Serial NW-34

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

ICNAF Meet. Doc. 52/4

REPORT OF MEETING OF PANEL 5 - OTTAWA - 26 AND 27 FEBRUARY 1952

1. A meeting of Panel 5 was held at the Chateau Laurier Hotel, Ottawa, Canada on 26 and 27 February 1952. The Commissioners for the Contracting Governments, Canada and the United States, were present supported by advisers. Observers were also present from Canada, France and the United States. The Panel was welcomed by The Honourable R.W. Mayhew, Minister of Fisheries for Canada. A complete list of the participants in the Meeting is contained in Appendix I to this report.

2. The agenda of the Meeting is contained in Appendix II to this report.

3. The Status of the Ground Fisheries and the Research Program of the United States Government in the Convention area are set out in Appendix III. The report refers to the present stability of the fisheries in Sub-area 5. Slightly increased haddock landings in 1951 are attributed to a strong 1948 year class. Increased redfish landings to an all time record in 1951 have resulted from increased catches on fishing grounds other than those of Sub-area 5.

The research program has been directed principally toward mesh regulation for haddock fishing in Sub-area 5, the results of research being used in the compilation of the reports of scientific advisers to Panel 5 (Appendices IV and V).

The United States scientists were complimented on their research program and summary report of activities in Sub-area 5.

4. The confusion of common names, 'rosefish', 'ocean perch' and 'redfish', for Sebastes marinus was discussed. It was agreed that the name 'redfish' would be used by Panel 5 and recommended to the Commission. 'Redfish' is the common name used by fishermen in Canada and the United States and in Denmark, Norway and the United Kingdom.

5. Mesh regulation for haddock fishing was the principal subject considered by the Panel. At the first Meeting of Panel 5 in April 1951 the desirability of establishing a minimum mesh size for haddock fishing in Sub-area 5 was recognized. The problem of summarizing pertinent information and recommending an experimental mesh regulation and research program was referred to a committee of scientific advisers, in order that the problem could be considered more definitively at the next meeting of the Panel. Three meetings of the scientific advisers, together with special studies by the United States Fish and Wildlife Service, resulted in the reports of scientific advisers to Panel 5 contained in Appendices IV and V to this report.

The case for establishing an initial experimental minimum mesh size of 3¾ inches was presented by the scientific advisers to the Panel. The catch of haddock from Sub-area 5 has been in a state of equilibrium for some 20 years with roughly one hundred million pounds taken annually. A consideration of the high growth rate, particularly at the smallest sizes now caught, and the 45 percent total mortality rate, the greater part of which is believed to be fishing mortality, suggests that a new equilibrium may be established at a higher level by beginning to take haddock at a larger size. On the basis of mesh selection experiments, it is predicted that an increase in mesh size from the present 2-7/8 inches to 3-3/4 inches would result in the release of the majority of haddock now discarded at sea and a loss of only a small proportion of the smallest haddock now landed. The release of small haddock, some of which would be taken at a larger size, would probably result in an initial decrease in total catch immediately following the adoption of the new mesh but a long-term increase to a higher equilibrium would be expected. These estimates assume the continuation of fishing intensity at its present level and no appreciable change in fishing efficiency as a result of the use of a larger mesh. It was pointed out that, in the long run, total catch would not decrease in consequence of this regulation and the possibility of increasing the total catch is believed to be good.

In consideration of the reports of the scientific advisers the following points were brought out by the Panel:

(1) Assessment of mortality rates is recognized to be a difficult problem. The natural mortailty for haddock of the sizes now landed is believed to be of the order of 5 to 15 percent. The assumption of natural mortality rates outside these limits does not conform with the analysis of detailed statistics which are available for this fishery. It is recognized that mortality rates are not known for sizes just below those now landed, but it seems reasonable to assume that the natural mortality rate does not differ greatly from that of haddock of commercial size. It is reasonable to assume that an increased mesh size would result in an increased escapement of small haddock and a long-term increase in haddock catch resulting from the favorable balance of growth over natural mortality.

(2) The variability in year-class strength results in annual variations in catch of an order greater than the initial decrease in catch to be expected from adoption of a 3¾ inch mesh. For this reason the anticipated temporary decrease in catch might not be apparent to the fishing industry or might be greater than that estimated.

(3) It was concluded that mesh regulation should apply to small vessels as well as those over 50 gross tons, in order to avoid any potential intensive fishing for small haddock.

(4) The method of measuring meshes was considered, and it was agreed that the average mesh size should be measured for any ten consecutive meshes in any part of the used, wet net.

(5) The life and cost of small-mesh codends now in stock and on order was considered and on the recommendation of the United States industry advisory committee it was agreed that the adoption of a minimum mesh size need not be delayed beyond August 1952. Since a recommended mesh size would be considered further by the Commission and the Contracting Governments of Panel 5 a mesh regulation could not be expected to enter into force before December 1, 1952.

(6) The importance of assessing the effect of a mesh regulation on this haddock fishery was discussed and it was agreed that it would be essential to carry out a special research program in order that the Panel would be assured of statistics comparable with those now collected for haddock fishing in Sub-area 5. It was recognized that this might involve continued use of the present smallmesh netting by one or more commercial trawlers. It was agreed that the means of carrying through this assessment should be explored in order that this problem might be considered further at the next meeting of the Panel, coincident with the Second Annual Meeting of the Commission. The need for further experiments to determine the selectivity of various meshes was emphasized.

On the basis of its considerations the Panel agreed to recommend to the Commission the adoption of a $3\frac{3}{4}$ inch mesh size for haddock fishing in Sub-area 5, together with a research program for the assessment of the effect of this regulation (recommendations III and IV below).

6. The following recommendations, adopted by Panel 5, are herewith submitted to the Commission:

I. The common name 'redfish' is considered by Panel 5 to be the most suitable name for Sebastes marinus and this name is recommended for general adoption by the Commission.

II. It is recommended that the Standing Committee on Research and Statistics be instructed to give attention to the detailed study of all fish resources, especially redfish, falling within the purview of the Convention.

III. The following mesh regulation for haddock fishing in Sub-area 5 is recommended to the Commission for consideration and if approved for transmittal as a proposal to the Depository Government for joint action by the Contracting Governments:

i No person or vessel subject to the jurisdiction of a Contracting Government shall fish for haddock (Melanogrammus aeglefinus) in Sub-area 5 with a net which has an average mesh size of less than 3¾ inches, measured under the conditions hereinafter specified.

ii For the purpose of this regulation, the average size of the mesh shall be the average of any ten consecutive meshes running lengthwise of the net in any part of the net, selected at the discretion of the enforcement officer, and measured with a flat wedge-shaped gauge with a taper of 2" in 9" and a thickness of 3/32" inserted into the mesh under a pressure of 12 pounds. In measuring to determine a violation, the net or netting shall be wet and have been used in normal fishing operations.

iii Possession of haddock amounting to more than 5000 pounds or 10% by weight of all fish aboard, whichever is larger, shall be evidence that the person or persons or vessel concerned have fished for haddock, and in such case possession on board the vessel of nets, parts of nets or netting having a mesh size less than that provided for in Sections i and ii is prohibited.

iv No device or method that will obstruct the meshes or otherwise in effect diminish the size of the meshes shall be used, except that any material may be fastened to the underside only of the cod end of the net to prevent damage to, or reduce wear upon, the cod end.

v The above regulation does not apply to government research vessels nor to any other vessel authorized by a Contracting Government, on recommendation of the Commission, to use a smaller mesh for experimental purposes.

IV. It is recommended that the Commission invite the attention of the Contracting Governments participating in Panel 5 to the importance of the following recommended haddock research program:

i Continuation of the present intensive collection of data on catch per effort and age and size compositions of the catch and landings.

ii Collection, both before and after the minimum mesh regulation comes into effect, of data on the number, sizes and ages of haddock discarded at sea.

iii Further experiments to determine the selectivity of various meshes, especially the larger meshes, which would be involved in the second step.

iv Further efforts to determine the relative strength of year-classes entering the fishery both before and after the regulation comes into effect. It is believed that this may require the continued use of the present gear by selected trawlers.

v Special fishing to determine distribution and changes in abundance of haddock in their first and second years.

vi Fishery-hydrographic research to determine the causes of fluctuations of year-classes.

vii Study of the biology of the other species of fishes which live in the same ecological system as haddock.

Signed: Francis W. Sargent
Chairman of Panel 5

Signed: W.R. Martin
Acting Executive Secretary

APPENDIX I

Participants

United States:	Commissioners	Francis W. Sargent Chairman John L. Kask Bernhard Knollenberg
	Advisers	Herbert W. Graham Howard A. Schuck
Canada:	Commissioners	Stewart Bates J. Howard MacKichan
	Advisers	A.W.H. Needler Frank D. McCracken
Observers:	Canada	C. Gordon O'Brien S.V. Ozere F.H. Wooding
	France	Louis J. Audigou
	United States	William C. Herrington Leonard Warner
Host:	Canada	Hon. R.W. Mayhew, Minister of Fisheries.
International Commission for the Northwest Atlantic Fisheries:		W. Robert Martin J. Welsh

APPENDIX II

AGENDA

1. Introductory remarks by Chairman, Francis W. Sargent

2. Reports by Commissioners, Advisers and Observers on the status of the fisheries and of research programs in Sub-area 5.
   Introduced by Dr. Herbert W. Graham, Chief, North Atlantic Fishery Investigation, U.S. Fish and Wildlife Service.

3. Consideration of reports of Scientific advisers to Panel 5.
   Introduced by Dr. A.W.H. Needler, Chairman, Committee on Research and Statistics.

4. Formulation and adoption of recommendations to the Commission.

5. Other business.

6. Approval of report to the Commission.

7. Approval of press release.

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APPENDIX III

The Status of the Ground Fisheries and the Research Program of the United States Government in the Convention Area.*

A report on the status of the United States ground fisheries in the Convention area was presented to the Commission in April 1951 and constituted Document 9 of the First Annual Meeting.

The general condition of the fisheries has changed very little since that date. Some preliminary estimates of the 1951 landings can be made at this time. Total landings in New England ports in 1951 probably exceeded 775 million pounds. This is the second largest production in the history of the industry. The highest landings were in 1950 when production exceeded 876 million pounds.

The preliminary estimate for the 1951 haddock catch from the Convention area is approximately 135 million pounds. This figure is about the same as for 1949 and 1950 and lower than the figure for several years previous to 1949.

The landings of haddock from Georges Bank (Subarea 5) in 1951, however, were a little higher than the average for the last two years due to the strong dominant year class of 1948. Throughout the past summer season this year class accounted for 65 percent of total United States landings. Present indications are that the 1949 year class is of only average strength or less.

The research program of the Fish and Wildlife Service in the North Atlantic during the past year was centered about studies pertaining to the proposed mesh regulation for haddock fishing in Subarea 5.

An intensive study was made of the haddock data accumulated for Georges Bank with the view toward determining the best possible way of managing the Georges Bank fishery.

Theoretical models were constructed to show the catch per recruit for various mortality rates and ages of first capture. Models were also constructed to show the effects on landings of changing the age of first capture of the haddock on Georges Bank with the present fishing effort.

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* Prepared for meeting of Panel 5, International Commission for the Northwest Atlantic Fisheries, held in Ottawa February 26 and 27, 1952.

All available data on mesh selectivity were assembled in order to refine our knowledge of the sizes of mesh which are required to effect the escapement of undersized fish.

A study was made of the methods used in measuring mesh size. A gauge was designed and constructed for measuring the inside stretch mesh opening under a standard pressure.

A program of observing the fish discarded at sea by commercial trawlers was instituted. Several trips have been made and a program has been initiated whereby an observer will be at sea each week of the year insofar as boat schedules will permit. Data on quantities, numbers, sizes, and ages of discarded haddock are being collected. It is planned to have this work continue up to and after the regulation becomes effective.

A study was made of the possible effect the mesh regulation might have on boats fishing for species other than haddock.

The investigations of the comparative growth rates of Georges Bank and Browns Bank haddock was completed. The results demonstrated the independence of the two stocks of fish.

A study of the vertebral counts of various populations of haddock on the banks within the Convention area was completed. Analysis of these data indicated an individuality of a number of stocks in Subareas 3, 4, and 5. Of particular interest was furth evidence of the distinctness of the Georges Bank stock as opposed to the haddock on Browns Bank. Significant correlations were found between number of vertebrae and temperature of the water.

The analysis of landings of haddock from Georges Bank for the years 1931 to 1948 by pounds, numbers, and sizes was completed. This study summarizes basic information required for the appraisal of changes taking place in the fishery.

A method for predicting the landings of haddock from Georges Bank one year in advance was developed. This method depends upon the accurate knowledge of the relative strength of year classes in the Georges Bank population. The prediction for 1951 was very close to the actual landings for that year. The figures differed by only 2.7 percent. The prediction for the 1952 landings will be made very soon.

The rosefish fishery has continued its phenomenal rise reaching its highest level of production in 1951 amidst alarms from the industry that stocks had been depleted in nearby areas. More vessels made longer trips to distant banks to secure adequate fish to fill the demand for this product.

The preliminary estimate for the 1951 landings of rosefish is about 261 million pounds. This is an all time record surpassing the 1950 landings by 53 million pounds.

Exact data on the relative amounts caught on the different banks are not yet available but it can be said at this time that most of the increased landings of rosefish are due to increased catches from the Convention subareas 4 and 3, rather than from increased production of the New England Banks. Beginning in the summer of 1951 the rosefish fleet extended its fishing to the Newfoundland Banks (Subarea 3). A considerable proportion of the landings during the last half of the year came from that area.

There is a widespread opinion throughout the industry that the populations of fish are being reduced and that the size of fish landed is likewise diminishing. The Fish and Wildlife Service has been studying this fishery since 1942.

The populations of rosefish as measured by catch per day have, indeed, dropped off appreciably in particular areas. In the Gulf of Maine, for instance, the catch per day dropped from 20 thousand pounds in 1943 to 8 thousand pounds in 1949. The average size of fish landed from this area, however, has not diminished from 1937 to 1950.

The Nova Scotian Banks (Subarea 4) are much richer rosefish grounds. For this area our records of abundance begin only in 1945. For one area in these grounds, around Sable Island, the abundance index reached 43 thousand pounds in 1946 and then declined to 21 thousand pounds in 1950.

Thus, the initial abundance on these banks has been considerably reduced although not nearly to the extent it has in the Gulf of Maine.

The Newfoundland Banks (Subarea 3) have very rich rosefish grounds judging from reports of the fishermen but no index of abundance has been developed for this area as yet.

Continued intensive study of the rosefish populations is required to yield information which is needed for the sound management of this fishery.

Present studies of the rosefish include research on the determination of age by otolith readings; studies of growth rates in various populations; studies of the incubation period, fecundity values, and spawning periods; studies of parasite incidence as related to stocks, and determination of vessel efficiency in order to improve the accuracy of the abundance indices.

Present indications are that many independent stocks of rosefish are involved in the fisheries. Intensive studies of particular stocks may be necessary in order to arrive at the basic information necessary for sound management.

The census data collected by the Albatross III on Georges Bank are now being analyzed. The distribution of species conforms well with a theoretical distribution. The species composition of catches is significantly related to type of bottom and does not vary significantly with depth over the range 0-150 fathoms. The availability of several species shows a statistically significant 24-hour cycle. Rosefish, for instance, are more available during daylight hours.

The concentrations of fish agree in a general way with concentrations of fleet activity but the concentrations of haddock as derived from Albatross III data do not agree well with values obtained by analysis of commercial catches. Analysis of commercial landings appears to be a more reliable method of determining concentrations of fish of commercial sizes because of the more representative sample obtained.

A study of the relation of year class strength with wind direction over Georges Bank has been initiated as part of a program of investigation of the causes of the fluctuations in brood strengths from year to year.

Future plans for research call for continuation of present studies and some expansion of investigations relating to the proposed mesh regulation.

Intensive collection of data on catch per effort and age and size composition of the catch and landings will be continued.

Experiments will be conducted on mesh selectivity of the larger sized mesh in order to refine our knowledge of this aspect of nets in connection with the second step increase of the minimum size for haddock fishing on Georges Bank.

Similar experiments on rosefish populations are also anticipated as little is known about selectivity on this species.

Increased efforts will be made to determine the relative strength of year classes entering the haddock fishery. Some commercial vessels may be licensed to use small mesh gear.

Analysis of accumulated data on haddock populations on Nova Scotian Banks will be started if funds are available.

Studies of the biology of the rosefish as well as the analysis of landings will be continued and possibly expanded.

Particular emphasis will be placed on research centering around the proposed mesh regulation affecting haddock fishing on Georges Bank. The accurate assessment of the effect of this regulation will be extremely important not only in regulating this fishery but in supplying invaluable information for use in appraising methods for managing other fisheries.

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APPENDIX IV

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Report of scientific advisers to Panel 5

United States and Canadian fisheries scientists, following a preliminary meeting in Woods Hole, April 30, 1951, met at St. Andrews, September 15 to 17, to discuss the regulation of the haddock fishery in Sub-area 5. The following took part in the discussions:

From United States: Dr. L.A. Walford, Mr. E.H. Dahlgren, Dr. Herbert Graham, Messrs. Howard Schuck, John Clark and Theodore Widrig, all of the United States Fish and Wildlife Service.

From Canada: Dr. A.W.H. Needler, Dr. W.E. Ricker, Mr. F.D. McCracken, Dr. G.F.M. Smith, all of the Fisheries Research Board of Canada.

From ICNAF: Dr. W.R. Martin.

2. A review of our present information showed that the haddock fishery has shown no consistent trend upward or downward for some time and this situation is likely to prevail as long as the fishing effort continues at about its present level. The question before the meeting was, therefore, whether the catch need continue at its present level or whether a new equilibrium might not be established at a higher level by the institution of a minimum mesh regulation.

3. The advisers concluded that the adoption of a minimum mesh size of $3\frac{1}{4}$* inches (inside measurement when in use) offered good prospect of a substantial ultimate increase in the equilibrium level of the catch, and recommend that such a regulation be put into effect by the Commission without delay.

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* Information on the method of measuring meshes in the experiments on which this conclusion is based came to light after the meeting. It suggests that, if meshes were to be measured by a method involving strain when the gauge is inserted, the mesh sizes in this report should be revised slightly upward. As, however, the accepted European method involves "free" passage of a gauge through wet used meshes and as this may well be more practical than the use of strain, no change has been made in the figures for mesh size used in first drafting the conclusions from the meeting.

The advisers concluded further that an increase in this minimum mesh size should be considered within two years of the institution of the 3¾-inch limit as a larger mesh size (perhaps 4½ inches) appears to offer prospect of a still greater increase in the catch. It is pointed out, however, that each of these steps would involve some immediate and temporary decrease but that fluctuations in the numbers of young haddock produced may cause increases or decreases much greater than the short-term effect of regulation.

4. The available evidence is not sufficient for definite prediction of the effects of the proposed regulation, but indicates that it is extremely unlikely to reduce the catch except during the first year or two, and would probably increase it substantially later. The regulation would thus, to some extent, be experimental. An intensive program of research is, therefore, essential in order to measure the effects of the regulation and to obtain all possible information on how these effects are brought about. It was agreed that Sub-area 5 is a particularly promising area in which to obtain such information, and that the project might, therefore, be expected to result in knowledge which would be valuable to the management of other fisheries. The above conclusions are based on the following points:

5. A. Discreteness of the area and of the stock. Peculiarities of growth and of vertebral counts, as well as limited marking experiments, show that the haddock stocks in Sub-area 5 are largely independent of those in other areas. The area is fished only by North American vessels, making it possible to obtain relatively complete information on the fishery.

6. B. High growth rate. As shown in the accompanying graph (Appendix 1a), the haddock of Sub-area 5 have an unusually high growth rate, especially in the first few years of their lives. The corresponding rapid increase in weight is shown in Appendix 1b. This influences the probable effects of a mesh regulation in the direction of expecting greater benefits from larger minimum mesh sizes than in areas where growth is slower, such as the North Sea.

7. C. Total mortality rate. Over the past twenty years the U.S. Fish and Wildlife Service has obtained very extensive data on the George's Bank fishery, including catch per effort of haddock at each age for each year-class going through the fishery during that period. These provide very good information on the total mortality rate above the age at which haddock are first caught effectively (3 years). The data show that from the age of 3 years onward the total mortality rate is close to 45 percent per year.

8. There is no adequate information on how much of the 45 percent total mortality is due to fishing and how much to natural causes. It was necessary, therefore, to consider various combinations of fishing and natural mortality, and with each combination to consider at what age the fish should first be caught to give the greatest yield. Estimates of catches (landings plus discards) which may be expected under various conditions are shown in Appendix 2.

9. It may be seen from Appendix 2 that if the natural mortality is high it makes little difference whether we use gear which will start catching the fish when they reach an age of 1 year or whether we use gear which will not start catching them until they get to be 3 or 4 years old. It is also clear from the graph that if the natural mortality is low we may expect a higher yield if we start to catch the fish at 3 years than if we start catching them younger than that. By increasing the mesh size and allowing young fish to escape we thus have nothing to lose if the natural mortality is high, and much to gain if it is low.

10. At the present time the mesh is such as to start catching haddock between 1 and 2 years of age, and the mesh proposed for immediate adoption would start catching them between 2 and 3 years of age. The advisers considered it unlikely that the natural mortality would be greater than 15 percent and at this level there would be a considerable gain in the yield.

11. D. Fish discarded at sea. Appendix 3 gives such figures as are now available on the proportions of fish of various sizes discarded at sea in Sub-area 5. These discards mean that the industry does not make full use of the quantities now caught, whereas they would make use of practically all the fish caught with the recommended mesh size. The gains to be expected in landings are, therefore, somewhat greater than the gains in actual catches at sea which are indicated in Appendix 2.

12. E. Effects of increasing the spawning stock. The proposed regulation would have the effect of increasing the numbers of mature fish, and, consequently, the numbers of eggs produced. There are so many cases in the sea fisheries where there seems to be little relationship between the numbers of spawners and the numbers of young fish produced that no benefits can be predicted with confidence. If the increase in the spawning stock has any effect it will probably be for the good, but it is so doubtful and unpredictable that it has been omitted from the above estimates.

13. F. Immediate and long-term effects. The expected benefits of imposing a minimum mesh size, which have been discussed, refer to the long-term effect of the regulation or, in other

words, to the landings which may be expected after a new equilibrium is reached. Because the larger mesh will fail to catch some of the smaller haddock which are now landed, the immediate effect will be a decrease in the total landings. In a year or two the immediate decrease will be offset by the greater survival of the young, fast-growing fish, so that the landings will then be larger than if the old mesh were still used.

14. Appendix 4A shows the expected effect of a $3\frac{3}{4}$-inch mesh limit in each of the five years following its adoption. An increase two years later to $4\frac{1}{2}$ inches would again reduce the total landings for a year or two, followed again by an increase. (Appendix 4B). As shown in Appendix 4A the expected reduction of the total landings in the first year after adopting a $3\frac{3}{4}$-inch mesh limit is only about 9 percent and may well be obscured by changes in the landings caused by changes in the strength of year-classes. Change to a $4\frac{1}{2}$-inch mesh limit two years later would cause a second and larger decrease of about 18 percent in total catch immediately following its adoption, but would again result in equilibrium at a still higher level. It was agreed that it would be better to reach a larger mesh limit in two steps than in one. Appendix 4C shows that adoption of a $4\frac{1}{2}$-inch mesh in one step would result in a 26 percent decrease in the total landings in the first year following its adoption - a decrease which might be rather disturbing to the industry. The above estimates assume uniform recruitment.

15. The average haddock catch from George's Bank for 1931 to 1938 was 94 million pounds. If mesh regulation eventually produces a 40% increase, this would become about 130 million pounds. Since the fish landed would be larger the increase in value would be somewhat greater under present market conditions.

16. G. Why select $3\frac{3}{4}$-inch mesh limit for first step? In selecting the $3\frac{3}{4}$-inch minimum mesh size as the first step, an attempt was made to select a mesh which would catch hardly any of the small fish now discarded and continue to catch about 90 percent by weight of those fish which are now landed. The selection was made on the basis of our present knowledge of the performance of various meshes, including the results of experiments conducted by the U.S. Fish and Wildlife Service in Sub-area 5 to determine the sizes of fish caught by various meshes in trawls.

17. H. Selection of mesh limit for second step. The desirable size of mesh to be reached in the second step would be assessed after the first change is in effect, making use both of observations on the commercial fishery then, and of further

experiments to determine the selectivity of various meshes. Present data suggest (Appendix 4B) that a 4½-inch mesh would result in an eventual increase in catch of about 12 percent over that obtained with 3¾-inch mesh.

I. Application of the minimum mesh size. It was agreed to recommend that the 3¾-inch minimum mesh size be applied to all parts of the net. In other words, the regulation should contain some such words as "No part of the trawl shall have meshes smaller than 3¾ inches . . . . . ." The definition of the mesh size and of an acceptable method of measurement remains to be drafted.

19. It is recommended that the regulation be applied to all otter trawlers of 50 gross tons or more whose catches contain 10 percent or more of haddock or 5,000 pounds of haddock, whichever is larger (see Appendices 5 to 8).

20. J. Expanded research program. The discussions emphasized the importance of an expanded research program which should include the following items:

i. Continuation of the present intensive collection of data on catch per effort and age and size compositions of the catch and landings.

ii. Collection, both before and after the minimum mesh regulation comes into effect, of data on the numbers, sizes and ages of haddock discarded at sea.

iii. Further experiments to determine the selectivity of various meshes, especially the larger meshes, which would be involved in the second step.

iv. Further efforts to determine the relative strength of year-classes entering the fishery both before and after the regulation comes into effect. It is believed that this may require the continued use of the present gear by selected trawlers.

v. Special fishing to determine distribution and changes in abundance of haddock in their first and second years.

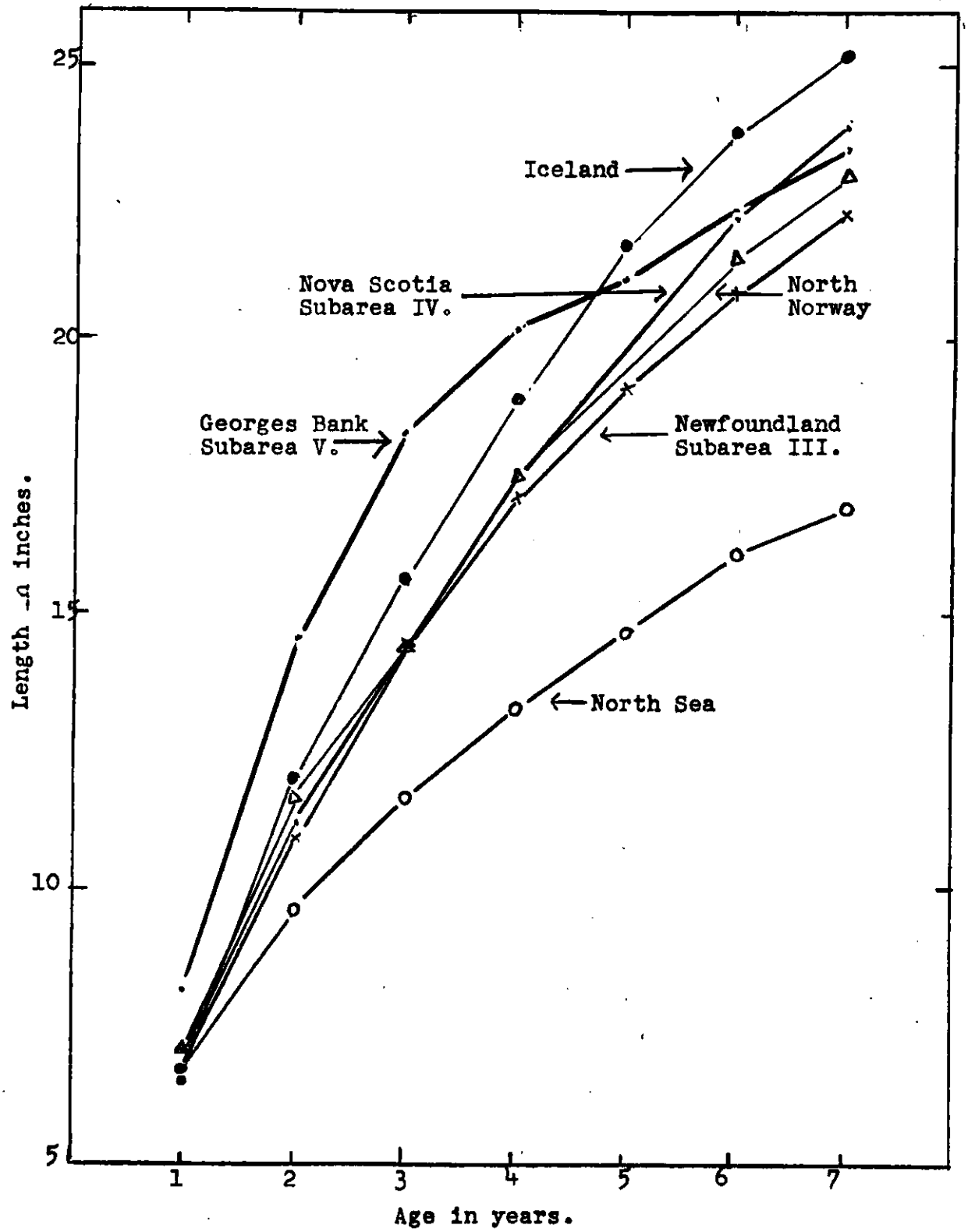
vi. Fishery-hydrographic research to determine the causes of fluctuations of year-classes.

vii. Study of the biology of the other species of fishes which live in the same ecological system as haddock.

21. The first four of these are essential to the assessment of the effects of the proposed changes in mesh sizes. The other items are important to understanding and prediction of natural changes in the fish stocks.

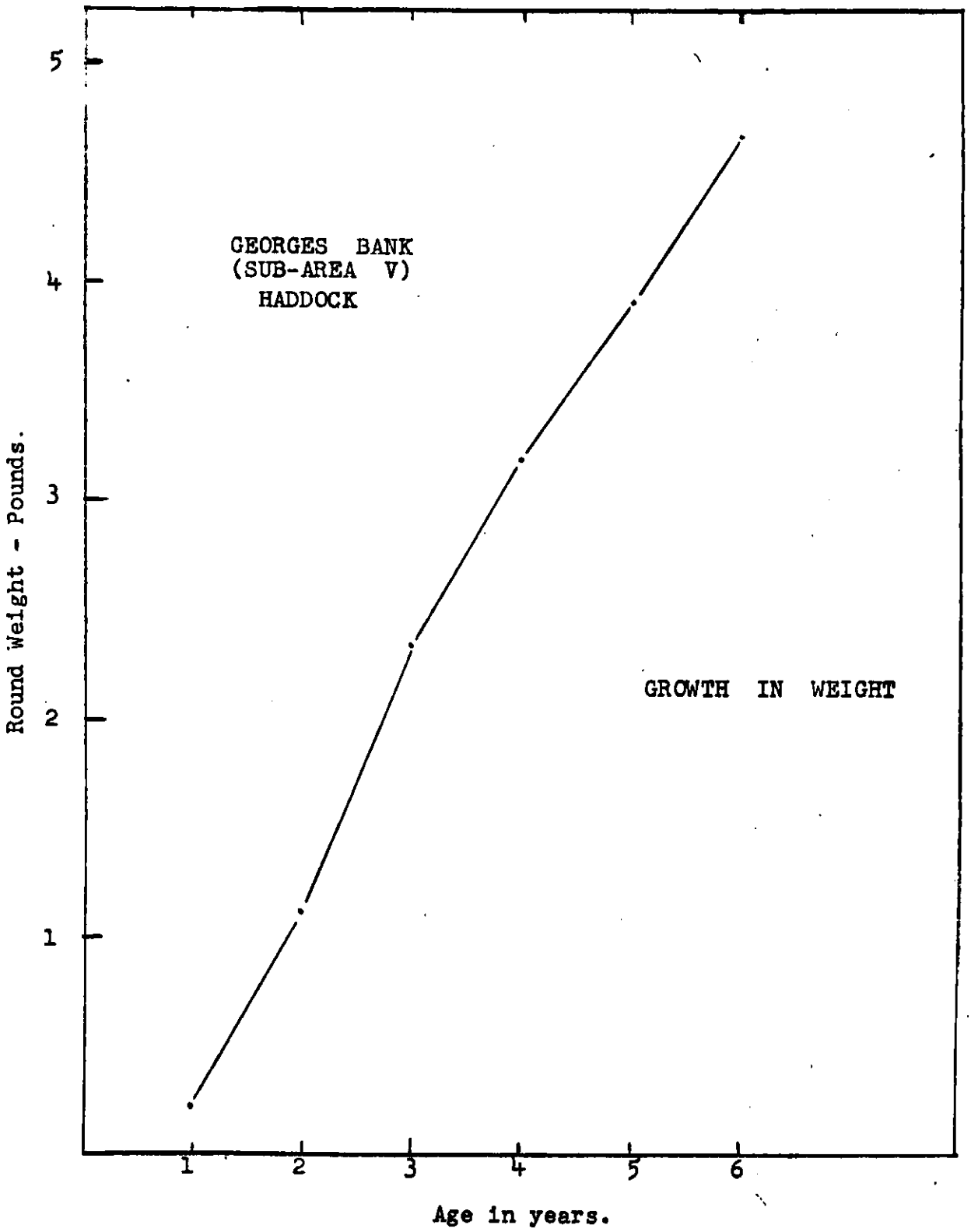
Drafted September 17, 1951
Revision December 5, 1951

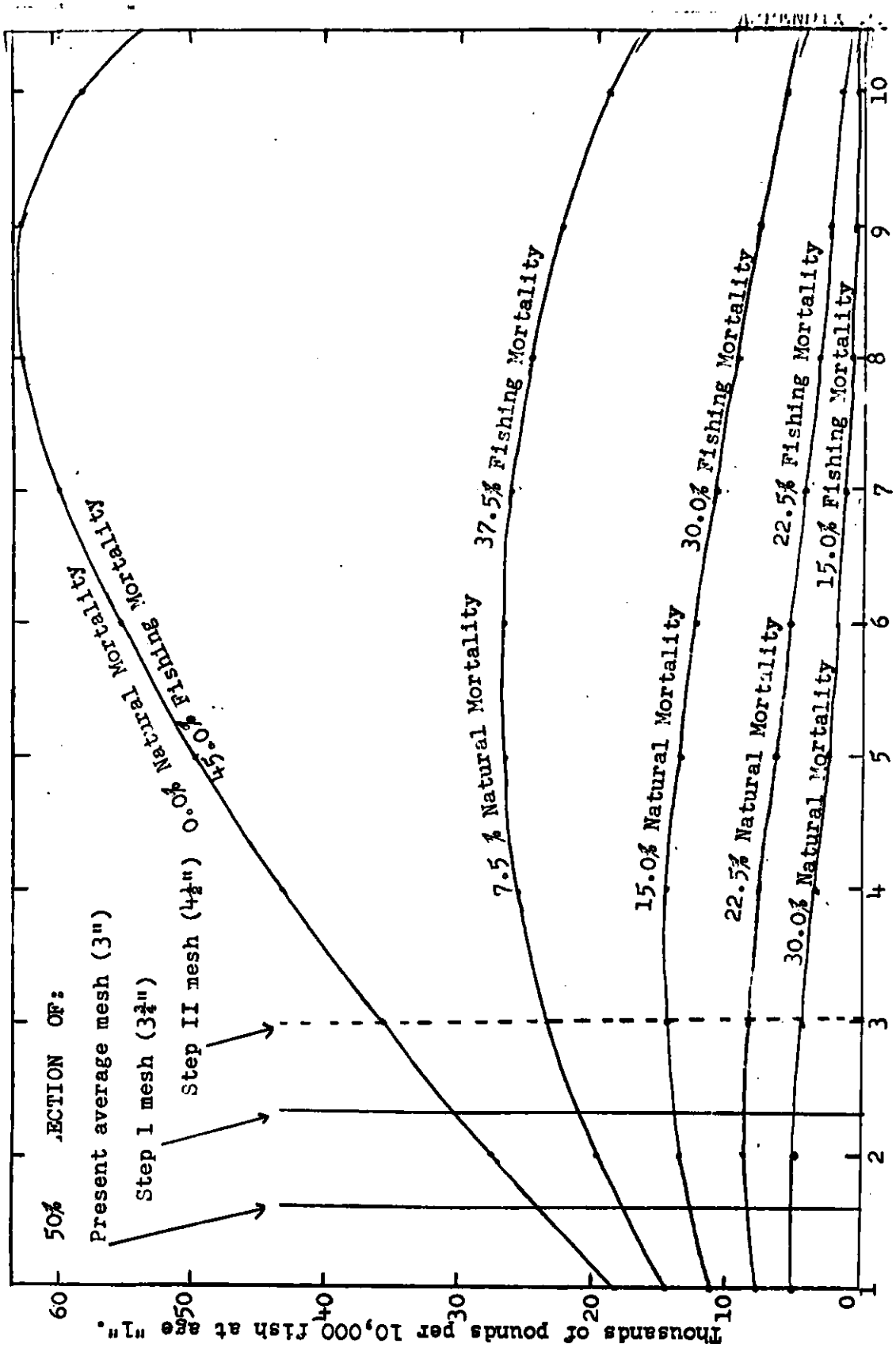
APPENDIX 1a.



GROWTH RATES OF HADDOCK IN VARIOUS LOCALITIES

APPENDIX 1b.


GEORGES BANK
(SUB-AREA V)
HADDOCK
GROWTH IN WEIGHT
Round Weight - Pounds.
Age in years.
1
2
3
4
5
6



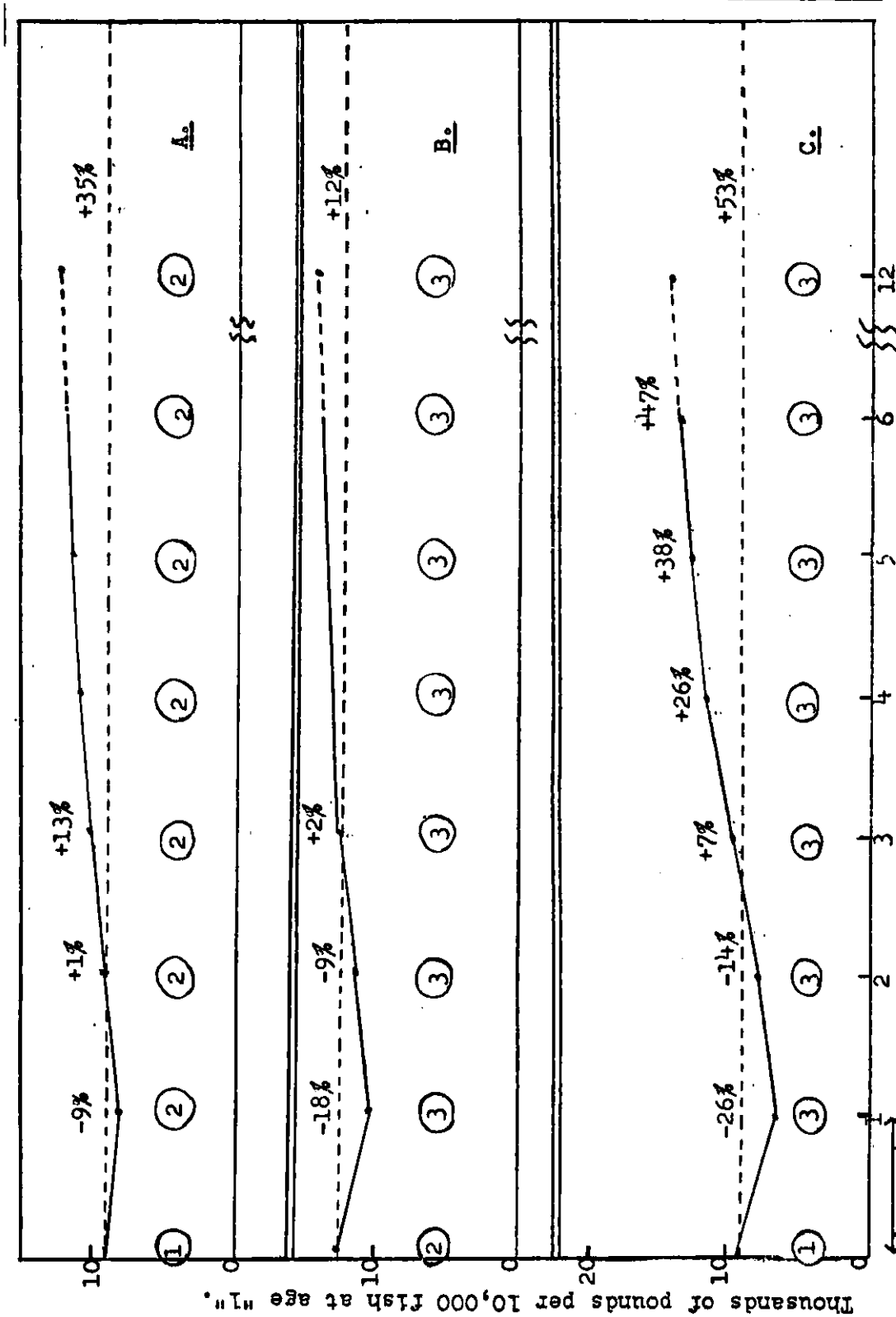
Estimated expected yields from 10,000 one-year-old haddock with total mortality rate of 45% per year and various natural and fishing mortalities. The graph gives estimates of the total yield from a year-class throughout its entire life, assuming the fishing mortality rates apply to half the fish present at the age when they are first caught and to all the remaining fish in subsequent years. The quantities estimated are those which would be caught after a new equilibrium has been reached. For the short-term effects of a new regulation see APPENDIX 4.

APPENDIX 3.

Average numbers of haddock discarded and retained per trip in first five commercial trawler trips - 1951

Length in centimeters	Number discarded	Number retained	Total caught	Percent discarded	Percent retained
15----------	6	---	6	100.0	0.0
18----------	153	---	153	100.0	0.0
21----------	875	---	875	100.0	0.0
24----------	1,398	---	1,398	100.0	0.0
27----------	1,691	---	1,691	100.0	0.0
30----------	2,992	5	2,997	99.8	0.2
33----------	1,917	324	2,241	85.5	14.5
36----------	882	2,474	3,356	26.3	73.7
39----------	99	5,216	5,315	1.9	98.1
42----------	23	10,001	10,024	0.2	99.8
45----------	1	11,182	11,183	0.0	100.0
48----------	---	7,147	7,147	0.0	100.0
51----------	---	2,992	2,992	0.0	100.0
54----------	---	1,047	1,047	0.0	100.0
57----------	---	588	588	0.0	100.0
60----------	---	281	281	0.0	100.0
63----------	---	434	434	0.0	100.0
66----------	---	57	57	0.0	100.0
69----------	---	60	60	0.0	100.0
72----------	---	22	22	0.0	100.0
75----------	---	5	5	0.0	100.0
78----------	---	---	---	---	---
TOTAL	10,037	41,835	51,872	19.3	80.7

APPENDIX 4.



Short-term effects of proposed regulations. The graph gives the estimated annual changes in the total landings (A) after adoption of 3¾" mesh, (B) after further increase to 4½" mesh, and (C) after adoption of 4½" mesh in a single step. The estimates are based on total mortality of 45% per year, of which 15% is from natural causes and 30% from fishing. The estimates cannot, of course, take into account the results of fluctuating strength of year-class.

APPENDIX 6.

Boston

For each group of trawlers, the percentages of their total landings that were of each species

1950

	OTL	OTM	OTS	All OT's
	Percent of total fish	Percent of total fish	Percent of total fish	Percent of total fish
Haddock	72.1	74.7	17.5	63.5
Cod	14.7	11.1	11.9	13.7
Pollock	4.8	3.9	10.5	5.6
Ocean Perch	.9	2.9	21.4	4.6
Whiting	0.0	0.0	17.4	2.8
Dab	1.5	.5	2.8	1.6
Others	6.0	6.9	18.5	8.2
TOTAL:	100.0	100.0	100.0	100.0

Boston - 1950

pecies the amounts and percentages landed by each group of trawlers.

(in thousands of pounds)

OTL		OTM		OTS		OT's combined	
Pounds landed	Percent of total fish	Pounds landed	Percent of total fish	Pounds landed	Percent of total fish	Pounds landed	Percent of total fish
86,581	79.5	17,422	16.0	4,923	4.5	108,926	100.0
17,583	74.7	2,574	11.0	3,355	14.3	23,512	100.0
5,800	60.0	917	9.5	2,950	30.5	9,667	100.0
1,115	14.3	676	8.6	6,024	77.1	7,815	100.0
0	0.0	0	0.0	4,877	100.0	4,877	100.0
1,837	67.1	120	4.4	782	28.5	2,739	100.0
7,187	51.4	1,604	11.5	5,197	37.1	13,988	100.0
120,103	70.0	23,313	13.6	28,108	16.4	171,524	100.0

Massachusetts - 1948-1950 Average

For each species the amounts and percentages landed by each group of trawlers.

(in thousands of pounds)

	OTL		OTM		OTS		OT's combined	
	Pounds landed	Percent of total fish	Pounds landed	Percent of total fish	Pounds landed	Percent of total fish	Pounds landed	Percent of total fish
Ocean Perch	61,788	36.8	102,064	60.7	4,161	2.5	168,013	100.0
Haddock	84,486	70.7	31,162	26.1	3,821	3.2	119,469	100.0
Whiting	6	0.0	3,304	8.6	35,167	91.4	38,476	100.0
Cod	23,869	63.3	8,955	23.7	4,895	13.0	37,720	100.0
Yellowtail	1,956	7.1	8,812	34.7	14,638	57.6	25,406	100.0
Hake	990	5.1	2,220	11.5	16,064	83.4	19,274	100.0
Pollock	10,116	56.3	6,560	36.5	1,287	7.2	17,964	100.0
Blackback	1,092	8.1	4,216	31.3	8,154	60.6	13,466	100.0
Gray Sole	2,058	40.3	1,979	38.8	1,063	20.9	5,101	100.0
Lemon Sole	1,256	28.1	2,766	61.9	447	10.0	4,469	100.0
Others	3,254	7.4	8,444	19.2	32,337	73.4	44,034	100.0

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APPENDIX V

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Supplementary report of scientific advisers to Panel 5

1. Following the meeting at St. Andrews September 15 to 17 the scientific advisers from Canada and the United States continued to study the problem of the management of the haddock fishery in Subarea 5 and the probable effects of the proposed regulation. A third meeting was held at Woods Hole January 23 and 24 and the following supplementary material is presented to Panel 5 to assist in general consideration of the recommended minimum mesh size.

2. Fish discarded at sea. Since the St. Andrews meeting two more trips to sea have been made on commercial trawlers to determine the quantities, sizes and ages of discarded haddock. Appendix 1 presents the results of the first seven trips of this program and supersedes Appendix 3 of the original report which included results of the first five trips only. The proportion of fish of various sizes discarded on the last two trips was about the same as on the previous trips so that no significant change is represented in the revised table.

Appendix 2 presents data on the estimated poundage of haddock discarded at sea by the Boston fleet each month of the year for the years 1947 to 1951. These data are the compiled estimates by the captains of trawlers landing haddock.

3. Selection effect of 3¾-inch mesh. Appendix 3 is a graphic presentation of the sizes of haddock caught and landed for seven commercial trawler trips observed in 1951 (Appendix 1). The dotted line represents the selection effect on this catch of a mesh which releases 50% of the haddock taken with present mesh (2-7/8") at a length of 16 inches. On the basis of mesh selection experiments conducted by the United States Fish and Wildlife Service this selection is to be expected from a mesh of approximately 3¾" inches. It will be noted that hardly any of the fish discarded at sea would be caught and the quantity landed would be affected largely in the baby scrod class. This initial reduction of baby scrod landings would, of course, not be the loss over any length of time, as some of the fish released would survive to be caught later at a larger size (Appendix 4 of first report of scientific advisers to Panel 5).

This graph shows the sort of initial selection effect of mesh regulation that would be expected, but it cannot be considered to be representative of an average year. It is known that the average size composition of the landed catch over an 18-year period is greater than that observed during the 1951 sea trips. The initial effect of the proposed mesh regulation on the landed catch would therefore not be as great for an average year as that shown.

4. Method of measuring the size of mesh. Subsequent to the St. Andrews meeting a pressure gauge was developed with which the inside measurement of the mesh can be made simply and quickly under a pressure of 12 pounds. Measurements made with this gauge by various persons showed greater consistency than measurements made by the same persons with other types of gauges.

5. Effect of proposed regulation on the New Bedford flounder fleet. The proposed regulation is not expected to have any serious effect upon the New Bedford flounder fishing as the flounder fishermen now use rather large meshes (Appendix 4). Increased amounts of haddock landed at New Bedford recently indicate that more of the effort from this port is being directed toward haddock fishing. This trend has resulted in the use of smaller meshes by many of the boats, and such haddock fishing by New Bedford vessels would be affected by the regulation

6. Effect of regulation on the Gloucester rosefish fleet. The Gloucester rosefish fleet uses small mesh nets (Appendix 5) presumably to prevent fouling of the net with these spiny fish. Under the regulation these nets would, of course, be illegal for haddock fishing in Subarea 5.

Any boat using a small mesh net (such as the present rosefish nets) landing in one trip from Subarea 5 more than 5000 pounds of haddock, representing more than 10% of the total catch, would be in violation of the regulation. This would affect about 6% of the trips landing at Gloucester and about one quarter of the haddock landings there (Appendix 5)

7. Draft of Regulation. A preliminary draft of the proposed regulation is appended (Appendix 6).

Appendix 1.

Percentage retention of haddock for first seven commercial trawler trips observed - 1951

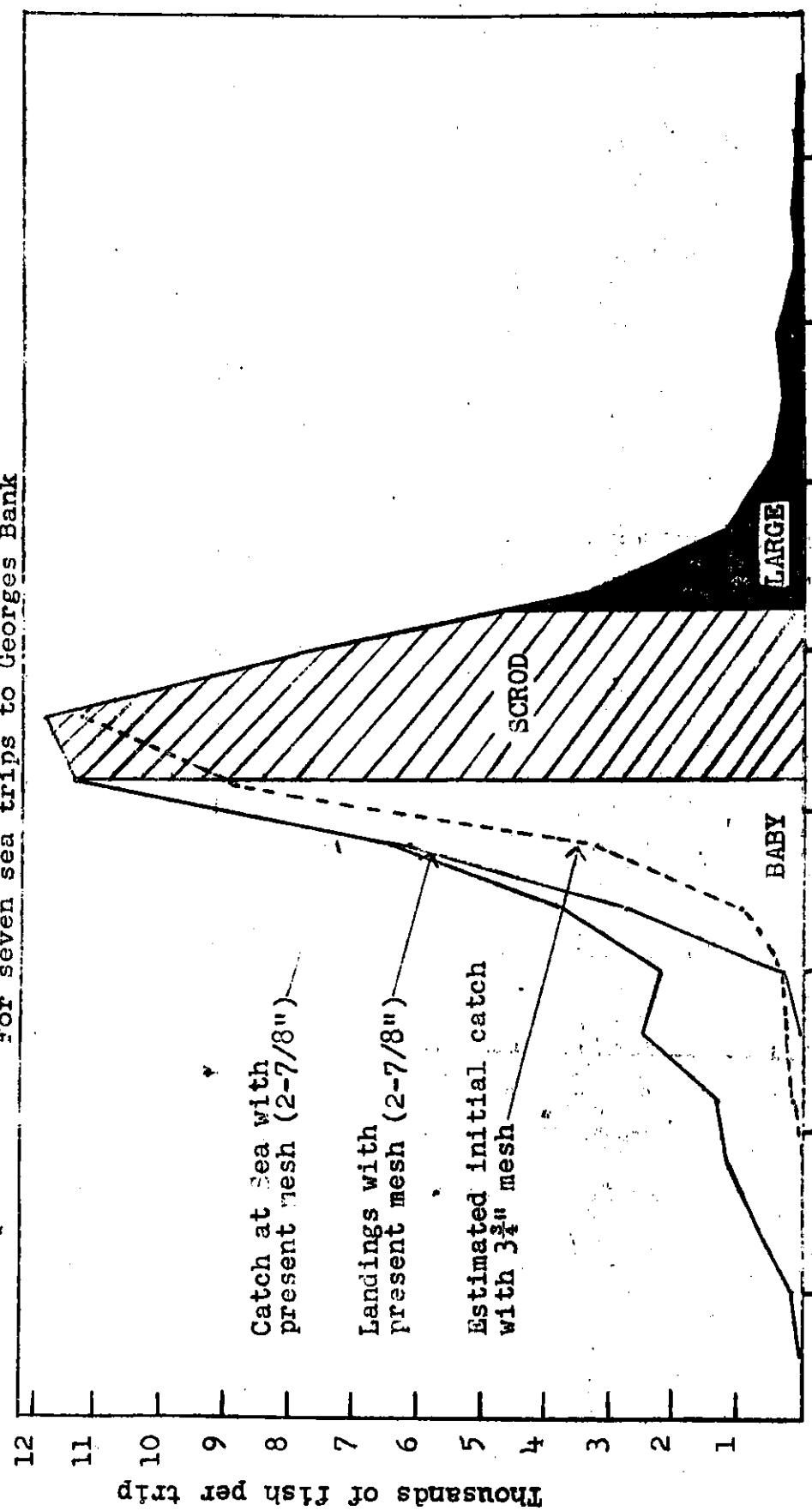
Length Mn cm.	Average No. Discarded	Average No. Retained	Average Total Catch	Percent Discarded	Percent Retained
15	5		5		
18	110		110		
21	636		636		
24	1,097		1,097		
27	1,358		1,358	100.0	0
30	2,398	13	2,411	99.5	0.5
33	1,867	322	2,189	85.3	14.7
36	1,023	2,678	3,701	27.6	72.4
39	212	6,095	6,307	3.4	96.6
42	73	11,162	11,235	0.6	99.4
45	45	11,768	11,813	0.4	99.6
48	4	7,865	7,869	0.1	99.9
51		3,285	3,285	0	100.0
54		1,112	1,112		
57		444	444		
60		330	330		
63		388	388		
66		124	124		
69		99	99		
72		41	41		
75		23	23		
Total	8,828	45,751	54,579		
%	16.2	83.8	100.0		

Appendix 2.

Estimated monthly discard of small haddock on Georges Bank by the Boston Fishing Fleet, 1947-51
(in thousands of pounds)

MONTH	1947	1948	1949	1950	1951	Average 1947-51
January	146	200	104	114	44	122
February	232	49	142	140	139	140
March	234	81	149	120	26	122
April	531	105	90	77	27	166
May	489	160	419	290	53	282
June	711	265	412	836	327	510
July	1,050	519	113	1,053	241	595
August	2,074	491	553	810	292	844
September	2,189	977	329	307	188	798
October	1,347	548	876	268	834	775
November	131	679	90	332	293	305
December	221	180	33	74	324	166
All Months	9,355	4,254	3,310	4,421	2,788	4,825

Appendix 3.

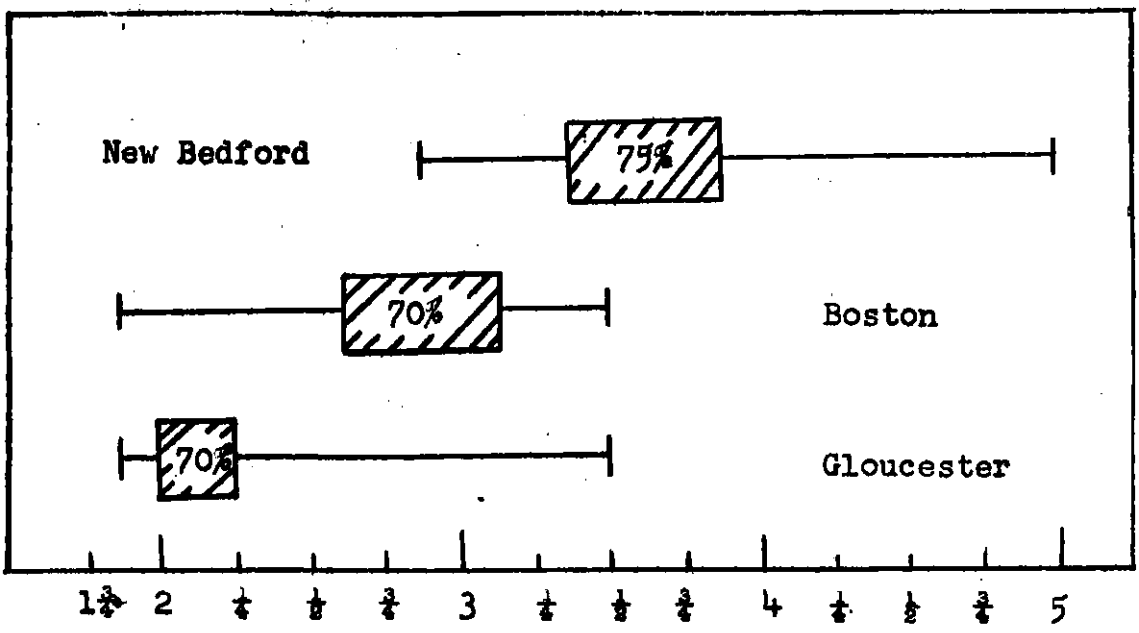


The sizes of haddock caught and landed per trip for seven commercial trawler trips observed in 1951 (from Appendix 1). The dotted line represents the initial selection effect, to be expected on this particular catch, of a mesh which releases 50% of the haddock normally taken at a length of 16 inches. On the basis of mesh experiments, such selection is to be expected with a mesh of approximately 3¾" inches.

The average-size composition of the landed catch over an 18-year period is greater than that observed in the 1951 sea trips and the initial effect of a 3¾" mesh on the landed catch would therefore not be as great as that shown.

Appendix 4.

Size of codend meshes used by the U.S. groundfish fleet.



The size of mesh in the codends of trawls used by New Bedford, Boston, and Gloucester groundfishermen. The horizontal lines show the total range of sizes and the shaded boxes show the sizes used by most vessels. The mesh is measured internally with a flat wedge-shaped gauge.

Appendix 5.

Trips of Gloucester rosefish fleet (OTM-OTL) according to percent of haddock landed and sub-area fished, during 1950.

	Trips with less than 5000 lbs. or less than 10% haddock		Trips with more than 5000 lbs. and more than 10% haddock		Total	
	Number	Percent	Number	Percent	Number	Percent
From Sub-area 5	500	39.3	73 *	5.7 *	573	45.0
From outside Sub-area 5	610	47.9	90	7.1	700	55.0
Total	1110	87.2	163	12.8	1273	100.0

* Would come under regulation.

Gloucester haddock landings by rosefish fleet (OTM-OTL) according to percent of haddock landed and sub-area fished, during 1950.
(thousands of pounds)

	Trips with less than 5000 lbs. or less than 10% haddock		Trips with more than 5000 lbs. and more than 10% haddock.		Total	
	Landings	Percent	Landings	Percent	Landings	Percent
From Sub-area 5	1,955	20.9	2,259 *	24.1 *	4,214	45.0
From outside Sub-area 5	2,389	25.5	2,761	29.5	5,150	55.0
Total	4,344	46.4	5,020	53.6	9,364	100.0

* Would come under regulation.

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Appendix 6.

SUGGESTED MESH REGULATION

1. No vessel of over 50 gross tons shall fish for haddock (Melanogrammus aeglefinus) in Subarea 5 with a net which when used and wet has in any part an average inside mesh size less than 3¾ inches.

2. Measurements for the purpose of this regulation are to be taken with a flat wedge-shaped gauge with a slope of 2" in 9" and with a thickness of 3/32" inserted into the mesh under a pressure of 12 pounds.

3. It is forbidden to employ any device or method which will obstruct the meshes or otherwise in effect diminish the size of the meshes except that any material may be fastened to the underside only of the cod end of the net to prevent damage to, or reduce wear upon, the cod end.

4. Possession of haddock amounting to more than 5000 pounds or 10% or more by weight of all fish aboard a vessel (whichever is larger) shall be evidence that the vessel concerned has fished for haddock.

5. The above regulation does not apply to fishery research vessels nor to any other vessels which may be authorized to use a smaller mesh for experimental purposes.