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ANNUAL MEETING - JUNE 1970Recent events in Canadian Atlantic herring fisheries

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The Canadian Atlantic herring fisheries increased five-fold during the 1960's. This rapid expansion was accompanied by a change from the traditional fixed gear operation using weirs, traps and gillnets for food and bait herring to one dominated increasingly by highly mobile purse-seine (and very recently M.W.F.) fleets serving a new meal and oil industry concentrated in a relatively few ports of landing. These features of the new Canadian herring industry, and the rapidity of the expansion have made it difficult for details of the change to be fully documented. In particular, the system of recording herring 'landings' at points of sale and disposal rather than dealing with the catch location, a system that may be adequate for fixed gear fisheries, cannot cope fully with a fishery in which mobile units can switch rapidly from one area to another in its day-to-day operations.

The stock situation for herring of the western Atlantic is unusually complex and not well understood and changes in fishing area usually mean a change in the unit stock being exploited.

Despite these difficulties it has become clear that by the beginning of the 1970's there is justification for concern for the continuing success of the Canadian herring fisheries and this communication attempts to summarise the present situation on the basis of the admittedly incomplete information at present available.

Table 1 lists Canadian herring landings for the years 1961 to 1969 by ICNAF areas and divisions. The increase in landings began in Div. 4X in 1964 and 1965; in 1966 the Newfoundland fishery in Subarea 3 and Div. 4R began its period of expansion and in 1967 the Gulf of St. Lawrence fishery (4T) showed its first significant increase. (The earlier increase in 4T landings in 1962 in Table 1 represents the last stages of recovery of the herring stocks there from the effects of a fungal epizootic epidemic of the 1950's (Tibbo and Graham, 1963)).

Division 4X

There are two major Canadian fisheries in Div. 4X. On the New Brunswick side of the Bay of Fundy a long established weir fishery exploiting mainly 2-year-old 'sardine' herring (McKenzie and Tibbo, 1960) has been augmented recently by a purse-seine fishery. On the Nova Scotia southwest coast weir and gillnet fisheries have been superceded as the major fisheries by the new purse-seine fishery centred on the Lurcher-Trinity area.

The Nova Scotia coastal fishery exploits an autumn-spawning stock which is generally considered to be distinct from herring stocks to the south, in particular the Georges Bank autumn-spawning herring (Anthony and Boyar, 1968). The New Brunswick sardines have often been hypothesised as representing the progeny of these Nova Scotia adults but the evidence is by no means conclusive (Tibbo, 1968) and there is some indication that no direct relationship exists between the two stocks on opposite sides of the Bay of Fundy (Iles, this meeting). The two Fundy fisheries are, therefore, best treated separately.

Table 2 gives information on landings listed by gear type and for the period 1963-1969.

The Nova Scotia Fishery

In Fig. 1 the landings for the Nova Scotia seiner fleet are compared with those for all other gears combined. It shows that the increase in total catch has resulted from the new purse-seine fishery. There has been no marked change in the seasonal catch pattern; both the traditional weir and gillnet fisheries and the new seine fishery record most of their catch in the summer months (June to October). There has been a change in the size and age structure of the catch.

Size and age structure of the catch

The gillnet fishery exploited adult fish used for food, the common mesh size being $2\frac{1}{2}$ - $2\frac{3}{4}$ inches (63-69 mm). The weir fishery based on St. Mary Bay and along the Fundy shore of Digby Neck caught, very largely, 'sardine' herring in their second year of life although adult fish are also caught on occasion more especially along the Fundy shore.

The purse-seine fishery developed specifically as an adult fishery concentrating on prespawning and spawning schools found in a relatively small area near the Lurcher and Trinity Shoals, and for most of the period of expansion adult fish predominated in the catch (Messiah et al., 1968). In 1968, 2-year-old herring were also caught in the summer in the Lurcher-Trinity area, although these were avoided by seiners, if possible, because they enmeshed in the nets. In 1969 the same year-class (1966), still predominantly immature, was caught in large numbers in the main fishing area; they made up about 50% of the catch in numbers and about a third of the total weight. This represents a new and possibly transient development. The 1966 year-class seems to be an unusually large one and in both 1968 and 1969 large, stable, concentrations of adult herring, capable of sustaining a fishery over a period of days or weeks, were much less in evidence than in earlier years. More effort was diverted in 1969 towards the more scattered, less densely crowded, but relatively abundant schools of the younger fish.

Fleet changes

Up to 1965 the seiner fleet was made up of about 20 small (60 ft) wooden vessels. Fleet expansion from 1965 to 1967 was very rapid and some 50 units were added. These included about 20 units in the 50-60 ft range, the same number of boats in the 60-100 ft range and about 10 larger units up to 140 ft. Of these larger units three were midwater trawlers. At the same time larger seines were used by the whole fleet, from 200-300 fathom X 50 fathoms rather than 100-150 fathoms X 15-25 fathoms. Only a few units have joined the Nova Scotia fleet since 1967, and these are all large steel boats and include both seiners and midwater trawlers.

Most of the fleet concentrate their effort in the Nova Scotia fishery but in 1969, after relatively poor fishing early in the season, seven of the larger units including three M.W.T. transferred operations to the Gulf of St. Lawrence. Some annual visitors from the Newfoundland fishery also left early in 1969. Most of the Nova Scotia fleet land in one of three ports, Saulnierville, Yarmouth, and East Pubnico, but after July in the 1969 season about 20 small units landed their catch in New Brunswick and Maine ports. Offshore effort by the Nova Scotia fleet directed towards Georges Bank and the Massachusetts and Maine areas has been sporadic and never sustained. The Nova Scotia fishery is almost entirely an 'overnight' fishery, boats leaving in the late afternoon and returning next morning about 12 hours later.

Total catch and relative abundance

Landings from the Nova Scotia fishery increased from 1963 to 1968 but declined sharply in 1969. This decline was partly due to a reduction in effort but mainly the result of a decline in abundance.

Table 3 gives the results of the analysis of log-book records of individual boats of known experience and capability. All of these boats are in the 50-70 ft range; under the prevailing conditions these smaller boats have outperformed the larger units on the basis of available catch statistics.

	1966	1967	1968	1969	1966	1967	1968	1969
Boat	Metric tons				Catch/night's fishing			
1	4271(70)	4605(70)	4244(64)	2697(66)	61.0	65.8	66.5	40.9
2	8100(70)	6646(63)	5800(70)	3000(50)	115.7	105.5	82.9	60.0
3	5501(68)	3500(55)	2449(51)	1589(53)	30.9	63.6	48.0	29.9
4			2615(64)	2098(54)			40.9	35.9
5			2795(48)	2472(65)			58.2	38.0
					Mean		59.3	41.5

Table 3. Nova Scotia fishery. Seasonal catch data.

(Number of nights' fishing for the season in brackets).

For each boat the catch/night fell in 1969; boat 4 entered the fishery in 1968 as a relatively inexperienced unit and showed only a small drop in catch/night in 1969. The average decline between 1968 and 1969 is 30%, but when 1969 is compared with the years 1966 and 1967 a fall in catch/night of about 50% is indicated. If the 1969 catch of the 1966 year-class is discounted so that catches of adult fish only are compared, there is a 50% decline in the catch/night from 1968 to 1969.

The New Brunswick Fishery

The breakdown of landings by gear for New Brunswick for the years 1963-1969 is shown in Fig. 2.

The weir fishery extends from the U.S. border to Saint John, about halfway along the western shore of the Bay of Fundy. Landings recorded from this fishery have not varied greatly over the period and, as with the Nova Scotia fishery, the increase in the New Brunswick fishery in the late 1960's is accounted for by the increased seiner activity.

The New Brunswick weir fishery has a long history (McKenzie and Tibbo, 1960) and exploits very largely 2-year-old 'sardine' herring (Messiah, et al., 1968) on which a canning industry is based. It is a summer seasonal fishery (May to October) and since 1966 has been protected by the exclusion of purse seiners from the area during the main weir season.

The purse-seiner fleet fishing New Brunswick waters is made up of small boats based on Grand Manan and Campobello, two islands at the entrance of the Bay of Fundy. These join the Nova Scotia fleet during the summer 'closed' season in New Brunswick and seine on the New Brunswick side of the Bay during the early and late months of the year only, when they then exploit very largely 'sardine' sized herring. The increase in seiner landings for the New Brunswick section of the Bay thus involves an extension of the season and a higher degree of exploitation of young herring.

Little detailed information on the fishing operations and catch rates for this fleet is available however. Their traditional markets are in New Brunswick and a considerable proportion of their catch is transported across the Bay of Fundy from the Nova Scotia fishery to these markets. Weir catches in Nova Scotia are also shipped across the Bay, and much of the difficulty in assessing the degree of exploitation of the herring stocks in the Bay of Fundy is caused by this transfer of catches and the recording of an, at present unknown, proportion as New Brunswick fish.

It is for this reason that the decline in the New Brunswick catch in 1969 is thought to be more marked than is indicated in Table 2. The indications are that in 1969 the cross-bay traffic into New Brunswick was more marked than in earlier years, and certainly, records from individual weirs indicate a greater fall-off in weir catches than the 20% indicated in the table.

The Bay of Fundy fisheries for a long time were dominated by the New Brunswick weir fisheries and could then properly be described as 'juvenile' fisheries. The important effects of the recent spectacular increase in the Bay of Fundy herring fisheries have been (a) to shift the main centre of fishing activity to the Nova Scotia side of the bay, and (b) to lead to a greater exploitation of adult fish.

The Nova Scotia stocks are generally considered to be biologically distinct from the Georges Bank herring complex (Anthony and Boyar, 1968) and any increase in their exploitation, whether of adult or juvenile stages, would not be expected to affect the Georges Bank stock situation. The parental stock of the New Brunswick 'sardine' is still in doubt, but even if they are Georges Bank stock, any effect of the increased exploitation of herring in New Brunswick waters in the mid 1960's would not be felt in the adult fishery until the late 1960's; two or three years would elapse before the 'sardine' recruit to the adult fishery.

While, then, a marked increase in the Fundy juvenile fisheries should be viewed with concern for the future, there is no reason to suppose that events in the Fundy fisheries are related to the decline in the Georges Bank stock during the 1960's (Studenetsky, 1969).

Division 4T. Gulf of St. Lawrence

Landings statistics for the Gulf of St. Lawrence herring fisheries covering the period 1933-1968 are listed and discussed by Tibbo et al. (1969). Total landings rose slowly and unevenly from 20,000 metric tons in the early 1930's to about 40,000 metric tons in the early 1950's but an epidemic fungus epizootic resulted in a sharp decline in the late 1950's and was followed by recovery in the early 1960's. The epizootic appeared to affect spring spawning stocks more than autumn spawners (Tibbo and Graham, 1963) but the basic structure and organisation of the fishery and its reliance on inshore gear, mainly gillnets, and fishing spawning concentrations was not altered.

The whole picture has been transformed in recent years since purse seiners became active in 1966. Table 4 compares purse-seine landings with total landings and demonstrates that the dramatic increase in the Gulf herring fisheries has involved seiners almost entirely (although M.W. trawlers are now becoming active).

The seasonal distribution of effort and landings has also changed. As recently as 1965 the Gulf fishery was very largely a spring fishery and over 80% of landings were recorded in April, May and June, much of it from the Magdalen Island spring-spawner fishery. In 1968 only 30% of the total Gulf landings were made in these months and in 1969 only 20%. Monthly landings for these years are given in Fig. 3 to illustrate these changes. It would appear that the Magdalen fishery is smaller both absolutely as well as relatively. It is also clear that the 1969 increase occurred in the two months July and August; catches for September and later were unchanged from 1968.

Log-book records are available for a section of the purse-seine fleet operating in the Gulf and indicates information for individual boats which have taken part in the fishery from its beginning. For recording purposes the Gulf is divided into areas shown on the map (Fig. 4). Scrutiny of log books indicates that some of these areas can be subdivided into divisions which represent significant changes in seining activity.

Area 115 includes the Magdalens and extends towards the entrance of the Gulf. Three fishing areas can be delineated. The area of the Magdalen Island spring spawning fishery which is an inshore fishery centred on Pleasant Bay and in which seiners now take part, the area between Cape North and St. Paul Island off Cape Breton Island, and the area centred on Bird Rocks north of the Magdalens and near the edge of the Laurentian Channel.

Area 109 includes American Bank off the Gaspé peninsula the major centre of summer seining operations, but besides this offshore fishery in 109 there is a significant shift in operations inshore into shallow water along the Quebec shore as can be fished by seiners. An "inshore" area of 109 is therefore treated separately.

The seasonal distribution of purse-seiner effort has been followed by tabulating the number of days successful fishing in each of the log-book areas and divisions for fortnight periods throughout the year. Results from the logs of about a dozen boats are given in Table 5.

The overall picture that emerges is of a migration of fish into the Gulf beginning in late April and an exodus which begins in September. The data presented in the table together with information given in log-books under the heading 'remarks' allow the following hypotheses to be suggested.

1) There is an influx of herring through the southern entrance of the Gulf in April and the timing of this movement makes it entirely possible that it involves Chedabucto Bay fish (see below) and/or herring recorded as caught in quantity in the early months of the year on Banquereau as moving towards Cape Breton in the spring (Konstantinov and Noskov, this meeting).

2) This does not exclude the possibility that Newfoundland fish also move into the Gulf; a westerly movement of herring along the south Newfoundland coast towards Port aux Basques in late winter is followed into the Gulf towards St. Pauls Island and Bird Rocks by seiners operating in the Newfoundland fisheries.

3) the Magdalen spring spawners could come from either Newfoundland or from the general Banquereau area. Records of spent fish in the Bird Rocks area and to the northwest along the edge of the Laurentian Channel suggests that they move into the Gulf to feed after spawning.

4) The main migration route appears to be along the southern edge of the Laurentian Channel and movement into the Gulf is rapid; no large stable populations have been found in the early part of the season at Orphan Bank.

5) American Bank is a major feeding area in the late spring and throughout the summer; there is a possibility that herring "spill over" southward from here to move towards P.E.I. and the New Brunswick shore.

6) The American Bank fishery exploits both feeding herring and also pre-spawning herring; which are followed inshore as they move to their spawning grounds. This accounts for the "inshore" fishery near American Bank itself and those in the Bay of Chaleur and the North Gaspé peninsula.

7) In late summer and fall herring move towards Orphan Bank and the area of distribution of fishable concentrations is extended. Movement out of the Gulf in the fall is therefore not as rapid as is the influx although both movements appear to follow the southern edge of the Laurentian Channel.

There seems to be little doubt that herring stocks fished in the summer in the Gulf of St. Lawrence are exploited also by fisheries outside the Gulf although the complexity of the stock situation will make it difficult to identify individual components. Canada has already initiated programmes to follow these suspected movements in and out of the Gulf by tagging herring at Newfoundland (March 1970) and at the Magdalen Island spring spawning fishery (May 1970). Other tagging operations are planned for 1970. The tagging of winter Banquereau fish is desirable.

Catch rates for 1968 and 1969 by months are listed in Table 6 for individual purse seiners. Each of the boats represented, fish similar gear and operate in a similar way. The data are limited but there is no indication of any great change in catch rate between the two years. For July and August, peak months for the fishery, the catch per day's fishing is almost identical so that unless there has been a large change in availability or in efficiency no major change in abundance has occurred and the increase in catch in 1969 represents the effect of an increase in effort.

	1968		Mean		1969		Mean		
May	40 (25)	155 (99)	97 (62)						
June	63 (31)	42 (37)	52 (34)	48 (23)	60 (44)		54 (33)		
July	147 (51)	107 (35)	72 (34)	146 (49)	118 (42)	122 (46)	115 (55)	129 (66)	122 (56)
August	111 (50)	84 (35)	111 (39)	153 (60)	115 (46)	122 (58)	111 (62)	125 (67)	119 (62)
September	175 (76)	109 (68)	122 (67)	127 (69)	133 (70)	104 (78)	115 (90)	73 (53)	97 (74)
October	81 (81)		102 (102)	72 (36)	85 (73)				
November	184 (85)			76 (51)	130 (68)				

Table 6. Monthly catch rates for individual purse-seiners in the Gulf of St. Lawrence as metric tons per day's fishing and as metric tons per set (in brackets).

The diversion of effort from the Nova Scotia fishery to the Gulf in 1969 is a trend which is likely to continue, for catch rates in the Gulf are high, but the extent to which Gulf stocks can withstand extra effort is unknown, as is the degree to which these stocks are exploited outside the Gulf fisheries.

Division 4W

The occurrence of herring in concentration in the Chedabucto Bay area, between Nova Scotia and Cape Breton Island has been known for some time. In 1969 a localized fishery on these herring developed involving about a dozen units, including five M.W.T.'s. From mid-January to late March an estimated 20,000 tons of herring from the Chedabucto Bay fishery were landed at Yarmouth, Nova Scotia. In addition herring were supplied to a local reduction plant at Canso.

The fishery in 1970 was considerably smaller, although detailed catch data are not yet available. Samples of herring from the 1970 fishery indicated that a wide range of size occurred in the area. One-year and two-year-old herring were found inshore but the bulk of the fishery was made up of mature fish in the spent or spent-recovering stages.

The distribution of M.W.T. effort in the general area from late fall 1969 to March 1970 indicated a possibility that the Chedabucto Bay area may well be an overwintering area for Gulf herring.

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	1961	1962	1963	1964	1965	1966	1967	1968	1969
4X Nova Scotia	39,261	32,916	22,753	40,511	60,638	99,276	104,902	138,860	96,936
New Brunswick	18,614	34,403	41,451	49,748	63,045	89,002	85,081	87,511	73,141
4X TOTAL	57,875	67,319	64,204	90,259	123,683	188,278	189,983	216,371	170,077
4W	1,977	1,788	2,161	1,868	1,364	1,199	1,028	1,206	6,154
4V ⁿ	789	749	526	411	281	143	296	239	750
4T	18,822	34,430	39,900	39,333	44,254	36,905	62,636	102,496	142,703
4S	57	85	47	31	47	78	67	55	44
4R	1,574	1,983	2,274	5,148	4,809	4,962	6,019	4,178)	
3	4,058	5,151	5,756	3,335	8,128	23,096	78,411	155,154)	167,308
5	-	144	-	636	30	47	6,532	35,171	8,339
GRAND TOTALS	85,152	111,649	115,868	141,021	182,596	254,708	344,972	524,870	495,375

Table 1. Total Canadian Herring Landings 1961-69 ICNAF Divisions - Metric Tons

	1963	1964	1965	1966	1967	1968	1969
Nova							
Seines	9,880	20,568	31,564	88,901	96,992	123,866	62,602
Scotia							
Gillnets	6,343	7,622	8,441	6,833	8,631	8,216	5,264
Weirs & Traps	5,345	12,673	10,449	4,065	6,713	5,397	4,491*
Mid-water Trawl	-	-	-	-	805	1,381	1,478
TOTAL	21,568	40,863	50,454	99,799	113,141	138,860	73,825
New Brunswick							
Seines	12,671	21,922	29,256	42,299	49,272	48,108	34,224
Weirs & Traps	29,279	27,337	33,685	39,605	35,931	39,403	31,901*
TOTAL	41,950	49,259	62,941	81,904	85,103	87,511	66,125
Unknown	1,691	1,657	12,650	943	1,115	466	820
GRAND TOTALS	65,209	91,769	126,045	189,646	199,459	226,837	140,757

Table 2. Division 4X landings by gear type for the two major fisheries.

* Estimated from total landings and gear-breakdown for the years 1966-1968.

	1963	1964	1965	1966
Seine Landings	10	5	28	2,249
Total Landings	39,900	39,333	44,254	36,905
Seine Landings as % Total	-	-	-	6.09%

	1967	1968	1969
Seine Landings	17,283	46,647	110,237
Total Landings	62,636	102,496	142,603
Seine Landings as % Total	27.6%	45.5%	77.3%

Table 4. Division 4T: Gulf of St. Lawrence. Landings (metric tons) for purse-seiners compared with total landings.

Area	April		May		June		July		August		Sept.		Oct.		Nov.		Total
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
116 Entrance	5	10															15
Bird Rocks	9	5	4										6		9	2	35
Magdalen Is.	17	12	7	1													37
112 Orphan Bank				4							39	20					63
109 American Bank	8	15	18	51	91	51	49	64	49	68	5	6					476
"Inshore"				2	9	71	39	14	1	1							137
110 Bay of Chaleur	1	2			19	9	3	1									35
107 St. Lawrence dist. (South Shore)	2			1	2	14	29	13	3	1							65
115) Southern Gulf 111)		2		4													6
	31	38	26	23	62	102	155	126	95	93	90	5	12	9	2		

Table 5. Seasonal and area distribution of successful fishing in the Gulf of St. Lawrence.

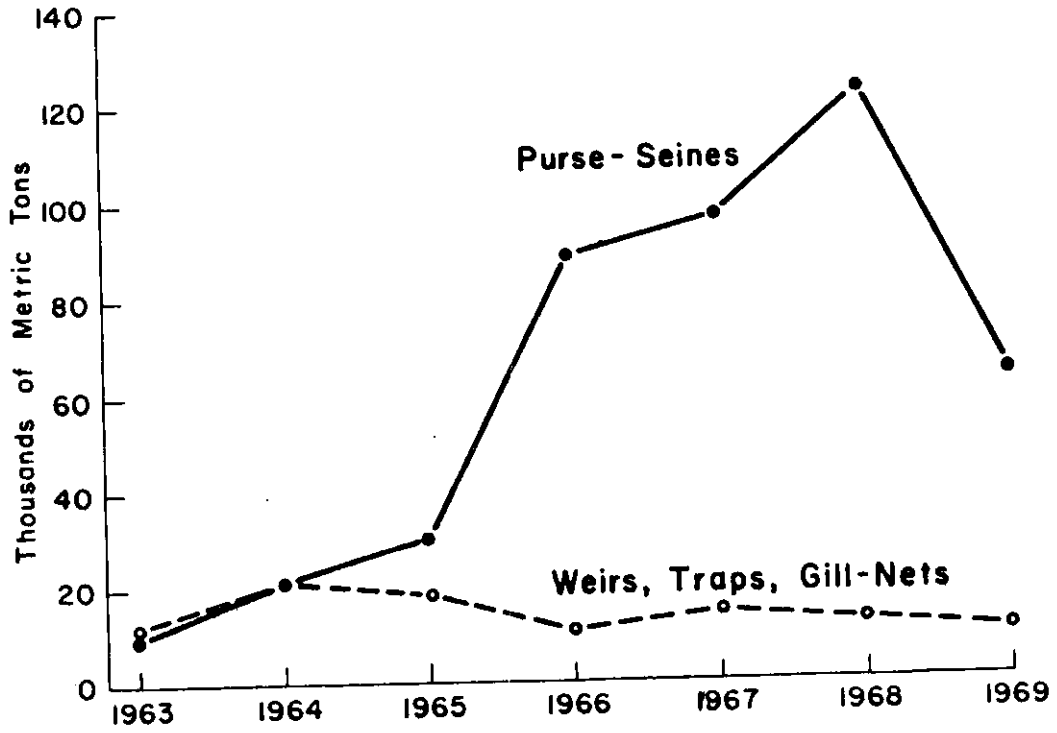


Fig. 1. Division 4X, Nova Scotia Fishery. Purse-seine landings compared with landings from other gears.

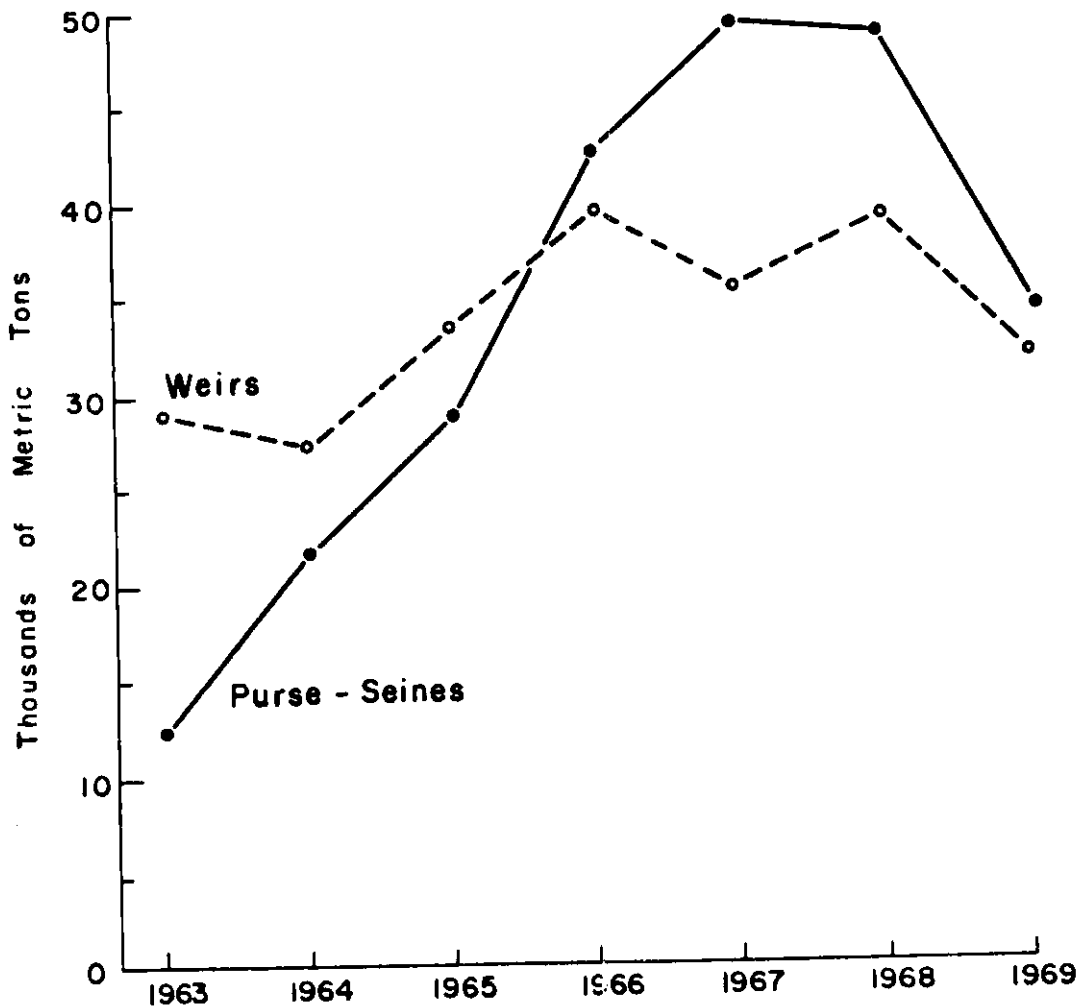


Fig. 2. Division 4X, New Brunswick Fishery. Comparison of weir and purse-seine landings.

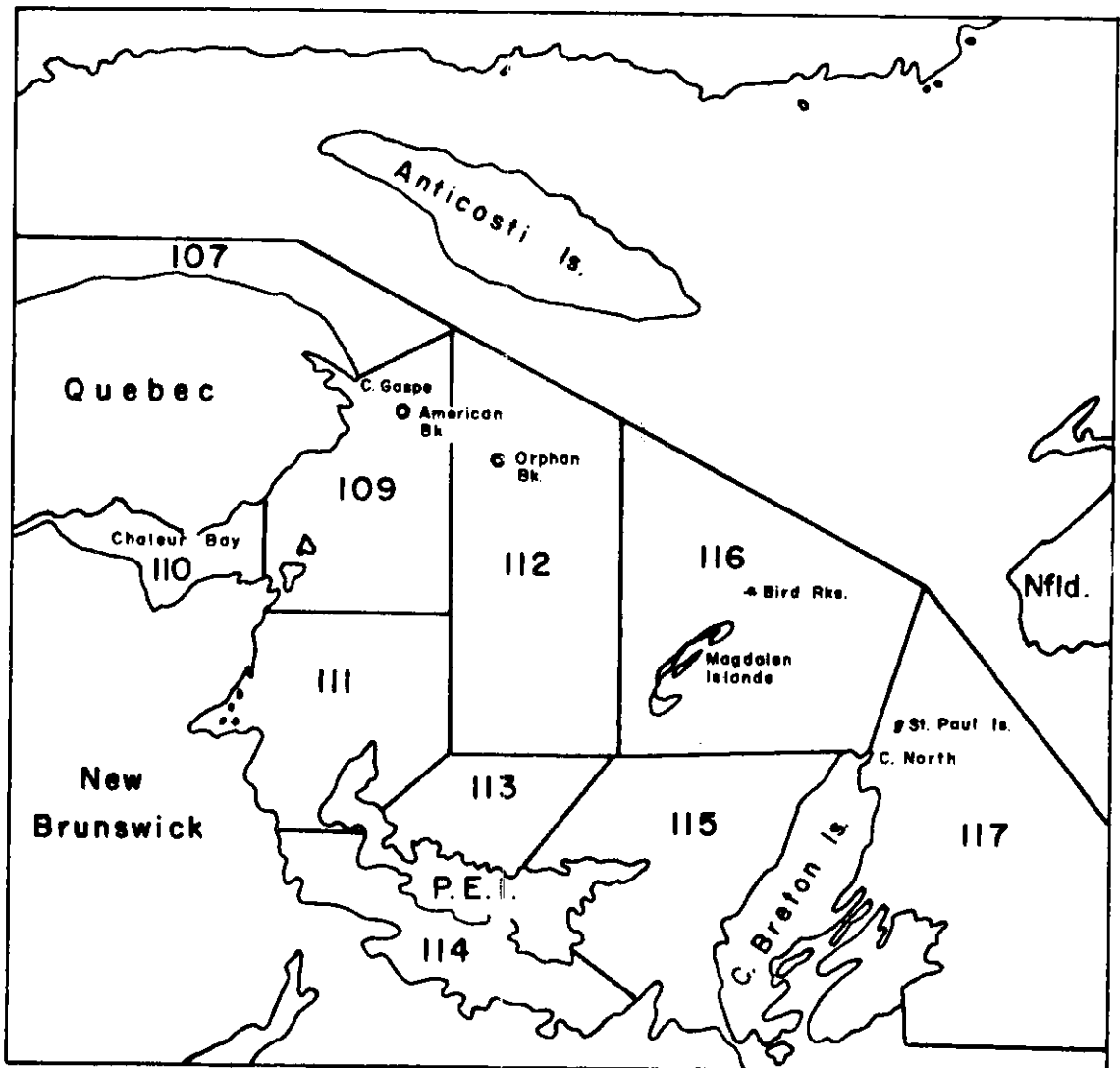
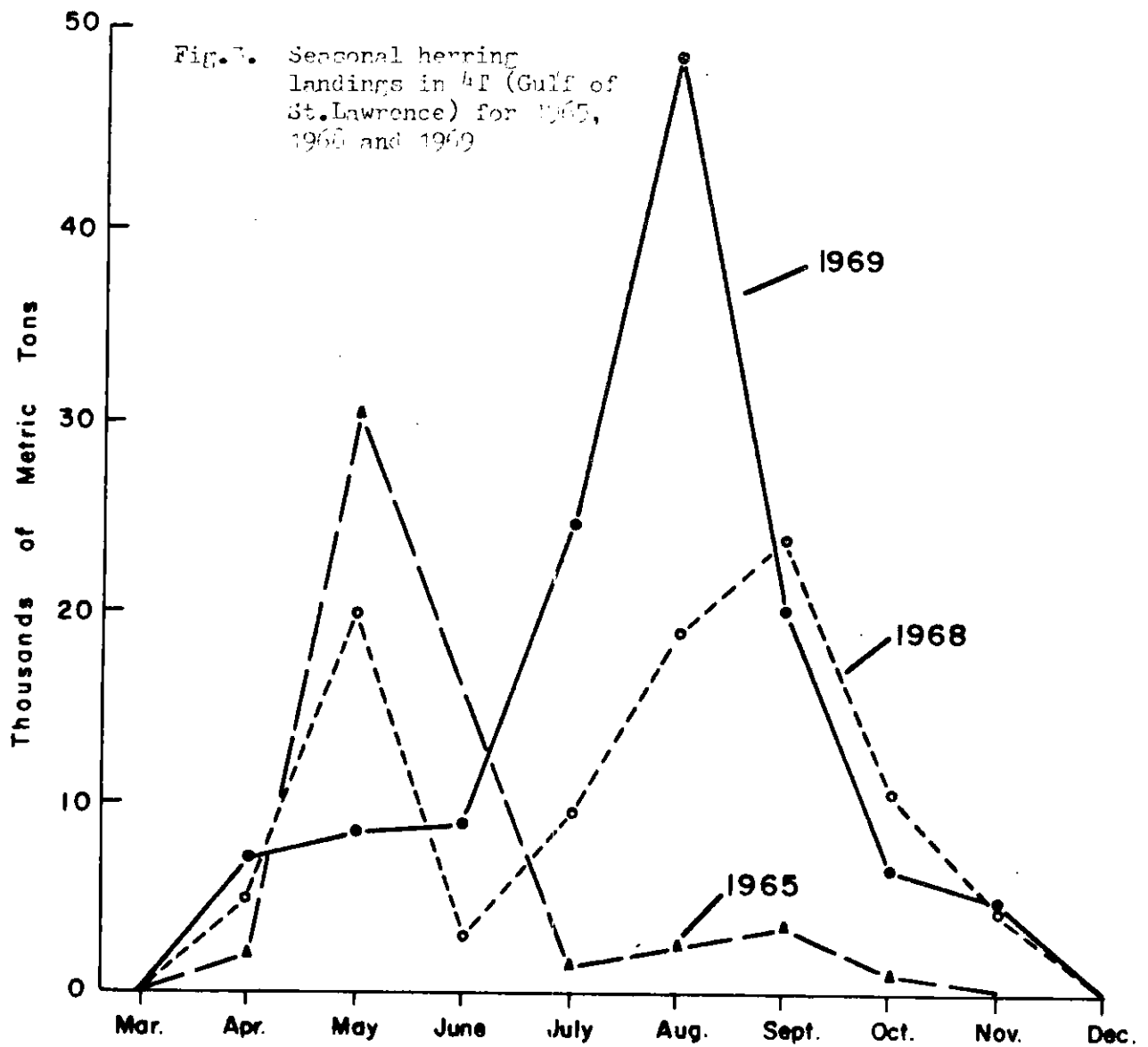


Fig. 4. Map of Gulf of St. Lawrence showing fishing areas.