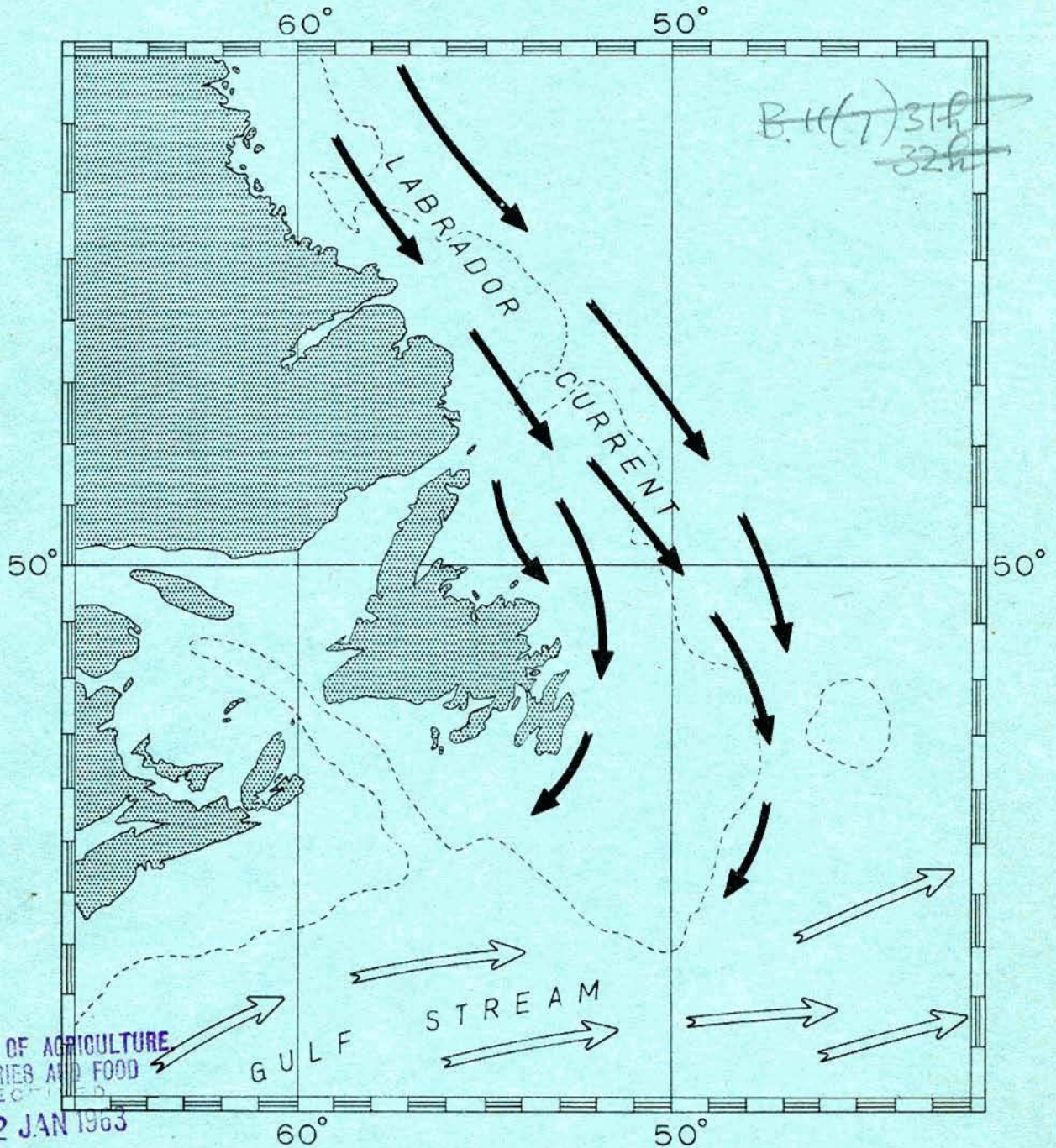


MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

NEWFOUNDLAND FISHING



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Laboratory Leaflet - New Series No. 1NEWFOUNDLAND FISHING

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1. INTRODUCTION

Fishing for cod in Newfoundland waters by European vessels started over 450 years ago, and very quickly the French and Portuguese built up large fleets to exploit the newly discovered grounds. Two types of fishing were employed, seine netting in the shallow water of the bays and hand-lining on the offshore banks. These two methods remained the most important up to the second world war. Since then trawling has become increasingly important on the banks, until now about half the cod caught in the Newfoundland area is taken by trawlers and the rest by hand-line, long-line and various inshore gears. This catch of cod is divided mainly between four countries; Canada (Newfoundland) takes about 40%, France about 20% and Portugal and Spain about 15% each.

Cod has always been the most important fish in the area, with haddock and flounders of some importance to the Newfoundlanders. But in the last ten years a fishery for redfish has developed rapidly on the edge of the shelf, and in 1959 the total catch of redfish was half that of cod: two thirds of this was taken by Russian trawlers.

The following account of the Newfoundland area and its fishery is derived mainly from reports and statistical tables published by the International Commission for the Northwest Atlantic Fisheries (ICNAF), and from other published reports, mainly Canadian. Figure 1 shows the area considered, with the principal banks and the boundaries of the ICNAF statistical divisions marked.



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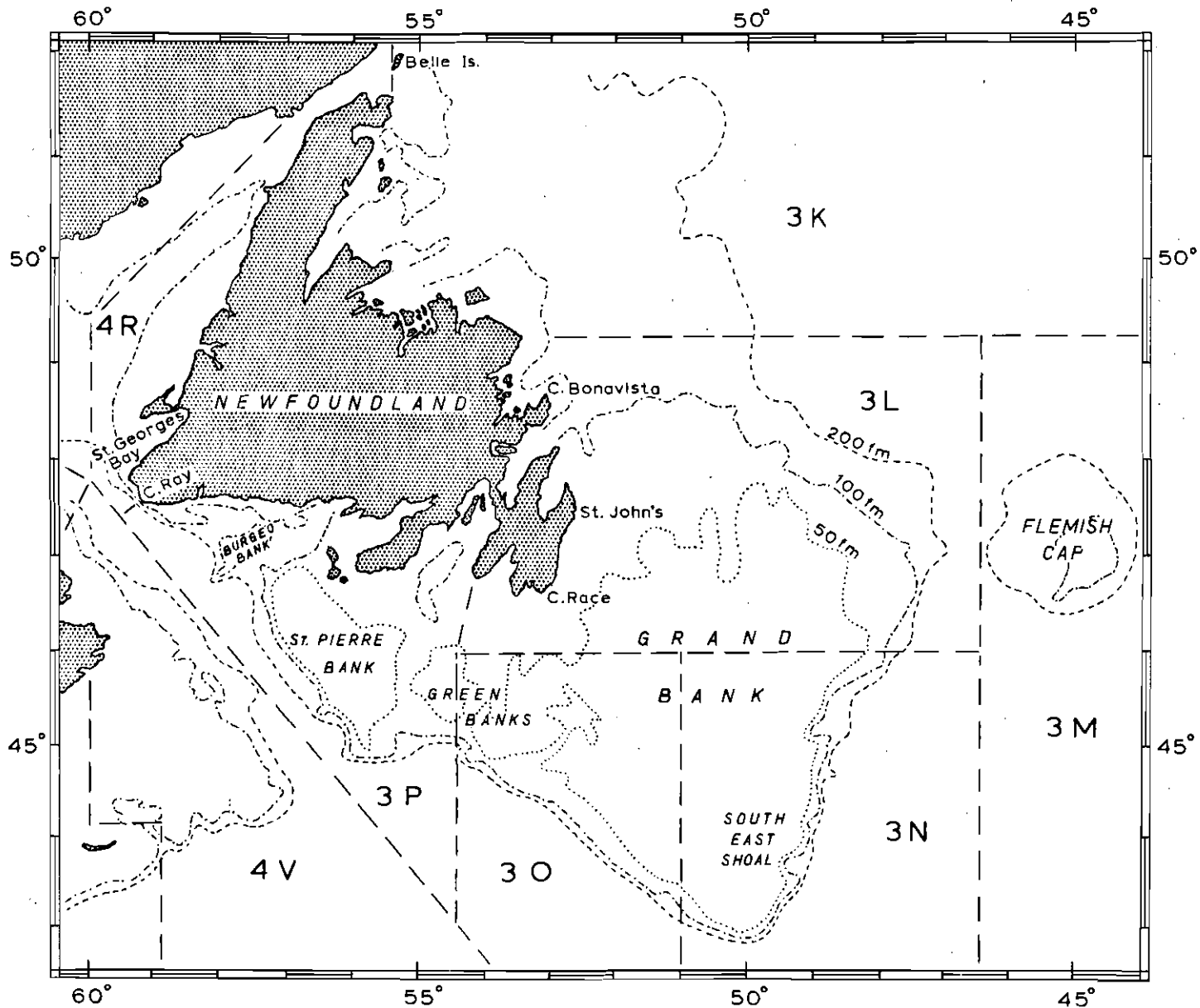


Fig. 1
NEWFOUNDLAND BANKS AND BOUNDARIES OF I.C.N.A.F. DIVISIONS

2. HYDROGRAPHY AND ICE

To the fisherman three of the main characteristics of the Newfoundland banks are the richness of marine life and the hazards of fog and ice. All three are related to the meeting of two main current systems. The warm Gulf Stream comes from the south-west along the continental slope of the American continent, turns eastwards south of Newfoundland and follows the line of the southern and eastern edges of the Grand Bank before moving to the east and north-east across the Atlantic. The Labrador Current brings cold water from the north-west along the coasts of Labrador and north-east Newfoundland over the northern part of the Grand Bank and southwards along the edges of the bank (see cover). The mixing of the warm and cold currents is responsible for the great productivity of the area. Fog is mainly caused by the warm moist air from the Gulf Stream blowing over the cold water of the Labrador Current, which cools the air and causes the moisture in it to condense. Fog is most frequent in late spring and summer, and with winds from between south and east. Ice, both as pack-ice and icebergs, is carried southwards by the Labrador Current.

Pack-ice reaches its southernmost extent sometime between the beginning of March and the middle of May. The time of maximum ice cover varies from year to year and so does its extent. Figure 2 shows the southernmost extent of pack-ice in the four years 1957 to 1960. In 1957 there was considerable pack-ice and in 1958 very little. 1961 was a year of exceptionally heavy ice along the coast and on the west of the Grand Bank; it came further south than usual and appeared in Placentia Bay, on the south coast, for the first time in fifty years.

Many of the icebergs are brought south embedded in the pack-ice. When the pack breaks up in late spring the bergs are freed and drift on further south. The "iceberg season" over the Grand Bank is from March to July, with the peak period between mid-April and mid-May. The severity of the season is reckoned by the International Ice Patrol as the number of bergs which drift south of 48° N. The average number per year since 1900 is about 400. In five recent years the numbers were about 940 in 1957, 1 in 1958, 690 in 1959, 270 in 1960, and 500 in 1961.

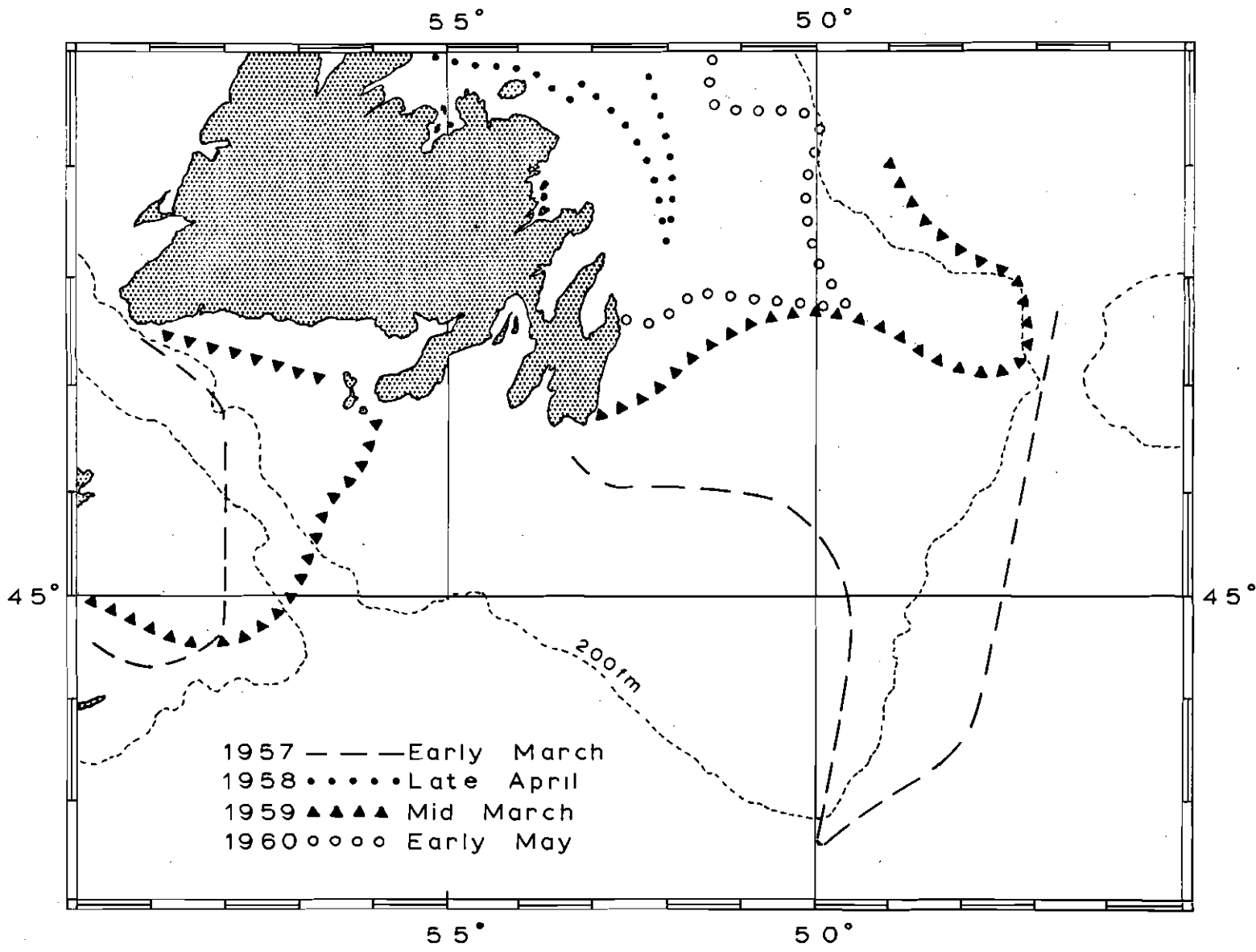


Fig. 2
 MOST SOUTHERLY EXTENT OF PACK ICE

As the Labrador Current impinges on the northern part of the Grand Bank it divides into two main streams. The offshore branch keeps close to the eastern slope of the Grand Bank and sometimes curls round the tail of the bank, extending along the south-western slope. The other branch flows southward in the Avalon Channel between the coast and the bank. There is an indication of the position of the two streams at the surface in the ice distribution shown in Figure 2. Figure 3 shows more clearly the two cores of very cold water (below -1°C) between 40 and 90 fathoms in a section across the northern part of the Grand Bank in the summer of 1959. This section also shows that the bottom temperature right across the northern part of the bank was below 0°C : temperatures above 2°C on the bottom were only found on the eastern slope of the bank below about 140 fathoms, and on Flemish Cap. The surface waters were warm down to about 20 fathoms.

The detailed hydrography of the area varies considerably from year to year depending on the strengths of the Labrador Current and the Gulf Stream system. The main features are that in winter, spring and early summer the tops of the banks are covered with cold water: and on the Grand Bank it is usually only the southern half that is covered with water of above 2°C on the bottom in summer and autumn. The eastern and southern slopes of the shelf below about 120 fathoms are usually covered with warm water throughout the year. The shallow inshore waters are cold in winter but warm up down to the bottom in 20 fathoms or so in summer. This hydrographic pattern governs the movements of the fish, which are described in the next section.

3. COD STOCKS AND FISHING

There are several separate stocks of cod in Newfoundland waters and their distributions and main seasonal movements are shown in Figure 4. The six stocks shown on the chart are the Labrador-Newfoundland stock, the Flemish Cap stock, the Grand Bank stock, the St. Pierre Bank stock, the West Newfoundland stock and the Avalon-Burin stock. A "stock" is here used in the sense of a unit in which the fish have a similar migratory pattern and occupy a unique territory for at least part of the year: there are usually also differences in growth rate and other characteristics between stocks. The general pattern of movement is to the deeper water on the

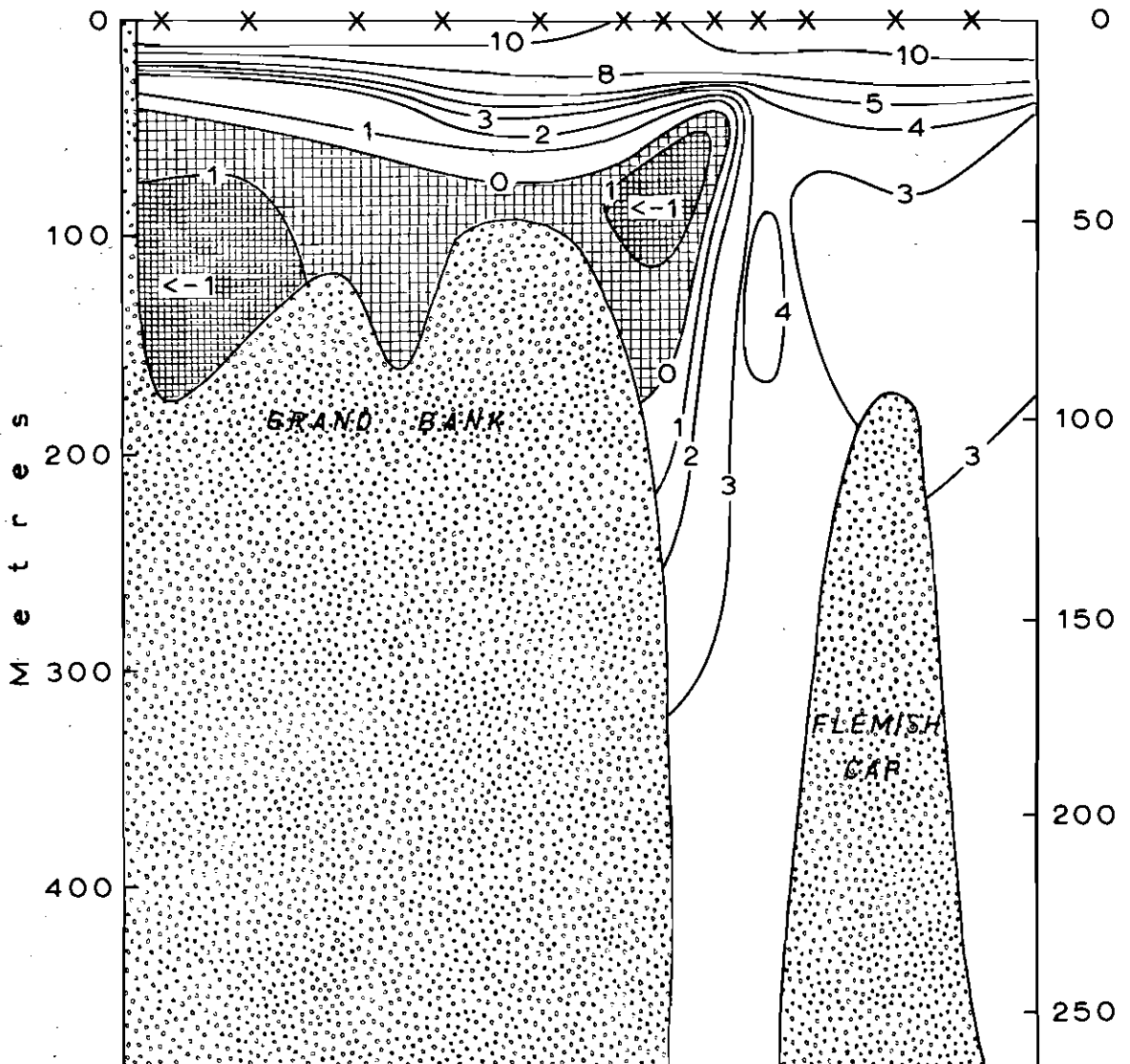


Fig. 3
 TEMPERATURE SECTION ACROSS THE NORTHERN PART OF THE GRAND BANK,
 ST. JOHN'S TO FLEMISH CAP. 25 - 27 July, 1959

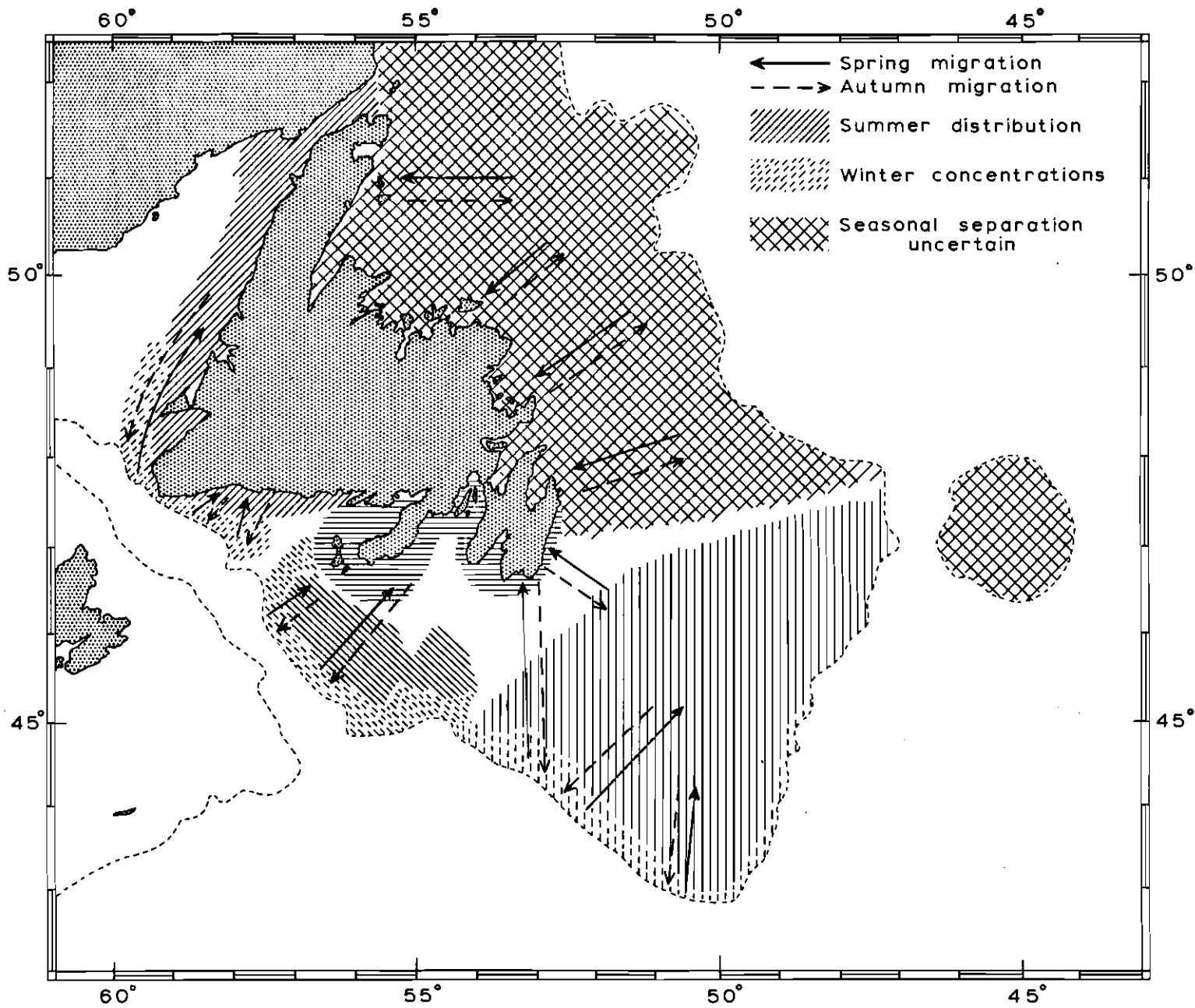


Fig. 4
 DISTRIBUTION OF MAIN COD STOCKS

outer slopes of the banks in winter and into the shallower waters on the banks or inshore to feed in summer. This general pattern is governed by changes in water temperature. It was in the Newfoundland area that the early work on cod and water temperature was done, and it was found that cod are rarely caught in water of less than 0°C . The best temperature in most parts of the area is between 2° and 6°C and few cod are caught above 8°C , except on the south-west coast in summer. In the south the cod appear to be acclimatised to higher temperatures than in the north.

The cod of the north-east coast (ICNAF Divisions 3K and 3L) are part of the large Labrador-Newfoundland stock which is probably divided into several sub-stocks, such as those of the Bonavista Shelf in the south and Labrador in the north. This is borne out by marking experiments which show some movement north and south; but many of the fish are recaptured close to the tagging area in succeeding years. The main movements are inshore in summer and offshore in winter. The cold water of the Labrador Current forms a barrier to the movement of cod on the bottom from the offshore wintering grounds towards the coast. One of the main local fisheries on this stock is in the Bonavista area and there the movements of the fish have been studied for several years. In winter the cod are in the warmer water towards the edge of the shelf, and there is a spawning ground on the northern part of the Grand Bank between 100 and 200 fathoms in April and May. By early June many of the smaller fish move upwards to the warm surface layers where they feed on capelin, which they follow towards the shore. The inshore fishery on these smaller fish usually begins in June and lasts until autumn. The larger fish appear to remain on the bottom near the lower edge of the cold water, and they have formed the basis of deep water long-line and trawl fisheries which have developed in 120-190 fathoms about 15 to 20 miles off Cape Bonavista (Division 3L) since about 1955. The main trawl fishery by Portuguese, Spanish and French vessels is between July and September.

In the last two or three years there has been a winter trawl fishery on the north-eastern stock in the Belle Isle area (Division 3K). This fishery developed from the autumn fishery for redfish in the Ritubanki area off southern Labrador ($52^{\circ}\text{N } 51^{\circ}\text{W}$). As the catches of redfish have declined,

those of cod have increased. The area is mainly exploited by German and Russian trawlers from October onwards and fishing is usually stopped by ice in February or March. Cod are caught between 130 and 150 fathoms.

The Flemish Cap stock (3M) is fairly small and isolated. It was fished only occasionally until 1956. In 1957 the Russians began fishing for redfish on the bank and they have developed a fishery during most months of the year. In 1960 about a quarter of their total catch was cod.

The third stock of cod occupies the southern part of the Grand Bank (3N and 3O). Marking experiments have shown that this stock is distinct from that on the northern edge of the bank. It is probable that the cold water in contact with the northern part of the bank in intermediate depths forms an effective barrier to mixing (Fig. 3). This southern stock has a seasonal migratory pattern like that of the northern one; in winter when the shallow parts of the bank are covered with cold water cod are found along the southwestern and eastern slopes of the bank, where they spawn in April and May. As the water over the bank warms up in summer cod concentrate on the shallow parts to feed, and return to deeper water in late autumn. The older fish tend to remain in deeper water throughout the year. Fishing on this stock is mainly by Spanish otter and pair trawlers and Portuguese dory vessels, although Russian trawlers started fishing successfully in the area in 1960. Most of the fishing is on the narrow southern edge of the bank in April and May and on the shallow south-eastern part (3N) between July and October.

The St. Pierre and Green Banks support a mixture of fish of several stocks, but there seems to be a resident St. Pierre Bank stock which winters along the southern slopes of the banks and moves on to the tops of the banks in spring. The main cod fishing in the area is on the wintering and pre-spawning concentrations in about 80-100 fathoms between the Green Bank and St. Pierre Bank from December to April, with a peak in February-March. These wintering concentrations also include fish from the Avalon-Burin stock which move inshore in summer, and also some from the Grand Bank stock to the east. Fishing on St. Pierre Bank in summer is mainly by Canadian, French and Spanish trawlers, and has decreased in recent years as the haddock stocks have declined.

The last of the main cod stocks in Newfoundland waters is that of the south-west and west coasts (3P and 4R). The wintering and spawning grounds of this stock are on the narrow slope of the shelf from about the Burgeo Bank to the north of St. Georges Bay. They are fished intensively in winter by trawlers from France, Portugal, Canada and Spain: the heaviest fishing is from February to April. In summer the cod migrate along the west coast where they are caught by inshore gears. It is not clear whether the cod found on the Burgeo Bank in winter and spring are a separate stock or part of the West Newfoundland stock.

The sixth stock is the inshore Avalon-Burin stock which is fished in summer and autumn all along the east and south coasts from St. John's to the Burin peninsula. During the winter they mingle with the St. Pierre and Grand Bank stocks offshore.

4. COD CATCH AND EFFORT

Some statistics of the cod catches in the Newfoundland area are set out in Tables 1 to 4. The boundaries of the ICNAF statistical divisions used in the tables are shown in Figure 1.

Table 1 shows the total catch of cod by all gears. A notable feature is the low catch in 1958, which was a warm year with high water temperatures and cod more dispersed than usual. The table also shows that the north-eastern stock in 3K and 3L accounts for about half the total catch. The south-western stock in 3P and 4R is next in importance and the southern Grand Bank stock in 3N and 3O third.

Table 2 shows the average catch by Canadian trawlers in tons/day. Most of their fishing is described in the statistical table as "mixed", and it can be seen from the table that haddock is the most important fish on the St. Pierre and Green Banks (3O and 3P). The moderate cod catches on the northern Grand Bank from May to August (3L) are during the flounder fishery, as also are poor cod catches on the eastern part of the bank in autumn (3N). Canadian trawlers also fish for redfish, and these trips account for most of their fishing in the Gulf of St. Lawrence (4R).

In Table 3 the average catch in tons/hour of the large Portuguese trawlers is set out. These ships are fishing for cod only and must nearly match the English fishing requirements. The Portuguese fleet is usually at home in January, off south-west Newfoundland and in the Gulf of St. Lawrence in February to April, in Greenland waters from May to July, and off north-east Newfoundland and Labrador from August to December. The table shows the generally poorer catches in the warm year 1958, high catches in the south-west in March and April and the declining catch per effort in summer in the Bonavista area (3L) after the start of trawling there in July 1956. Ice prevented fishing in area 4R in the spring of 1959.

In Table 4 the catch per effort of the Portuguese trawler fleet at Newfoundland and Greenland is shown for several years, with the English figures for Greenland and some other areas (taken from "Fish Stock Record") set out for comparison. The Portuguese catches are expressed as tons landed to make them comparable with the English statistics. The figures for the two fleets are not strictly comparable because the Portuguese trawlers are larger and more powerful, and at Greenland they tend to fish in different areas and in different months from the English fleet. The table shows that for three of the four years the Portuguese catch per effort at Greenland was about twice that at Newfoundland. The figures suggest that if English trawlers had been fishing at Newfoundland in those years they would probably have had better catches per hours fishing than at White Sea, Norway Coast, Bear Island or Iceland, but not so good as at Greenland. A fuller appraisal of the potential of the grounds for English trawlers must also take account of the differing steaming times to the various grounds.

5. HADDOCK

Because haddock will not tolerate such cold water as cod they are restricted to the southern part of the Newfoundland area. There are two main stocks, on the St. Pierre Bank and on the southern Grand Bank, but only the latter provides the basis for a fishery at present. There are considerable differences in the survival of year classes in haddock stocks, particularly at the northern end of the range. The stock on St. Pierre Bank is a good example. The 1949 year class there was very successful and

provided good fishing from 1954 to 1956. Since 1949 there has been no good year class and since 1957 no haddock fishery.

The haddock of the southern Grand Bank perform a seasonal migration similar to that of cod. They winter on the south-west slope and during spring and early summer move clockwise on to the bank as the water warms. By late summer or early autumn they are usually concentrated on the South East Shoal in less than 30 fathoms, although the larger fish tend to stay in deeper water. In late autumn they move south to the slope again. From about December to May they are fished by Canadian trawlers along the slope and the good fishing is shown by the figures for division 30 in Table 2. The depth of the best fishing varies from year to year according to the water temperature: for instance, after the cold winter of 1959 best catches in April were between 120 and 140 fathoms, whereas, after a warmer winter, in 1960 they were at 40-50 fathoms. Spanish trawlers fish for haddock on the South East Shoal (3N) from about July to October, and in the last two years Russian trawlers have also concentrated in that area. In 1960 the Russians caught about 4 tons/hour in July, declining to about 2 tons/hour in November. Catches were poorer in 1961, and as there has been no very successful year class in this stock since that of 1955 catches may be expected to decline over the next few years.

In Table 2 the high Canadian figures for division 3P are accounted for by the good fishing on St. Pierre Bank in 1955 and 1956.

6. OTHER FISH

As has already been mentioned the two other main fisheries in the Newfoundland area are for redfish and "flounders": the latter are mainly long rough dabs. The flounder fishery is chiefly a Canadian one on the north-eastern part of the Grand Bank in summer and autumn.

The redfish fishery in the Newfoundland area has increased rapidly in the last five years. Most of this increase has been from Russian trawlers in the Belle Isle and South Labrador areas (3K) and on Flemish Cap (3M). German fishing has also been in the north-east (3K and 3L). The older established redfish fishery along the southern slope of the Grand Bank and westwards to the Gulf of St. Lawrence is carried out by trawlers from Canada

and U.S.A. All the redfish fishing is on the outer slopes of the banks below about 130 fathoms.

7. CONCLUSION: EFFECT OF FISHING AND FUTURE PROSPECTS

Results of the past few years suggest that over the year the best cod catches are obtained:-

- January and February - Belle Isle area (3K)
- February to April - South-west Newfoundland (3P and 4R)
 - South of St. Pierre and Green Banks (3P and 3O)
 - Southern slopes of the Grand Bank (3O)
- May to September - North-east Grand Bank, Bonavista area, and northwards (3L and 3K)
- August to October - South-east Grand Bank (3N)
- November and December - Belle Isle area (3K)

The best haddock fishing is on the southern slopes of the Grand Bank (3O) from February to April and on the South East Shoal (3N) from July to October.

A study of the past data of catches, amount of fishing, and size and age of fish shows that the stocks in the Western Atlantic are moderately heavily fished. Thus the stock abundance, and the catch per hour, have in some areas been markedly reduced from their original level. As the stocks in one area have been reduced to a low level, other concentrations in other areas have been exploited. The increase in fishing intensity in recent years, particularly by trawlers, has resulted in previously unexploited stocks being fished; and the decline in catch per unit effort over the area as a whole is less marked than the decline in local areas. Thus the catch per effort on the southern Grand Bank (3N and 3O) has decreased considerably since 1953 and so the fishing in that area has decreased. Since about 1957 there has been some decrease in the catch per effort on the northern Grand Bank (3L) and the trawl fishery has expanded further north towards Belle Isle (3K) and Labrador. At the same time the fishery on the south-western stock (3P and 4R) has increased. There is no clear indication yet that these northern and western stocks have been substantially reduced.

It seems fairly certain that, in the North Atlantic as a whole, there are now no further completely unexploited stocks of cod left - all grounds of a suitable depth for cod are now fished to some extent - and a further expansion of fishing will have to be on the presently known grounds. The size of the future stock, and the level of catch per hour, therefore depend critically on how much fishing is being done. In this context the whole of the West Atlantic grounds from Nova Scotia to Cape Farewell, and probably also the Bear Island and Barents Sea grounds, must be considered together. In all the western areas a major and increasing part of the fishing is done by east European factory trawlers, and trawlers working with a mother ship, and by big salting trawlers from France, Spain and Portugal. These fleets are highly mobile, staying at sea for months at a time and moving rapidly from area to area according to the catches - for instance, in May of this year there were many trawlers fishing Hamilton Bank off Labrador at a time of year when little or no fishing had previously been done.

Statistics are given below of the total number of trawlers fishing in the West Atlantic in 1953, 1956 and 1959, arranged in size classes, according to their gross tonnage.

Size of trawler	1953	1956	1959
51-150 tons	224	229	227
150-500 tons	132	129	166
501-900 tons	126	97	209
901-1800 tons	78	85	95
Over 1800 tons	-	1	38
Total Tonnage (app.)	240,000	240,000	410,000

The increase in the trawling fleet, especially of the very big trawlers, is obvious (the fleet in 1953 is in fact exaggerated, through the inclusion of the exceptional number of over ninety British trawlers which each made 1 or 2 trips to the Cape Farewell area), and this increase has certainly continued since 1959. The prospect is therefore of declining stocks and catches per hour for the immediate future throughout the North-west

Atlantic, though probably the stocks will not become "over-fished" in the sense of the total catch declining, though it will certainly not increase as fast as the total amount of fishing.

TABLE 1

COD LANDINGS FROM THE NEWFOUNDLAND AREA 1955-1960

BY ALL COUNTRIES AND ALL GEARS - METRIC TONS, ROUND, FRESH

Division	1955	1956	1957	1958	1959	1960
3K	81,005	79,386	83,360	73,515	139,267	107,512
3L	157,837	187,044	161,190	105,897	133,307	161,521
3M	792	6	17,799	4,615	6,949	5,565
3N	82,774	50,386	58,182	31,417	42,250	30,470
3O	30,233	14,496	27,393	14,557	20,215	30,307
3P	71,337	49,304	77,921	50,138	70,688	86,687
4R	46,234	39,062	47,872	71,656	40,930	66,568
3 (unknown)	5,062	1,083	22,970	12,657	12,585	14,295
Total	475,274	420,767	496,687	364,452	466,191	502,925

TABLE 2

CANADIAN TRAWLERS 151-500 TONS - AVERAGE CATCH 1955-1958 - TONS/DAY FISHING

	J	F	M	A	M	J	J	A	S	O	N	D
<u>COD</u>												
3L	(0.56)	(0.43)	(2.98)	5.44	4.35	5.63	2.60	1.60	6.02	7.04	1.49	(0.79)
3N	3.34	(1.55)	(1.50)	(8.08)	(4.92)	(1.12)	(0.81)	0.55	0.62	0.60	0.68	0.83
3O	3.97	1.26	1.05	3.46	5.75	2.90	(3.80)	(0.92)	(0.23)	0.76	4.23	2.94
3P	3.63	1.99	4.63	2.09	1.80	1.19	1.71	1.68	1.85	2.75	1.57	1.43
4R	-	(18.67)	(15.79)	(9.62)	8.45	(4.46)	-	(16.83)	(15.06)	(14.57)	(10.06)	-
<u>HADDOCK</u>												
3N	1.30	(4.75)	(0)	(1.58)	(3.05)	(0.12)	(0.91)	2.16	2.55	4.87	3.90	4.50
3O	11.47	15.26	20.59	14.03	9.57	14.05	(19.20)	(0.23)	(8.83)	3.78	3.90	8.60
3P	8.20	16.99	10.11	12.13	6.57	8.64	8.14	14.01	12.18	9.91	8.86	9.81

N.B. (i) Figures in brackets are from less than 100 days fishing

(ii) Redfish trips are excluded wherever possible: flounder trips not excluded

TABLE 3

PORTUGUESE TRAWLERS - AVERAGE CATCH - TONS/HOUR FISHING

	J	F	M	A	M	J	J	A	S	O	N	D	Year
3K	1956			1.87				(0.71)	(1.00)	0.88	1.53	1.39	1.39
	1957							0.38	0.75	0.75	1.73	1.64	1.17
	1958							2.25	1.13	0.75	1.04		1.34
	1959				(0.83)	2.29	1.71	1.29	0.73	(1.61)	1.00	(8.53)	1.48
3L	1956		(0.31)	2.16	1.01		4.85	1.82	1.64	1.09	1.49	1.86	1.72
	1957		-	1.49		(9.83)	2.32	1.44	1.16	0.44	1.06	0.75	1.61
	1958	1.63	(1.24)	1.41		1.33	1.37	0.92	0.41	0.43	1.11	0.74	1.23
	1959			1.77	2.25	1.37	0.25	(0.33)	0.99		(0.67)		1.62
3P	1956	2.10	1.25	1.68									1.67
	1957	1.74	2.94	1.03				(1.25)	(1.16)				2.28
	1958	0.65	1.40	1.49						(0.29)			1.28
	1959	1.54	1.21	1.67	(2.45)	(1.58)							1.60
4R	1956		1.88	1.41									1.79
	1957		1.62	1.93				(1.44)	(1.22)				1.72
	1958	2.40	1.70	1.34									1.57
	1959			(1.15)									(1.15)

N.B. Figures in brackets represent less than 100 hours fishing

TABLE 4

TONS OF COD LANDED PER HOURS FISHING

	1956	1957	1958	1959	1960	1961
PORTUGUESE TRAWLERS						
Newfoundland	1.42	1.38	1.15	1.27		
Greenland	3.12	2.33	2.08	1.19		
ENGLISH TRAWLERS						
Greenland	1.48	1.66	1.00	1.38	0.86	0.98
"White Sea"	0.62	0.45	0.44	0.48	0.39	0.43
Norway coast	0.70	0.49	0.47	0.46	0.36	0.32
Bear Island	1.25	0.72	0.66	0.66	0.58	0.71
Iceland	0.53	0.51	0.44	0.37	0.33	0.26