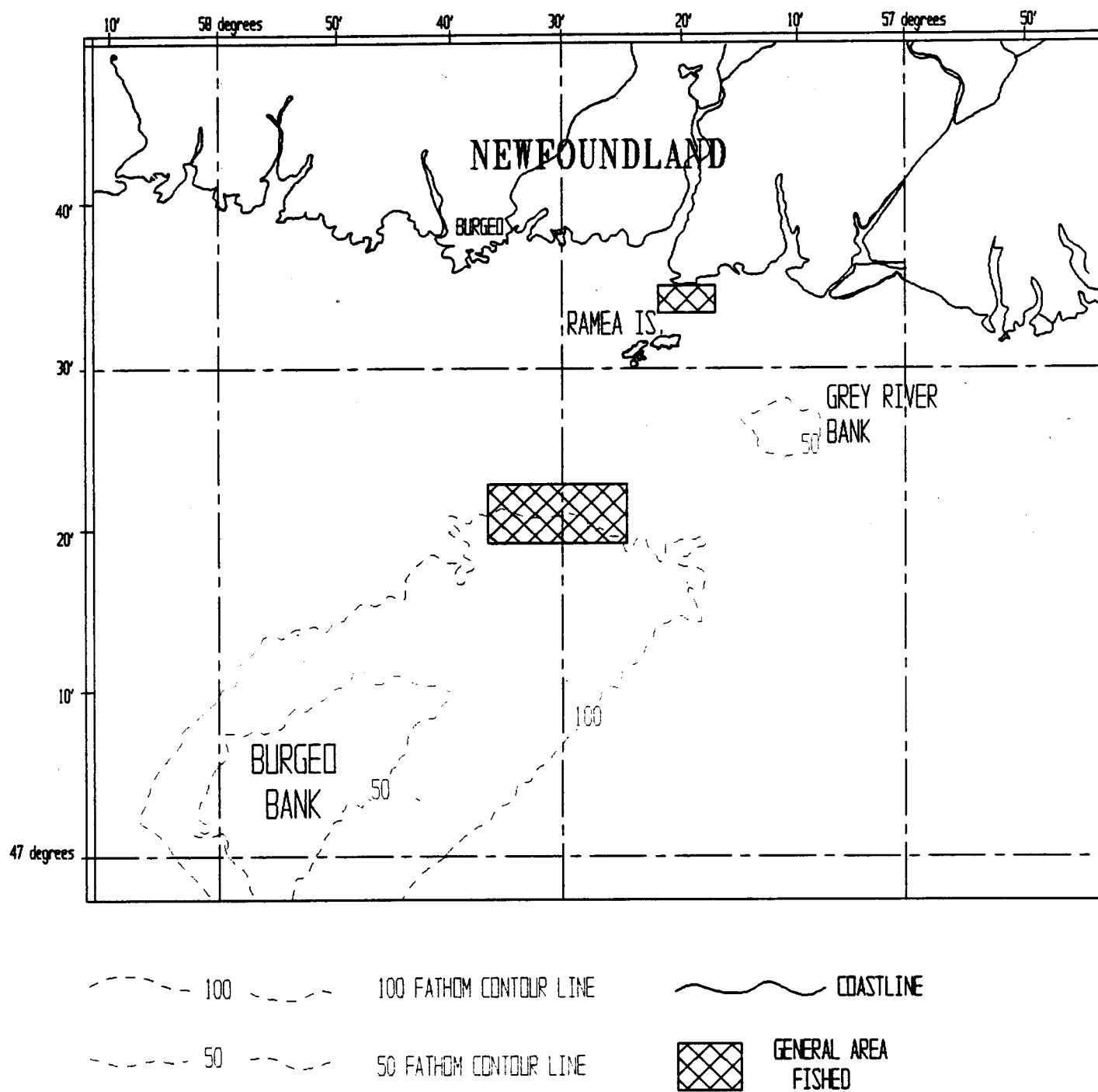


FIGURE 2

3. FISHING GEAR AND METHOD OF OPERATION

In both Harbour Breton and Ramea a set fleet of gear consisted of two buoys, one radar reflector, two 9 mm (3/8") diameter polypropylene moorings, two 18-23 kg (40-50) lb weights, 9 mm (3/8") diameter spun nylon groundline, and hooked 40 cm (16") twisted polyester gangions.

The project was originally designed to observe and compare #14, #15, and #16 gauge hooks, but since the #6/0 was used by fishermen in Harbour Breton, this size was included as well. Fishermen in Ramea were already using the #16 hook, therefore, in that area, no adjustments to the original plan were necessary. Here the study was carried out with the original three sizes being observed.

The hooks were arranged on groundlines in the following manner: #14, #15, #16, #6/0, #14, #15, #16, #6/0, ... and, for easy identification of hook size, groundlines were marked with color coded twine at the points where gangions were attached.

All hooks used in this selectivity study were of the J-type produced by O. Mustad and Son Ltd. As previously stated, hooks of #14, #15, #16, and #6/0 gauges were used. In total, 6140 hooks were used during the study.

Presently, an international standard for gauging hook size does not exist. Therefore, in describing the differences between these hooks it is necessary to be familiar with the various parts (see Figure 3 and Table 1). Of these, most important are the width of the gap, which is the clearance between the point and the shank, and the depth of the throat, which is the distance between the tip of the point and the bottom of the bend.

The #6/0 differs somewhat from the other three hooks in its shape. While the other hooks have smooth bends and bent eyes, the #6/0 has a sharp bend and a straight eye.

Fishing Hook Description

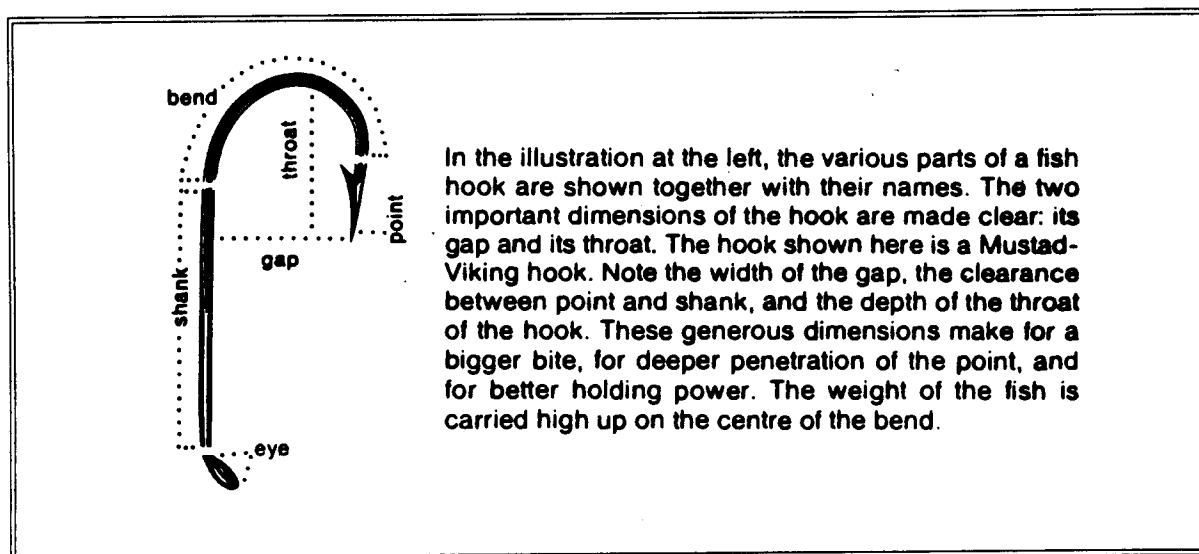


FIGURE 3 Taken from "Mustad Fish Hook Catalogue"

Table 1 Primary Hook Characteristics

HOOK	GAP (mm)	THROAT (mm)	BEND	EYE
#14	21	21	ROUND	SLANT
#15	18	20	ROUND	SLANT
#16	17	17	ROUND	SLANT
#6/0	17	17	ANGULAR	STRAIGHT

4. RESULTS

Since fewer #6/0 hooks were set than the other three sizes, the data obtained has been categorized into two groups. The first group consists of data collected for the #14, #15 and #16 hooks in both Harbour Breton and Ramea. The second group is composed of data from Harbour Breton only and includes the 6/0 as well as the other sizes studied.

4.1 Harbour Breton and Ramea

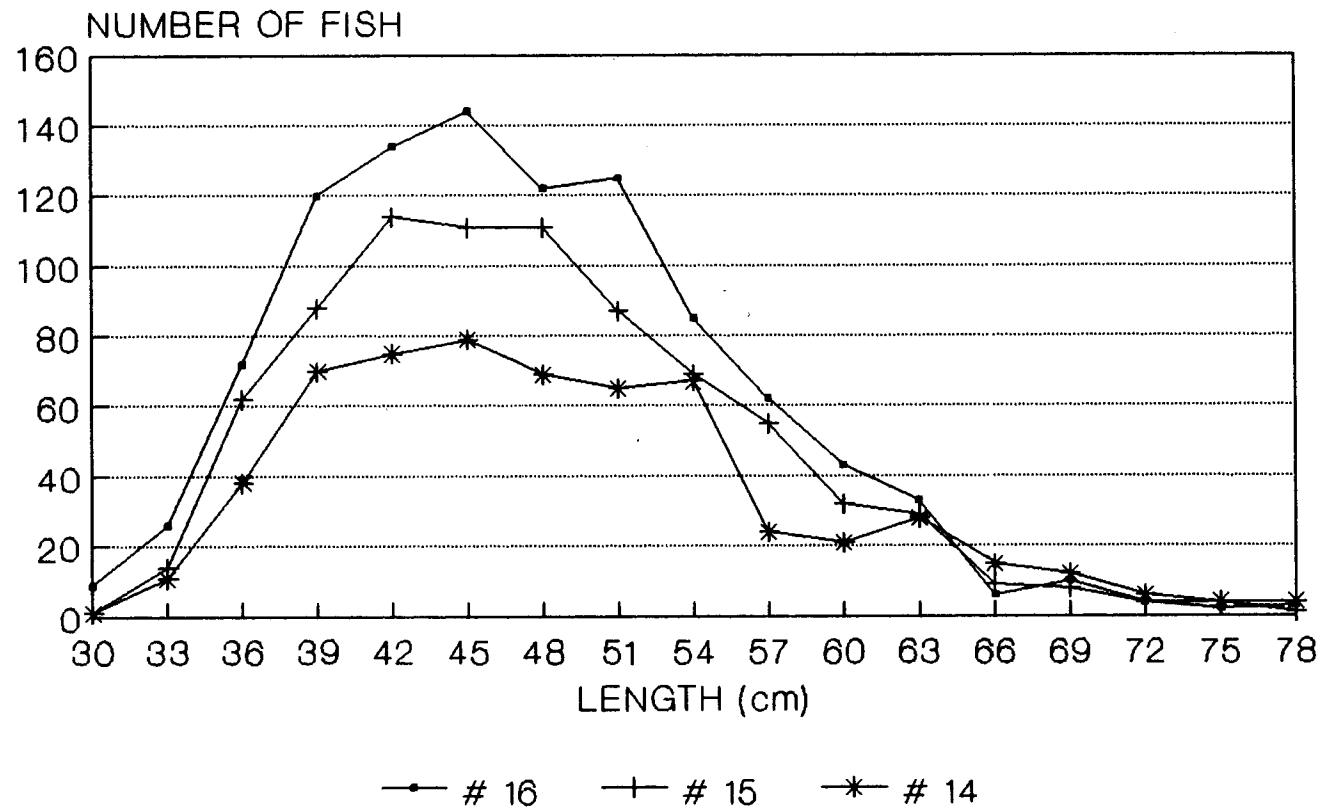
In total, 2387 fish were caught on the three primary hook sizes in the survey. From Table 2 it is obvious that the #16 has the greatest catching ability of the three, taking 40% of the total catch compared to 33% and 27% for the #15 and #14 respectively. However, most of the fish caught on the #16 hook was in the 30-55 cm range. In the 60-80 cm range the catching ability of the #14 hook is somewhat better than that of the #16, indicating a greater effectiveness in catching large fish as well as a high degree of selectivity with respect to small fish. The #15 shows a small degree of selectivity in the 30-55 cm range, but is approximately equal to the #16 in the larger range (see Figures 4 & 5).

Table 2 Hook Size Versus Catch (Hr. Breton and Ramea)

HOOK SIZE	NUMBER OF HOOKS SET	NUMBER OF FISH CAUGHT	AVERAGE LENGTH (cm)	TOTAL WEIGHT (kg)	PART OF CATCH BELOW 51cm
14	10732	588	49.8	579.2	58.0%
15	10732	801	48.8	728.1	62.6%
16	10732	998	48.3	876.3	62.8%

FIGURE 4

LENGTH FREQUENCY - TOTAL CATCH HARBOUR BRETON and RAMEA

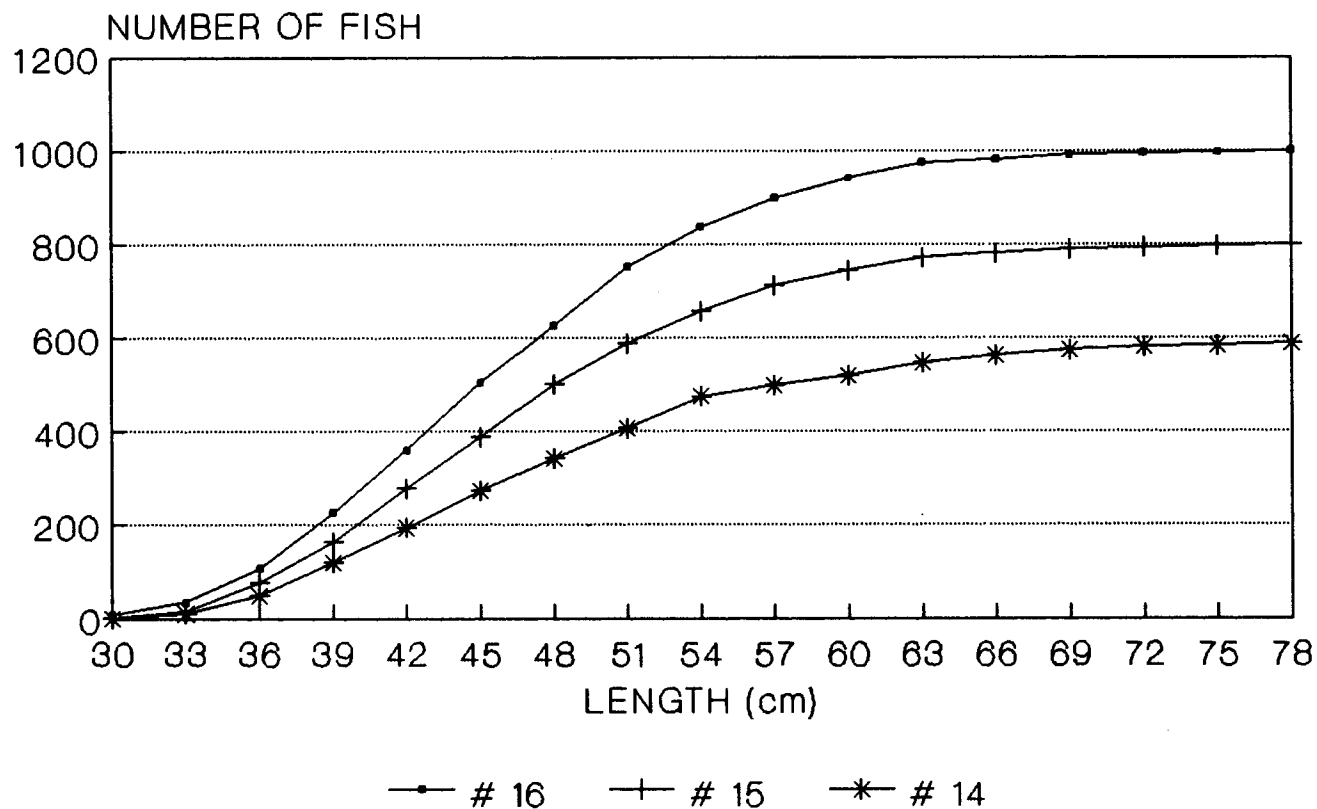


3 cm GROUPINGS (#6/0 HOOK EXCLUDED)

FIGURE 5

CUMULATIVE LENGTH FREQUENCIES HARBOUR BRETON and RAMEA

10



3 cm GROUPINGS (#6/0 HOOK EXCLUDED)

4.2 Harbour Breton

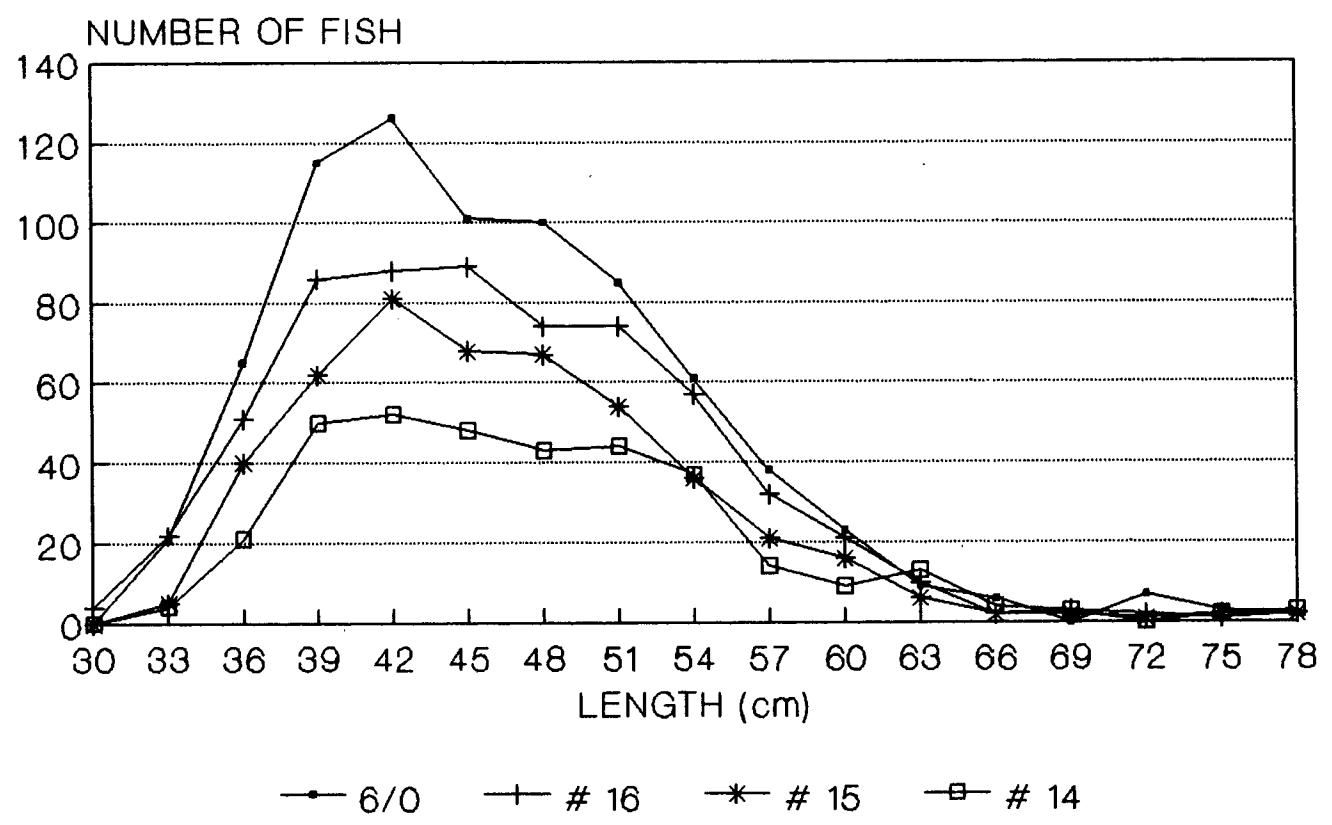
In total, 2183 fish were caught on all four hook sizes studied (see Table 3). The #6/0 hook proved to be the most effective at catching fish in this area, with the #16 close behind. The #14 shows better selectivity in catching less fish in the 30-55 cm range while catching approximately the same number of fish as the other hooks in the 65-80 cm range. The #15, again, shows a small degree of selectivity in the 30-55 cm range, while differing little from the #16 in the larger range. The #6/0 hook is less selective than the #16 over all ranges (see Figures 7 & 8).

Table 3 **Hook Size Versus Catch (Hr.Breton)**

HOOK SIZE	NUMBER OF HOOKS SET	NUMBER OF FISH CAUGHT	AVERAGE LENGTH (cm)	TOTAL WEIGHT (kg)	PART OF CATCH BELOW 51cm
14	6545	348	49.3	312.5	62.6%
15	6545	465	47.8	381.8	69.5%
16	6545	608	47.5	492.0	68.1%
6/0	6545	762	47.5	620.4	69.3%

FIGURE 6

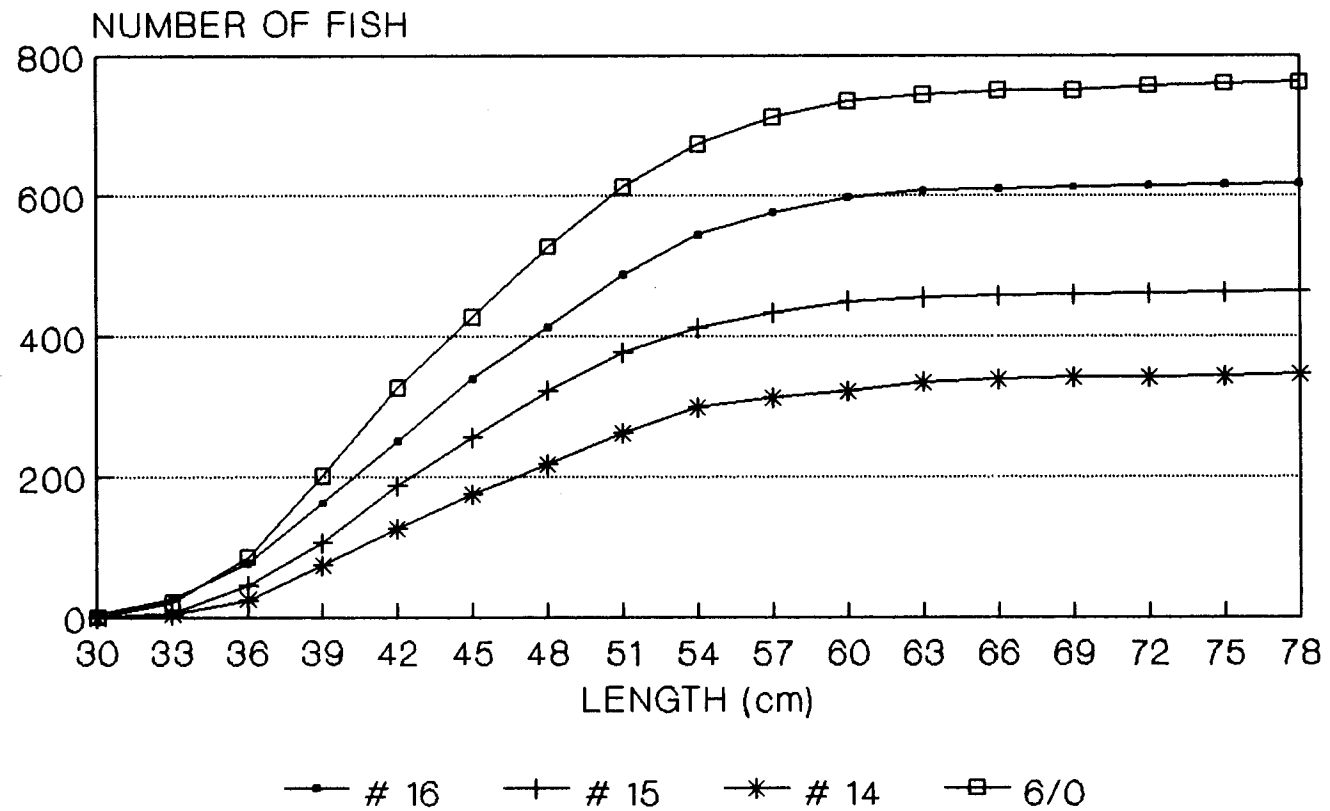
LENGTH FREQUENCY - TOTAL CATCH HARBOUR BRETON



3 cm GROUPINGS

FIGURE 7

CUMULATIVE LENGTH FREQUENCIES HARBOUR BRETON



3 cm GROUPINGS

4.3 Hook Comparison

In comparing the various hook sizes the #16 was chosen as the standard, since it is used most prevalently in the Newfoundland longline fishery. That is, catches made on the other three hooks were compared, in ratio form, to catches made on the #16. The results of this comparison were graphed and a relationship observed (see Figures 6 & 9). The horizontal line at 1.0 indicates the #16 catch. Points below this line indicate catches smaller than that made on the #16, while points above the line indicates larger catches. With ratios much less than 1.0, the #14 and #15 hooks caught fewer fish than the #16 for fish lengths less than 66cm, and therefore tend to catch more smaller fish. The positive slope of the trend lines for the these hooks also indicate a higher propensity to catch larger fish than the #16. The #6/0, however, produces ratios greater than 1.0 and is therefore less selective than the #16.

4.4 The 6/0 Hook

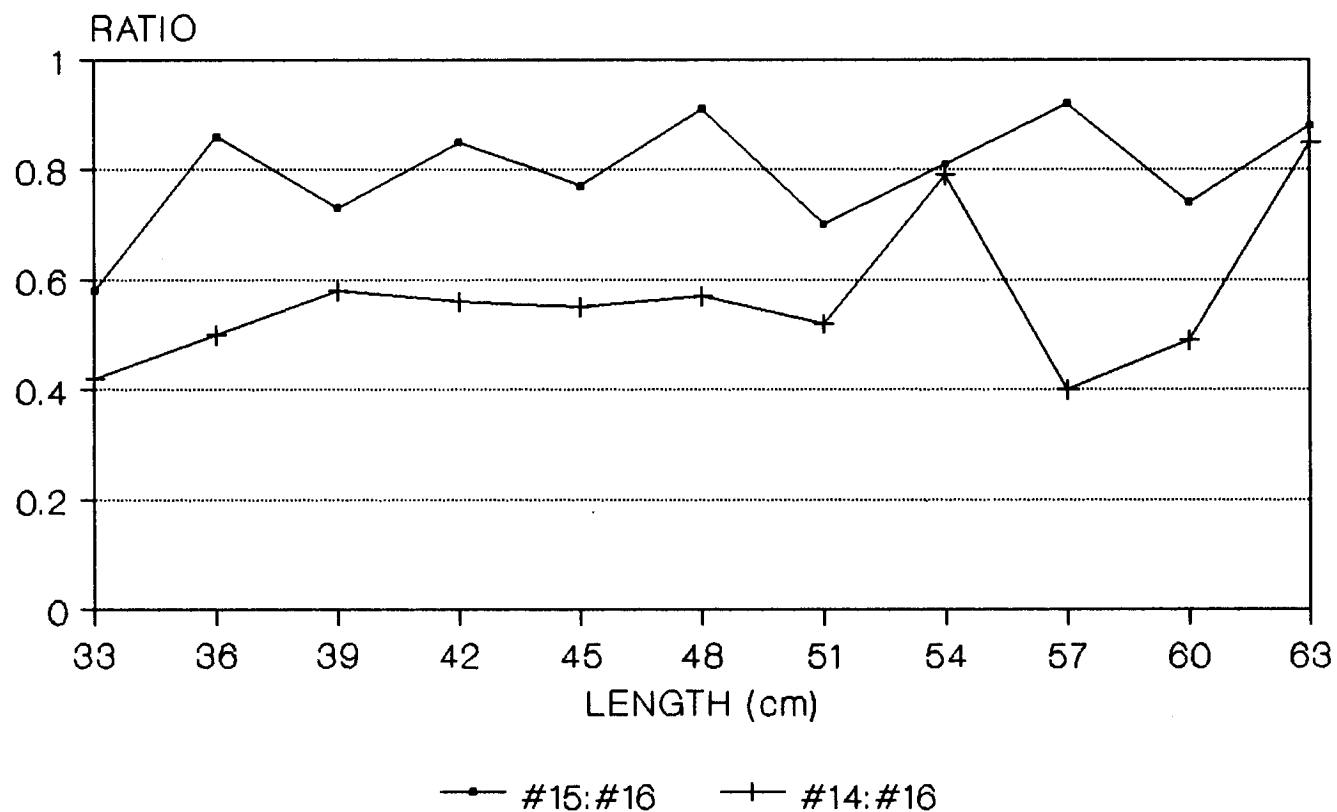
The results returned by the #6/0 hook were quite unexpected. Measurements taken of the hook's dimensions were compared to the #16. Surprisingly the gap and the throat were the same measurement on both hooks. Yet, the #6/0 showed a greater ability to catch fish than the #16. The shape of this hook seems to permit better hooking and retaining of fish than the regular J-type.

Overall fishing was poor, catches were small and suitable fishing days were scarce. The average length of fish caught was 48 cm (19"). Sixty three percent of the total catch was below 51 cm (20"). It was found that fewer small fish were caught on the larger hooks while all the hooks caught approximately the same number of large fish. Had the average fish size been greater, selectivity trends may have been less noticeable.

FIGURE 8

15

LONGLINE HOOK COMPARISON HARBOUR BRETON and RAMEA

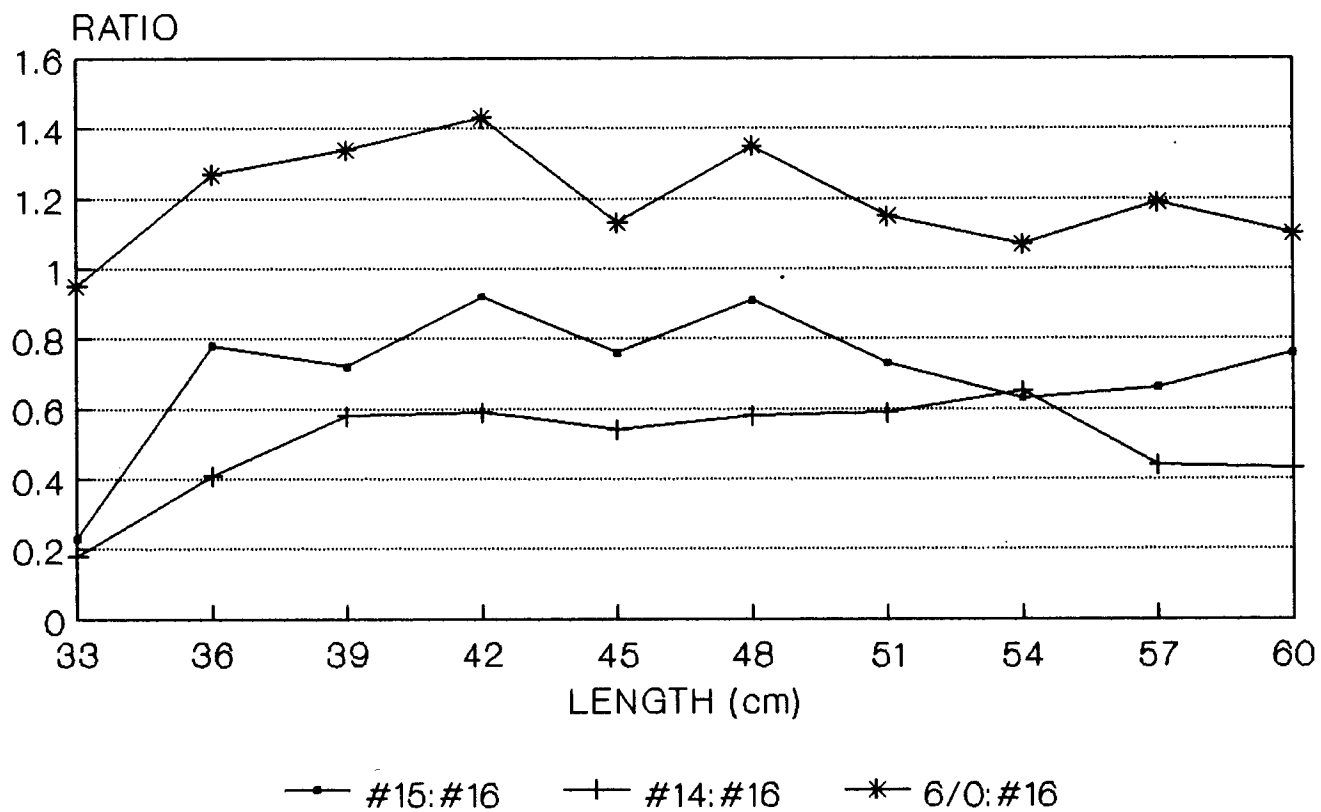


3 cm GROUPINGS (0/0 EXCLUDED)

Figure 9

16

LOGLINE HOOK COMPARISON HARBOUR BRETON



3 cm GROUPINGS

5. CONCLUSIONS

As the compiled data suggests, there was a relationship between the size of hook used and the size of fish that the hook catches. That is, larger hooks are more selective, catching fewer small fish. The selectivity of the #15 hook differed little from that of the #16, but nevertheless caught fewer smaller fish. The #14 hook was more effective in reducing the catch of smaller cod.

The #6/0 hook, although having the same dimensions as the #16, was more effective at catching fish. This fact would appear to be attributable to the slight difference in the shape of the #6/0.

Changing to larger hooks could result in a reduction of profit for fishermen. With this two scenarios are possible. One involves the fishermen changing to larger hooks without increasing the number of hooks fished above normal, resulting in a drop in catch. The second involves the fishermen changing to larger hooks and increasing the number of hooks fished to compensate for lost catch, leading to increased operating costs.

For example, if fishermen in Harbour Breton were to switch from #6/0 to #16 hooks without increasing the amount of gear fished they could potentially incur a 20% loss in catch weight. If they were to compensate for lost catch, they would need to increase the number of hooks fished by 26%.

6. RECOMMENDATIONS

1. Further studies should be conducted in other areas fished predominantly by longlines to obtain a larger sample.
2. In the future circle hooks should be studied for comparison.
3. A wider range of hook sizes should be studied, including smaller as well as larger gauges, to verify selectivity trends presented in this study.
4. An International method of gauging hook size should be established.
5. The #6/0 hook, with its different shape, was much more effective at catching both large and small fish. A study should be implemented to determine the reason for this improved effectiveness.

7. BIBLIOGRAPHY

Barney, Wade, Williams, Paul, and Paul, Harold, Groundfish Bottom Trawling Survey, Labrador, 1983, DFO.

Devore, Jay L., Probability and Statistics for Engineering and the Sciences, Wadsworth, Inc., Belmont, California, 1987.

Dunne, E.B., Report of the Implementation Task Force on Northern Cod, DFO, 1990.

MUSTAD Fish Hook Catalog.

Peeling, D. A., and Rodgers, D. M., Circle Hook Comparison Study, DFO, 1984.