

ANNUAL MEETING - JUNE 1965The occurrence of some regulated fish species with redfish in
research vessel catches in ICNAF Divisions 3N, 3O, 3P, 4RST and 4VW

by E. J. Sandeman

A. INTRODUCTION

Under the mesh regulations for Subareas 3 and 4 (ICNAF Ann. Proc. Vol. 11, 1961), a vessel fishing primarily for redfish in Subarea 4 and Divisions 3N, 3O and 3P is permitted to use a net with mesh sizes smaller than are required for the taking of regulated species provided the amounts of regulated species taken incidently do not exceed certain stipulated limits or proportions of the total catch. These proportions are different in the two Subareas but are based on the total fish aboard the fishing vessel.

In view of reports that on occasions trawlers fishing for redfish with small mesh nets have had to ^{discard} dump quantities of fish because the amount of regulated species for that trip had already reached the maximum allowed for such incidental catches, it seems desirable to examine just how often such incidental catches might be expected to occur and what amounts and sizes of fish are likely to be involved in this wasteful procedure.

Although not by any means the complete answer, catches made by a research vessel using a small meshed net do provide some information on the likelihood of occurrence of regulated species with redfish as well as provide some data on the amounts and sizes of these fish. Unfortunately the research vessel data are only available for rather limited times of the year and that which is the prevailing situation at one time of the year is not necessarily the situation at a different season.

B. GENERAL

The research vessel catches considered here were obtained by the research trawler A.T. Cameron during redfish survey cruises in the areas concerned. The nets used in all sets were $4\frac{1}{5}$ manila otter trawls having their codends lined with $1\frac{1}{8}$ inch nylon netting. The mesh sizes and other net variables remained constant (apart from a minor modification in the sizes of steel bobbins used on the footrope).

The procedure used in these redfish survey trips was to attempt to fish a standard series of depths (100, 125, 150, 175, 200, 250, 300, 350 and 400 fathoms) on predetermined lines across the slope of the bank. These depths cover the redfish range and provide some idea of the fish populations inhabiting the slope areas of the different banks. Because of the diurnal migratory pattern which is usually a feature of the redfish's way of life, fishing was limited to the hours of daylight.

The sets were nearly all of 30 minutes duration (net on bottom in fishing condition) and in the occasional set which was of different duration the catches have been adjusted to 30 minutes.

In examining the occurrence of regulated fish species with redfish, interest must specially be centered on those occasions and localities where catches of redfish were such as to attract or support commercial fishing for this species. The figure of 1000 lb (454 kg) per set or about 2000 lb (906 kg) per hour has been arbitrarily chosen as representing a minimum catch which might support commercial redfish fishing and only sets in which the catch of redfish was 1000 lb (454 kg) or greater (per 30 minute set) have been considered in this paper. The figure of 1000 lb (454 kg) per 30 minute set is rather low for the larger vessels fishing the offshore grounds but for the smaller vessels which account for much of the catch in Subarea 4, as well as Division 3P the figure is probably realistic.

C. SUBAREA 3

In order to examine the frequency of occurrence of regulated species with redfish, it is necessary first to peruse the regulations to see which species are in fact regulated and what are the stipulations for incidental catches of these regulated species.

Paragraph 1 of the proposed regulations for Subareas 1, 2 and 3 (ICNAF Ann. Proc. 11, 1961) states . . .

"The contracting governments take appropriate action to prohibit (except as provided in paragraphs 2 and 3) the taking of groundfish in Subareas 1, 2 and 3 by persons under their jurisdiction with trawl nets (hereinafter called nets) having a mesh size less than $1\frac{1}{4}$ mm or $\frac{1}{2}$ inches etc."

Paragraph 6 of the same proposed regulations defines "groundfish" as including "all those species defined as such in the Statistical Bulletin of ICNAF". Reference to the most recent Statistical Bulletin at the time when the proposals were drafted reveals that "groundfish" must be regarded as including those species which are listed in the Statistical Bulletin as "groundfish" and "other groundfish". Thus "groundfish", the regulated species, must be regarded as embracing many different species of fish in addition to cod, haddock, and redfish, but does not include most of the flatfishes, which, with the exception of halibut, are classed as "flounders".

In Statistical Divisions 3N, 3O and 3P vessels fishing primarily for redfish are permitted to use nets having mesh sizes smaller than are required for the taking of regulated species and in using these small meshed nets are permitted to take small quantities of "groundfish" incidentally "as long as such persons do not have in possession on board a vessel fishing primarily for redfish, cod (together with other groundfish with the exception of haddock and redfish) or haddock (together with other groundfish with the exception of cod and redfish) in amounts in excess of 10% by weight for each of all fish on board such vessel." The section within the quotation marks is taken directly from the proposed regulations for Subarea 3 paragraph 3, ICNAF Annual Proceedings Vol. 11, 1961.

Thus in an examination of the occurrence of regulated species with redfish, in the light of the proposed regulations, the amounts of (a) cod + other groundfish (with the exception of haddock and redfish) (and not including the flounders which are not defined as "groundfish") and (b) haddock + other groundfish (with the exception of cod and redfish) (and not including the flounders) should be examined as percentages by weight of the total catch of all fish which would be on board the vessel in question.

From the last sentence it can be seen that these percentages will depend on the commercial practices of the different ships and countries, and that where two vessels fishing alongside each other might obtain similar catches, the percentages on which the exemptions are based could be widely different as the one ship could land several species of fish which the other would discard.

For this reason it was arbitrarily decided to base this study on current Canadian (Newfoundland) practice and to consider only those species of fish which would normally be landed by Newfoundland otter trawlers. If the flounders, American plaice and witch, are not included, these would be cod, haddock and redfish. During redfish trips small amounts of halibut, common hake, pollock and wolffishes might also be landed but these would generally be in very small amounts. In this connection it might be mentioned that in the 29 sets or 15 1/2 hours fishing in Division 3N which are considered below only 75 lb (34 kg) of common hake, 490 lb (222 kg) of wolffish, 176 lb (80 kg) of halibut and no pollock were taken. This represents less than 0.6% of the total commercial fish.

Thus from the point of view of the regulations proposed in 1961, it is necessary to examine the amounts of cod and the amounts of haddock in relation to the total catch of cod + haddock + redfish + plaice + witch. As it is possible that the "flounders" might be included among the regulated species in the not too distant future (such was the recommendation of Panel 3 at the time of formulation of the proposed regulations), a section is also included in which the amounts of cod + witch + plaice and the amounts of haddock + witch + plaice are considered as percentages of the total weights of cod + haddock + redfish + plaice + witch.

(a) ICNAF Division 3N

Redfish survey cruises have been made to the area on three occasions since 1958 when the A.T. Cameron was commissioned. The general positions of the redfish survey lines visited in this and other areas are shown in Fig. 1.

During the period June-July 1959 redfish catches greater than 1000 lb (454 kg) per 30-minute drag were obtained in 14 sets at various depths on the following lines (Fig. 1) I, K, N, P, and S. Redfish catches in these sets varied from a high of 12,075 lb (5477 kg) at 125 fathoms on line I to 1125 lb (510 kg) at 150 fathoms on line P.

A further redfish survey trip was made to the area in September 1961 and on this occasion only two lines, S and N were visited and catches of redfish greater than 1000 lb (454 kg) were obtained in three sets on each line.

In November 1964 five sets on line K, three sets on line N and one on line S yielded redfish catches of 1000 lb (454 kg) or greater.

The total catches of the different species and of the particular combination of species discussed previously for each of these trips as well as the totals for the three trips combined are shown in Table 1. Also shown in this table are the weights of each species and combinations of species expressed as percentages of the total weights of redfish + cod + haddock + American plaice + witch.

It is evident that, during these trips and in these sets which were aimed at catching redfish, although haddock was of rather minor importance, cod occurred in quite large quantities, so much so in fact that it comprised 26% of the total commercial fish caught during these sets in 1961, and 17% of the total commercial fish caught during the three trips to the area. Not shown in the table is the number of occasions on which the catch of cod was greater than 10% of the total catch of commercial fishes. In 1959, five of the fourteen sets yielded catches of cod greater than 10% of the total catch, while in 1961 and 1964 these numbers were 3 of 6 and 2 of 8 respectively. Thus in the total 29 sets in the area 10 or 34% yielded cod catches greater than 10% of the total catch.

The individual catches of cod and redfish obtained during these trips are plotted as a scatter diagram in Fig. 2. It is evident in this figure that when really good catches of redfish were forthcoming, these were rather clean (relative to cod) and catches of cod greater than 10% of the total catch of commercial species were only obtained when redfish catches were less than 4000 lb (1814 kg). From this it might be argued that, as the fishing vessels will fish where the greater catches are to be obtained, it is unlikely that they would fish for mixed cod and redfish catches of up to 5000 lb (2268 kg) per 30-minute drag when 7000 lb (3175 kg) or greater of redfish are available somewhere else in the same ICNAF division. Whether or not this is so will depend on many factors not among the least of which will be whether or not the vessels know of the existence of the better fishing in the other area, as well as the prices paid to the fishermen for the different species and sizes of fish. Furthermore, very often it is the practice of Canadian vessels to fish redfish during the daylight hours and when the catches of this species become diminished during the hours of darkness they move a few miles into shallower water where they then devote their efforts to the catching of American plaice. With this in mind it may be better for the fishing vessel to prosecute a mixed fishery of this sort with redfish in the day and American plaice at night, than it would be for the same vessel to obtain higher catches of redfish during the daylight hours and practically nothing at night.

The above type of situation could easily arise on the slope of the Grand Bank in ICNAF Division 3N. The data from these trips of the A.T. Cameron show that the largest catches of redfish (>6000 lb, 2722 kg) occurred on the more southerly lines I, K and N, whereas the smaller catches of redfish (2000-4000 lb, 907-1814 kg) occurred both on the southerly lines and the northerly lines (P and S) but it was on the latter lines that fair catches of cod were obtained simultaneously with the redfish and further, particularly at line S, catches of American plaice can, at suitable times of year, be obtained in nearby shallower water during the hours of darkness.

Sizes of Cod:- Measurements of cod were obtained from each of the ten sets where the catch of cod exceeded 10% of the total catch of commercial species. The length-frequencies, which were derived from fish measured in cm, and which are shown with lengths in 3 cm groups, have been combined for all these sets and the combined frequency is displayed in Fig. 3. This length-frequency besides showing the total number of fish, in each 3 cm group, caught in the ten sets also indicates the numbers of cod which could be expected to escape had a net with meshes of the regulated size (4 1/2 inches or 114 mm) been used. This has been calculated using the selection ogive for a mesh size of 4 1/2 inches on cod of Subareas 3, 4 and 5, as reported in Appendix II of the "Report of working group of scientists on fishery assessment in relation to regulation problems" (ICNAF, 1962). Of the total number of 2926 cod taken in the ten sets 21.6% could be considered as likely to escape if a 4 1/2 inch mesh had been used.

(b) ICNAF Division 30

The southwest slope of the Grand Bank, Division 30 has been surveyed in redfish depths by the A.T. Cameron only on two occasions. In May 1959 catches of redfish greater than 1000 lb (454 kg) were obtained in 8 sets at different depths, on lines B, D, E and F. In October 1962 a further trip to the area yielded catches of redfish greater than 1000 lb (454 kg)/30 m drag in 14 sets on lines C, D and F. (Fig. 1 shows the positions of these lines.)

Table 2, which expresses the same summary of combined data for these trips as was expressed in Table 1 for ICNAF Division 3N, shows that in the two trips to Division 30, while cod was found to be of only minor importance, haddock made up about 30% of the total catch obtained from these sets in the 1959 trip. The occurrence of so greatly reduced catches of haddock in the trip of October 1962 is in part due to the different distributional pattern of this species in May and October and probably also in part due to the general decrease of abundance of haddock in this area during recent years which has resulted from a series of rather poor year-classes.

In the total of 22 sets in which catches greater than 1000 lb (454 kg) of redfish were obtained only in one set in 1962 did the catch of cod exceed 10% of the total catch and only in four sets (all in 1959) did the catch of haddock exceed 10% of the total catch. The figure of 12% as the percentage of haddock in the total catch for the two trips is rather artificial as it is formed from the combination of one trip when haddock was fairly plentiful and the other when haddock was rather scarce.

Sizes of Cod and Haddock:- Cod were not measured from the one set where the catch of cod exceeded 10% of commercial species. Haddock, however, were measured on the four occasions when the catch of haddock exceeded the 10% value. The fish from these sets were measured in cm and these measurements have been combined into 2 cm groups for display in Fig. 4. Not only is the length-frequency of the haddock obtained in these four sets shown in this figure, but also, using the selection ogive for haddock of Subareas 3, 4 and 5 and mesh size of 4 1/2 inches (Appendix II Supplement to ICNAF Annual Proceedings Vol. 11, 1962) the number of fish that could be expected to escape if this net had been used, has been calculated and these values also shown. Of the total 5766 haddock taken in these sets 2002 or 36% could be considered as likely to escape if a 4 1/2 inch (114 mm) mesh net had been used.

(c) ICNAF Division 3P

Two rather poor redfish catches of 1374 and 1536 lb (623 and 697 kg) which were made on Laurentian Channel slope of St. Pierre Bank in June 1960, and a trip to the Hermitage Channel-Burgeo Bank area in February of 1965 provide some data for ICNAF Division 3P.

In these trips redfish catches of amounts greater than 1000 lb (454 kg) were obtained in a total of 13 sets. In these 13 sets only one catch of cod was obtained where the amount of cod caught was greater than 10% of the total catch, and in this case the 11.5% of cod was due not so much to a large catch of cod but a small catch of redfish. In one of the two sets in 1960 haddock made up 23.8% of the total catch but apart from this set haddock did not figure to any degree in these sets and this is reflected in the summary data shown in Table 3.

(d) Remarks concerning Flounders

As has been previously mentioned, it was the recommendation of Panel 3 that flounders should be included among the regulated species for Subarea 3 (ICNAF Ann. Proc. Vol. 11, 1961), and as it seems possible that this might be done in the not too distant future it seems desirable that we should examine the occurrence of redfish with other fish species in the light of a regulation which includes the "flounders" as regulated species.

In this case, the proposed regulations as applied to Newfoundland trawlers that are landing only cod, haddock, redfish, plaice and witch, would require that no vessel had cod + plaice + witch or haddock + plaice + witch in amounts in excess of 10% by weight for each of cod + haddock + redfish + plaice + witch.

In Tables 1, 2 and 3 columns have been included to show the total amounts of (a) cod + plaice + witch and (b) haddock + plaice + witch occurring in the different trips. As previously, only sets in which the redfish catches were in excess of 1000 lb (454 kg)/30 m drag are included.

In general catches of plaice and witch were not very large in Division 3N and the total catch of plaice taken in the redfish sets for the three trips only amounted to 1.4% and that of witch only 0.1% of the total catch of commercial species for the trip. Although the amounts of plaice and witch caught are small they do reduce the amount of cod or haddock which would be allowed and this leads to an increase in number of sets which would yield illegal catches if regarded on a trip basis. Whereas with only cod and haddock regulated 10 of the 29 sets (34%) in 3N yielded catches of cod in excess of 10% of the total catch, this figure increases to 41% when plaice and witch are also regarded as regulated species.

In Division 3O the situation is somewhat similar and the addition of the flounders to the regulation would slightly upgrade the percentage of regulated species landed. It would not, however, change the frequency of occurrence of sets in which the 10% exemption would be exceeded.

In areas where flounders are caught in any great amount, the difference between the 10% exemption being based on cod or haddock and being based on cod + plaice + witch or haddock + plaice + witch could be

quite considerable and an example of this was evident from the two sets on the seaward edge of St. Pierre Bank which were the only occasions when catches of redfish greater than 1000 ^(104 Kg) were obtained during the trip in June 1960. In these two sets witch made up a significant part of the catch and caused one catch when no haddock were caught. ^(65 Kg) of haddock were caught. In these two catches + plaice + witch in the amount of 23% and haddock + plaice + witch 31% of the total catch of commercial fish.

Sizes of American Plaice:- American plaice catches in ICNAF Divisions 30 and 31 were very small and no measurements were made. However, in Division 31 a few larger catches were obtained and on two occasions American plaice were measured. Although the length frequency (Fig. 5) is rather scrappy and peaky because of the rather small numbers of fish obtained it is evident that the sizes of fish were on the small side and that the use of a 4 1/2 inch (114 mm) codend would allow some ^{27%} ~~23%~~ of the small fish to escape. In calculating this escapement the selection ogive for witch, winter and summer flounders for a 4 1/2 inch net in Subarea 5 as shown in Table 4 of the appendices to the ICNAF assessment report, (Appendix II, Supplement to ICNAF Annual Proceedings Vol. 11, 1962), was used.

Although it would seem from the above title that this ogive referred to different species of flounders to that which we are considering, the ogive was in fact based on selection information given by Clark, McCracken and Templeman (1958) and the 50% selection point of 25 cm is similar as that quoted by Templeman (1963) in which, as a byproduct from selection experiments on haddock, a 50% point of 25.1 cm was obtained for American plaice when a codend of mean mesh size of 4.4 inches was used.

D. SUBAREA 4

The species to be regulated in ICNAF Subarea 4 are specifically listed in the proposed regulation. (ICNAF Ann. Proc. Vol. 11, 1961).

"The Contracting Governments take appropriate action to prohibit (except as provided in paragraph 2) the taking of cod, Gadus morhua L., haddock, Melanogrammus aeglefinus (L.), and flounders (witch), Glyptocephalus cynoglossus (L); yellow-tail, Limanda ferruginea (Storer); winter flounder, Pseudopleuronectes americanus (Walb.); and American plaice, Hippoglossoides platessoides (Fabr.) in Subarea 4 by persons under their jurisdictions with trawl nets, or seine nets (hereinafter called nets) having a mesh size less than 114 mm or 4 1/2 inch manila twine etc."

Paragraph 2 of the proposed regulations permits the use of a smaller mesh net in fisheries conducted primarily for other species "as long as such persons do not have in possession on board a vessel fishing primarily for other species, cod, haddock, or flounders in amounts in excess of 5000 lb or 2268 kg for each, or ten per cent by weight for each of all fish on board such vessel, whichever is greater".

Thus the catches of each: (a) cod, (b) haddock and (c) the four species of flatfishes defined above, should be considered as percentages by weight of the total catch of all fish which might be aboard the vessel in question. As these percentages will depend on the current commercial practice of the various countries and/or ports of landing which will determine the different species which may or may not be landed by a given vessel, the decision has been made to follow the procedure used in this paper for Subarea 3 and to consider the total catch to consist only of redfish, cod, haddock and the four species of flounders listed above.

The research vessel data presented here from Subarea 4 are even more restricted as to the time of year during which it was derived than the data for Subarea 3, for all the sets were made within the two months of October and November.

(a) ICNAF Divisions 4R, 4S and 4T

These divisions have been considered together because they form the natural geographical division of the Gulf of St. Lawrence.

Trips have been made to the Gulf of St. Lawrence by the A.T. Cameron on 4 occasions all of which were within the period of October and November. In 1959, five sets on lines D, E and F (Fig. 1) yielded redfish catches greater than 1000 lb (454 kg) per 30 minute drag, while in 1960 in a more extensive redfish survey trip similar catches were obtained in 11 sets on lines A, B, E and F. During this latter trip some gear experimental sets on line F boosted the total redfish sets by a further 8 sets. In 1961 and 1963 two further trips to the area showed redfish catches greater than 1000 lb (454 kg) in 10 sets during each trip. In the former year these catches were obtained on lines A, B, D and E (the A.T. Cameron did not fish on line F during this year) whereas in the latter year these catches were confined to lines A and F.

The catches of commercial species from these trips are summarized in Table 4. It is apparent that catches of species other than redfish were not very large. The best catch of haddock obtained in these trips only amounted to 3.9% of the total catch and that of the flounders reached 7.6% only on one occasion with all other sets showing the amounts of flounders taken as less than 5% of the total catch of commercial species. The table does however show that during one trip (1961) the amount of cod taken during these redfish sets reached 11.3% of the total catch and in five of the ten sets in this trip the cod catch did exceed 10% of total catch. The other trips yielded catches of cod greater than 10% of the total catch only on three occasions.

Sizes of Cod:- Cod measurements were obtained from ^{six} of the seven catches when the amounts of cod taken were more than 10% of the total catch and these measurements originally made to the nearest cm have been combined in 3 cm groups for display in Fig. 6. Also shown in this figure is the number of fish which could be regarded as likely to escape had a net having a codend mesh size of 4 1/2 inches (114 mm) been used. This has been calculated using the selection ogive for cod in subareas 3, 4 and 5 as

tabulated in the Appendices to the supplement to ICNAF Annual Proceedings Vol. 11, 1961 (1962).

(b) ICNAF Divisions 4V, 4W and 4X

The distribution of redfish on the Nova Scotian shelf part of Subarea 4 has been examined by the A.T. Cameron on three occasions, in 1959, 1961 and 1962. These survey cruises, which were all in the month of November, yielded catches of redfish greater than 1000 lb (454 kg) in 6 sets in 1959 (lines A, D and G), one set in 1961 (line J) and 13 sets in 1962 (lines B, G, H, J, and K). The data for the three trips are summarized in Table 5. It is apparent from these sets that in this area and at least at this season of the year, commercial redfish catches are rather clean relative to the regulated species and in the 20 sets where the redfish catch was greater than 1000 lb (454 kg) per 30 minutes trawling, not once did the catch of either cod or haddock or flounders reach 10% of the total catch and usually the percentages of these species were very much lower.

E. REFERENCES

- Clark, John R., F. D. McCracken and W. Templeman (1958). Summary of Gear Selection Information for the Commission Area. ICNAF, Ann. Proc. Vol. 8: 83-99.
- Templeman, W. (1963). Otter-Trawl Covered Codend and Alternate Haul Mesh-Selection Experiments on Redfish, Haddock, Cod, American Plaice and Witch Flounder: Girth Measurements of Haddock, Cod and Redfish and Meshing of Redfish in the Newfoundland Area. ICNAF Spec. Publ., No. 5: 201-217.

Table 1. Total catches (lb) of commercial fish obtained in Division 3N during 30 minute sets when catches of redfish were greater than 1000 lb (454 kg). Also shown in parenthesis are the percentages that these amounts are of the total catch of redfish + cod + haddock + plaice + witch.

Dates of trips	No. of sets	Redfish	Cod	Haddock	Plaice	Witch	Total	Cod + witch + plaice	Haddock + witch + plaice
June-July 1959	14	56,220 (81.4)	10,747 (15.6)	642 (0.9)	1,380 (2.0)	41 (0.1)	69,030	12,168 (17.6)	2,063 (3.0)
September 1961	6	24,954 (73.8)	8,762 (25.9)	-	83 (0.2)	2	33,801	8,847 (26.2)	85 (0.3)
November 1964	9	23,994 (89.1)	2,495 (9.3)	12	342 (1.3)	88 (0.3)	26,931	2,925 (10.9)	442 (1.6)
Total	29	105,168 (81.0)	22,004 (17.0)	654 (0.5)	1,805 (1.4)	131 (0.1)	129,762	23,940 (18.4)	2,590 (2.0)

Table 2. Total catches (lb) of commercial fish obtained in Division 30 during 30 minute sets when redfish catches were greater than 1000 lb (454 kg). Also shown in parenthesis are the percentages that these amounts are of the total catch of redfish + cod + haddock + plaice + witch.

Dates of trips	No. of sets	Redfish	Cod	Haddock	Plaice	Witch	Total	Cod + Haddock +	
								plaice + witch	plaice + witch
April-May 1959	8	17,190 (62.1)	1,143 (4.1)	8,200 (29.6)	108 (0.4)	1,560 (5.8)	27,701	2,311 (8.3)	9,368 (33.8)
October 1962	14	42,120 (97.1)	775 (1.8)	352 (0.8)	91 (0.2)	49 (0.1)	43,387	915 (2.1)	492 (1.1)
Total	22	59,310 (83.4)	1,918 (2.7)	8,552 (12.0)	199 (0.3)	1,109 (1.6)	71,088	3,226 (4.5)	9,860 (13.9)

Table 3. Total catches (lb) of commercial fish obtained in Division 3P during 30 minute sets when redfish catches were greater than 1000 lb. (454 kg). Also shown in parenthesis are the percentages that these amounts are of the total catch of redfish + cod + haddock + plaice + witch.

Dates of trips	No. of sets	Redfish	Cod	Haddock	Plaice	Witch	Total	Cod + Haddock +	
								plaice +	witch
June 1960	2	2,910 (54.8)	6 (0.1)	942 (17.7)	115 (2.2)	1,311 (25.2)	5,314	1,462 (27.5)	2,398 (45.1)
February 1965	11	36,942 (97.5)	798 (2.1)	27 (0.1)	18 -	120 (0.3)	37,905	936 (2.5)	165 (0.4)
Total	13	39,852 (92.2)	804 (1.9)	969 (2.2)	133 (0.3)	1,461 (3.4)	43,219	2,398 (5.5)	2,563 (5.9)

Table 4. Total catches (lb) of commercial fish obtained in Divisions 4R, 4S and 4T during 30 minute sets when redfish catches were greater than 1000 lb (454 kg). Also shown in parenthesis are the percentages that these amounts are of the total catch of redfish + cod + haddock + flounders.

Dates of trips	No. of sets	Redfish	Cod	Haddock	Flounders	Total
October 1959	5	11,022 (96.9)	217 (1.9)	27 (0.2)	114 (1.0)	11,380
November 1960	19	37,406 (90.7)	3,253 (7.9)	127 (0.3)	463 (1.1)	41,249
November 1961	10	15,714 (86.3)	2,049 (11.3)	158 (0.9)	295 (1.6)	18,216
November 1963	10	25,136 (98.1)	343 (1.3)	-	155 (0.6)	25,634
Total	44	89,278 (92.5)	5,862 (6.1)	312 (0.3)	1,027 (1.1)	96,479

Table 5. Total catches (lb) of commercial fish obtained in Divisions 4V, 4W and 4X during 30 minute sets when redfish catches were greater than 1000 lb (454 kg). Also shown in parenthesis are the percentages that these amounts are of the total catch of redfish + cod + haddock + flounders.

Dates of trips	No. of sets	Redfish	Cod	Haddock	Flounders	Total
November 1959	6	11,120 (99.7)	-	1	38 (0.3)	11,159
November 1961	1	5,690 (96.2)	54 (0.9)	-	168 (2.8)	5,912
November 1962	13	34,720 (97.9)	298 (0.8)	112 (0.3)	321 (0.9)	35,451
Total	20	51,530 (98.1)	352 (0.7)	113 (0.2)	527 (1.0)	52,522

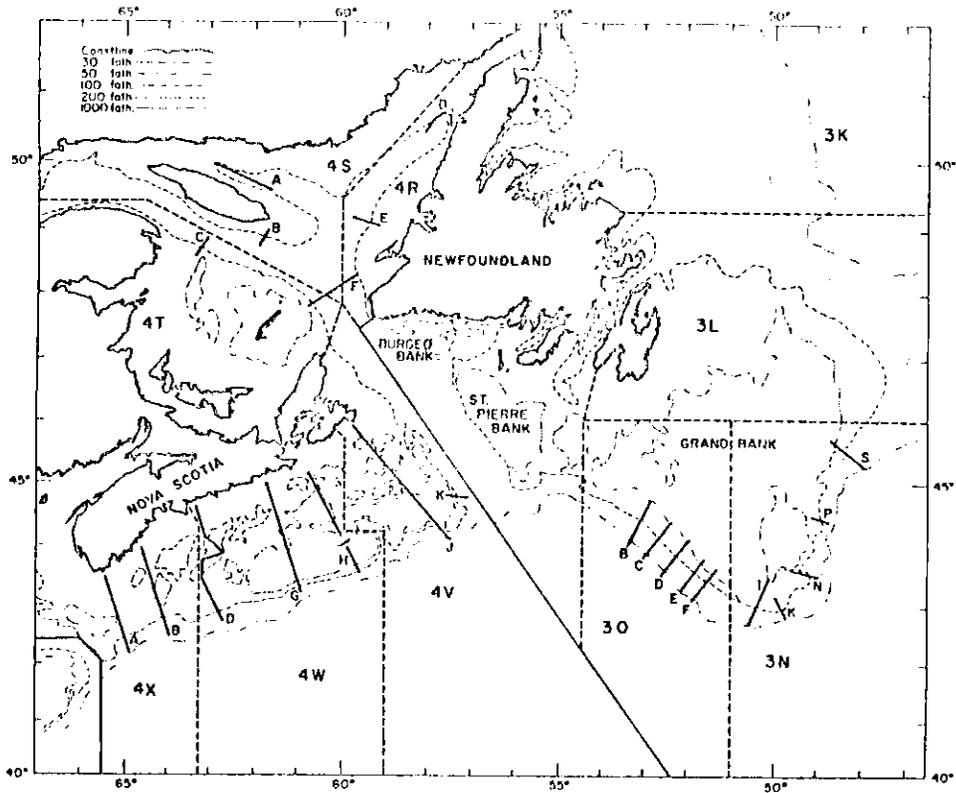


Fig. 1. Map showing general positions of redfish survey lines.

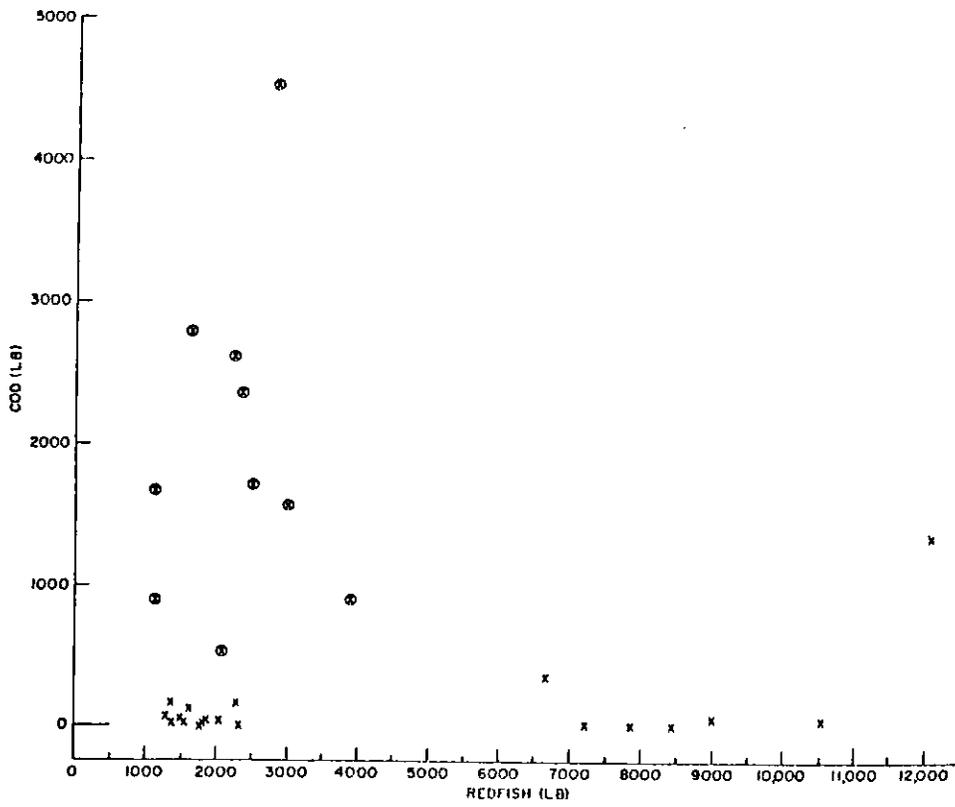


Fig. 2. ICNAF Division 3N. Plot of cod catches against redfish catches obtained in the same set. Circles denote sets when the catch of cod was greater than 10% of the total catch of commercial fish.

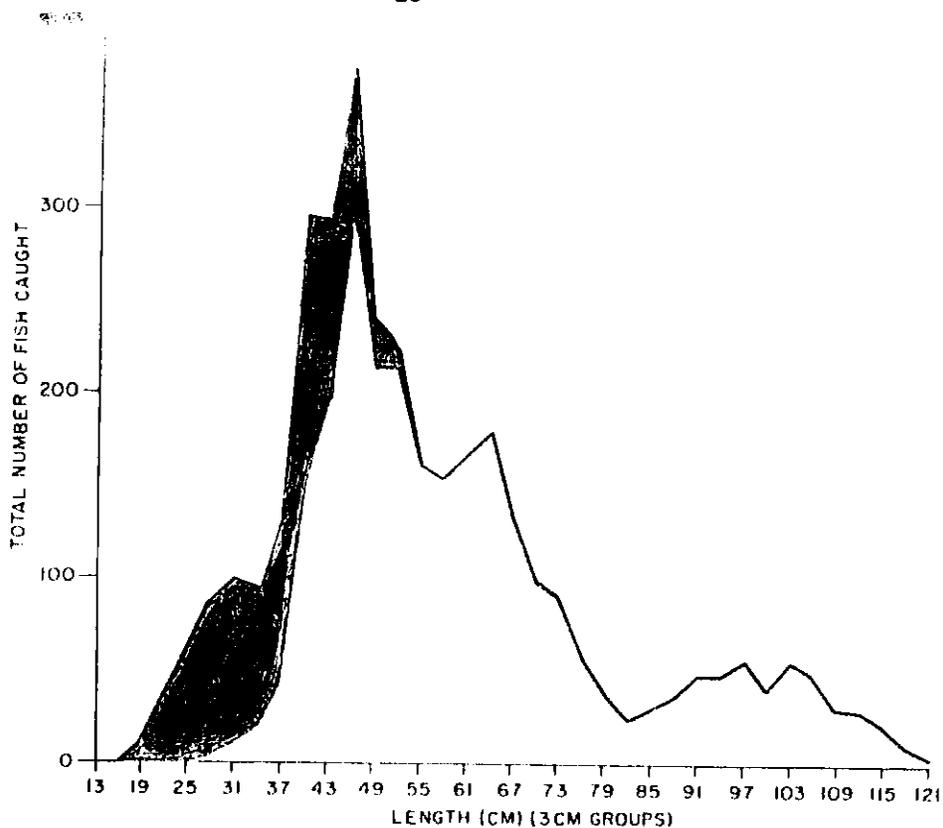


Fig. 3. ICNAF Division 3N. Length-frequency of cod taken during sets when catches of redfish exceeded 1000 lb (454 kg) per 30 m tow and cod exceeded 10% by weight of the total catch of commercial species.

The shaded portion indicates the theoretical amount which would have escaped had a 4 1/2 inch (114 mm) mesh cod-end been used.

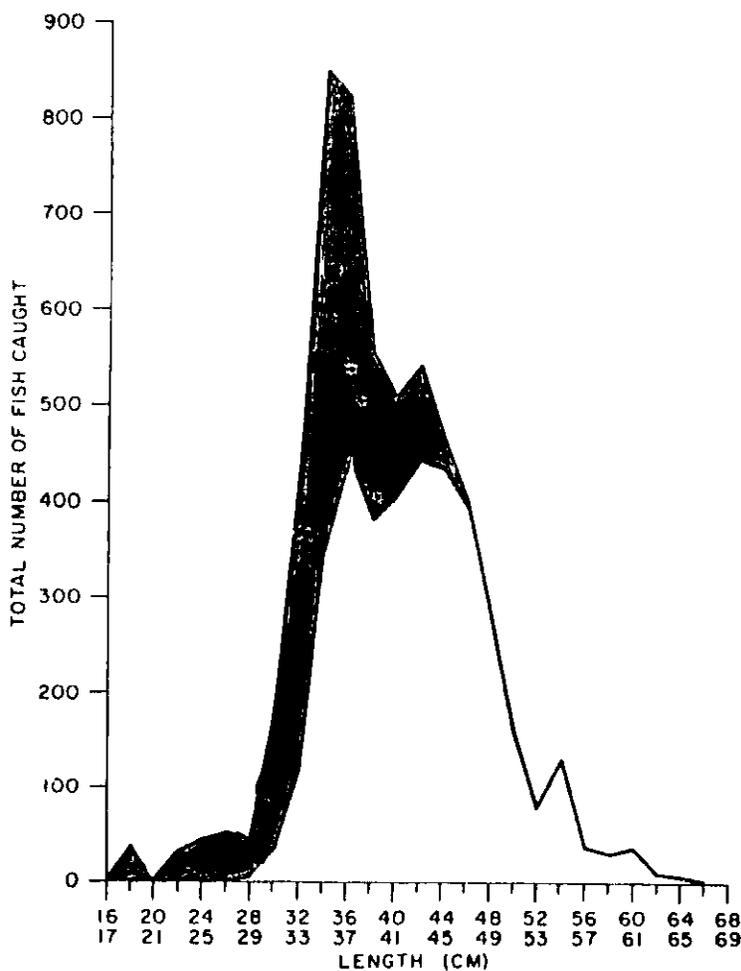


Fig. 4. ICNAF Division 30. Length-frequency of haddock taken during sets when catches of redfish exceeded 1000 lb (454 kg) per 30 m tow and haddock exceeded 10% by weight of the total catch of commercial species.

The shaded portion indicates the theoretical amount which would have escaped had a 4 1/2 inch (114 mm) mesh cod-end been used.

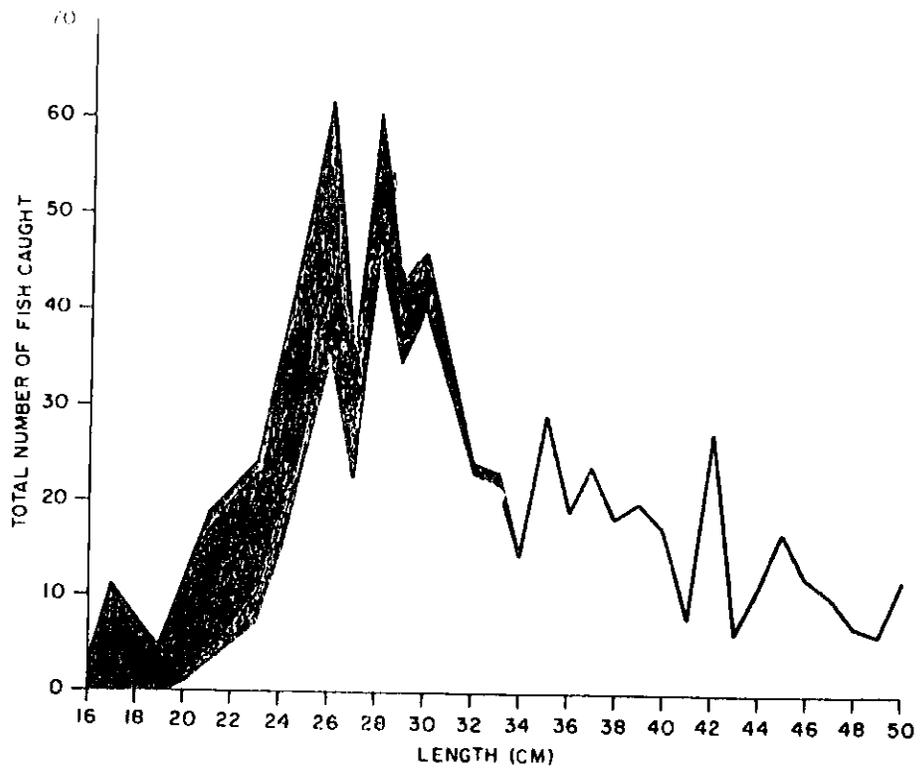


Fig. 5. ICNAF Division 3N. Length-frequency of American plaice taken during two sets in which the catch of redfish exceeded 1000 lb (454 kg) per 30 m tow.

The shaded portion indicates the theoretical amount which would have escaped had a 4 1/2 inch (114 mm) mesh size been used.

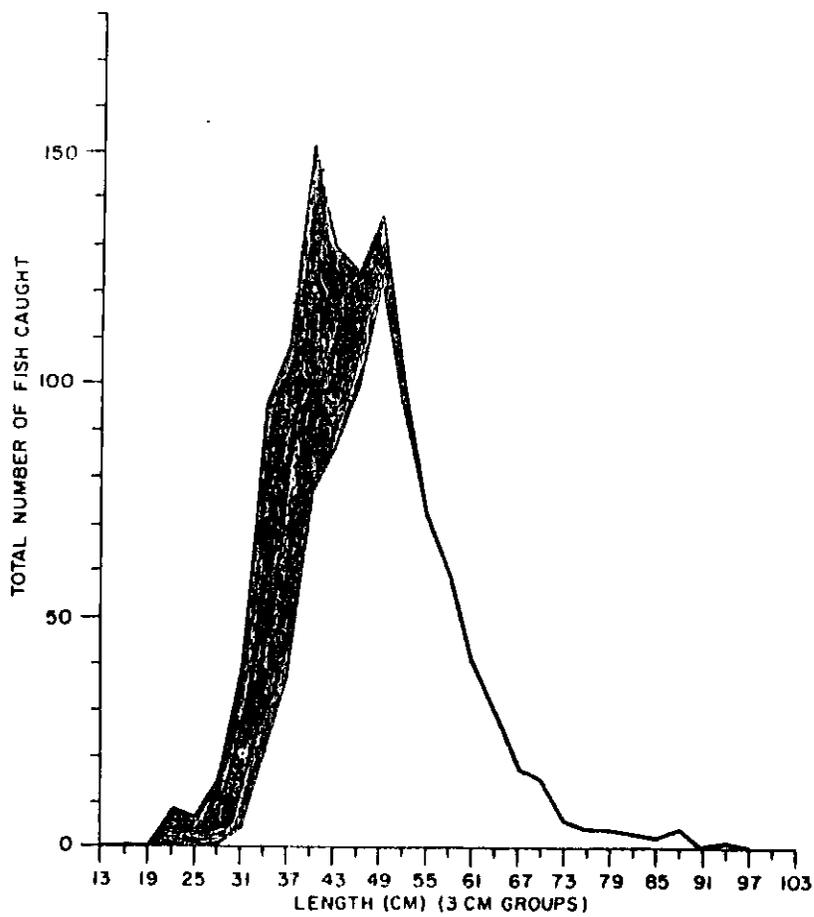


Fig. 6. ICNAF Divisions 4R, 4S and 4T. Length-frequency of cod taken during sets where catches of redfish exceeded 1000 lb (454 kg) per 30 m tow and cod exceeded 10% by weight of the total catch of commercial species.

The shaded portion indicates the theoretical amount which would have escaped had a 4 1/2 inch (114 mm) mesh cod-end been used.