

International Commission for



the Northwest Atlantic Fisheries

Serial No. 3331
(D.c.3)

ICNAF Res.Doc. 74/95

ANNUAL MEETING - JUNE 1974

The Canadian 4VWa herring fishery: analysis of the 1973-74 catch, and the distribution of fishing activity and catch per unit effort from 1971-74.

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INTRODUCTION

The herring fishery in ICNAF Divisions 4VWa has been a relatively recent one, with large catches first appearing during the 1968-69 fishing season. (Uncertainty about stock interrelationships makes any interpretation of events in the fishery difficult.)

For the purposes of management, it has been assumed that the stock has three components; one in each of the ICNAF Divisions 4Vn, 4Vs, and 4Wa. There is however little available biological evidence to confirm this hypothesis. The fishery on the 4Vs component has virtually collapsed. During the 1968-69 and 1969-70 seasons, catches of over 70,000 and 60,000 mt. respectively were taken, but have since declined to less than 2,500 mt. seasonally. The more inshore Canadian fishery however, has been rather stable with the season catches exceeding 25,000 mt every year since 1968.

Relatively little background information has been presented on the development, trends, or geographical distribution of the Canadian 4VWa fishery during the season. Stobo et al (MS 1973) have already reviewed the catch trends of the total fishery and the age composition of Canadian catches in 4Vn and 4Wa from the 1969-70 to the 1972-73 seasons.

The purpose of this paper is to examine the 1973-74 Canadian fishery and to present a more comprehensive description of the Canadian fishery in terms of seasonal movement and catch per unit effort from 1971-74.

MATERIALS AND METHODS

Canadian catch information for the period 1971-74 was reworked using log-book records, purchase slips and the weekly reports of field staff to obtain the best minimum monthly catch estimates possible. The same data source provided information on the geographical distribution of catch and effort over time for a large proportion of the catch. Using these data, trends in the geographical distribution of the fishery were determined and monthly catch per unit effort values calculated. No such information is available for the fishery prior to 1971. The unit of effort used in the CPUE is defined as a day of successful fishing. Due to the nature of the data source, the presently inadequate log book coverage, and the generally unfavorable weather conditions, it would prove difficult to account for searching time or to use a standard week in the calculations.

During the 1973-74 season, data collection was intensified for the 4VWa fishery. The data collected included 188 random length frequency samples (100-300 fish per sample) and 96 length stratified samples (2 fish from each half-centimeter length group) for more detailed biological analysis.

Ages were determined as described by Hunt et. al. (MS 1973). Two age-length keys were calculated, one for November-December 1973, and one for January-February 1974. Deriving two keys was necessary since the fishing season extends over the arbitrarily assigned January 1st. birthdate. Also, the fishing activity was almost solely prosecuted in 4Vn in 1973 and 4Wa in 1974, in widely separated geographical areas, thus the 1973 and 1974 catches are weighted separately.

Monthly length-weight relationships to be used in the weighting procedure were derived from observed mean weights by month per centimeter interval.

The weighting procedure used to determine numbers at age is outlined below.

1. Estimated catch, date, and location were available for almost all landings made during the season, and for all landings from which length frequency and detailed samples had been taken. Therefore the length frequency samples were first used to convert individual catches into numbers of fish at length.
2. The numbers of fish at length for individual catches were then grouped (by a visual comparison of modality) into time intervals and geographic areas and a revised length frequency produced. In all but one instance, the time intervals were limited to no more than 15 days, although modal comparison suggested that longer time periods were possible.
3. The revised length frequencies were applied against the total catch in that period and area to obtain numbers at age.
4. These numbers at age were then summed for monthly and ICNAF Division totals.

RESULTS

Catch Statistics

Tables 1 and 2 present the Canadian catch statistics for ICNAF Divisions 4Vn and 4Wa since the beginning of the mobile fishery in 1968. The data are presented on the basis of a fishing season from July 1 - June 30. Re-analysis of the catch statistics since 1971-72 has resulted in somewhat different monthly, and yearly, figures than previously reported.

The catches in 4Vn (Table 1) gradually increased to over 17,000 mt. in 1972-73 and decreased by almost 11% to 15,000 mt. in 1973-74. The fishery in 4Vn in 1973-74 occurred almost entirely in the November-December period. In 4Wa (table 2) the peak catch occurred in 1970-71 and subsequently declined to less than 8,000 mt. in 1972-73. But catches in 1973-74 increased again to more than 25,000 mt. This was the catch level that has been taken in 4Wa in four of the six seasons since the mobile fishery began.

The total Canadian catch from the 4VWa fishery ranged from 55,600 mt. in 1970-71 to 25,100 mt. in 1972-73. The catch in 1973-74, at 43,000 mt., was the second highest since the mobile fishery began.

Geographical Distribution

The 4Wa Canadian mobile fishery developed in early 1969 as a source of sardines to sustain the Bay of Fundy industry over the winter. In that first year over 25,000 mt. were taken, primarily within the confines of Chedabucto Bay. The mobile fishery in 4Vn however did not develop to any extent until the 1971-72 season when fishing vessels moving from the Gulf of St. Lawrence discovered large concentrations of herring 4Vn.

Figs. 1, 2, and 3 present the compiled information from 1971-74 on the geographical distribution of Canadian catch and effort for specified time intervals during the fishing season for mobile units. Although there were no records of location of catch for some landings, it was possible to assign over 90% of the catch in these three years to geographical areas. The vessels operating in the fishery were predominately purse seiners greater than 70 feet in length and mid-water trawlers. Smaller purse seiners do participate, though usually in the more protected near-shore areas. Catch per unit effort (CPUE) is given for all categories that operated in the designated areas.

In 1971-72 (Fig. 1a, b), midwater trawlers commenced fishing in 4Vn in August, but catches remained small and scattered until December. Then for the duration of 1971 activity was concentrated near the southwestern portion of 4Vn with high CPUE for both large purse seiners and midwater trawlers. The fishery in 4Wa commenced in December and persisted until mid-April with the majority of the catch being taken in Chedabucto Bay between December and mid-February. About mid-February, the fishing activity moved offshore into the western portion of 4Wa. The CPUE remained fairly high throughout this fishery, although a decrease was observed in all categories between March and April. The fishery terminated in mid-April with the fleet moving north to participate in the Gulf of St. Lawrence fishery.

During the 1971-72 season, the fleet appeared to move from areas of high to areas of lower CPUE on two occasions, that is from 4Vn to Chedabucto Bay, and then to the southwestern portion of 4Wa. This movement, and the decline in CPUE, could be the result of the fishery slowly depleting a large froup of herring migrating southward. But, at the same time, the movement of the fleet was dictated by strictly physical factors. In 1971-72, ice conditions influenced the duration of the fishery northeast of Chedabucto Bay. By the end of January, ice covered all of 4Vn and the northeastern portion of 4Wa thus terminating any fishing activity in these areas. Then on February 4, 1972, a large oil tanker grounded in Chedabucto Bay and released over 72,000 barrels of bunker C fuel oil into the water during the next two months. The drifting oil slicks fouled fishing gear and terminated fishing activity within Chedabucto Bay. Therefore, even discounting a general southwestern migration of fish, physical factors forced a southwestern movement of the fishing activity.

In the 1972-73 fishing season, the majority of the catch was taken in 4Vn (Tables 1, 2), and solely by large purse seiners. The fishery started in November, and a sustained high CPUE occurred to the end of 1972 (Fig. 2). In 1973, the majority of the fishing activity occurred in 4Wa although the distribution suggested more of a continuum with the 4Vn fishery than observed in 1971-72. The total catch in 4Wa was only 8,000 mt. and the CPUE was substantially lower than that obtained in 4Vn. Most of the catch was taken in the northeastern portion of 4Wa; little fishing activity occurred in Chedabucto Bay.

However, bad weather restricted fishing activity throughout the season and ice conditions prematurely terminated all Canadian fishing effort in 4Vwa by mid-February. No information is available on the amount of fish available after mid-February, but since substantial catches were made in February in 1972 and 1974 (Table 2) it is questionable to take the relatively small catch in 4Wa in 1973 as indicative of a serious decline in stock size.

Catches during the 1973-74 fishing season totalled 43,000 mt., the second highest for the Canadian fishery. For the first time, substantial catches were made in the Sydney Bight area of 4Vn. Between November and mid-December the fishery moved in a southerly direction toward the 4Vn-Wa boundary. In the last half of December fishing activity was essentially suspended for 10 days due to the Christmas holidays. In January, the majority of fish were taken in Chedabucto Bay and the western portion of 4Wa, with accompanying high CPUE for the participating gear types. The fishing activity moved west of Chedabucto Bay in February, in February, with a sustained high CPUE, but by February 23 ice conditions again terminated the fishery.

Catch per Unit Effort

The monthly CPUE data presented in Table 3 were calculated using a day of successful fishing as the unit of effort. Although the unit of effort as de-

ined will bias the CPUE upward by excluding unsuccessful days, the resultant values should nevertheless indicate serious declines in the stock.

In 4Vn there has been a continuous decline in CPUE since the 1971-72 season for all categories even though the total catch has increased over the 1971-72 level. The difference between 1971-72 and 1972-73 may be explained by the fact that usually only the more efficient units are involved when a new fishery develops (Table 1). But the decline between 1972-73 and 1973-74 must be interpreted as a real change in either availability or stock size.

In 4Wa the CPUE has shown an equally dramatic increase between 1971-72 and 1973-74. The increase between January-February 1972 and 1974 appears to be due primarily to increases in CPUE in the southwestern portion of 4Wa. It should be noted that even with the much reduced catch in 1972-73, the CPUE remained similar to that in 1971-72.

1973-74 Fishery

For analysis of the 1973-74 fishery, over 4,400 fish were examined for age and length-weight relationships, and over 30,000 for length frequency data, 11,600 from 4Vn and 18,500 from 4Wa.

Table 4 presents the observed mean weight at age by month for the fishery. Due to the arbitrary January 1st. birthdate, there is a year difference in age for similar mean weights between 1973 and 1974. Thus the year class has also been indicated in the Table. There is substantial variation between months at various ages, but generally the 1973 samples (4Vn) appear to have greater mean weights for older fish.

The length-weight relationship were calculated according to the equation

$$\text{weight} = a (\text{length})^b$$

The coefficients are given below

	a	b
November	0.0114	2.8738
December	0.0083	2.9727
January	0.0072	3.0040
February	0.0059	3.0533

The age-length keys from the stratified samples are presented in Tables 5 and 6. The numbers of fish at age are presented in Table 7 for the various time intervals and geographic areas, plus monthly and seasonal totals. In all cases, the 1970 year class, as 3-year olds in November-December and 4-year olds in January-February dominate the catch, but the representation of the other year classes vary substantially as the season progresses. The January period is most interesting since the time intervals really represent geographical areas. The January 1-10 period represents fish taken in the northeastern portion of 4Wa and in 4Vn (Fig. 3). Those fish taken in the January 1-22 period are Chedabucto Bay fish and the last two periods represent fish taken in the southwestern portion of 4Wa. It is obvious that the catch in the southern portion of 4Wa consists of much younger fish than northern 4Wa or 4Vn, especially in Chedabucto Bay where substantial numbers of the 1972 year class were taken.

Fig. 4 summarizes the weighted year class composition from Table 7 and the weighted length frequency composition. The 1970 year class represented 52% and 70% of the catches in 4Vn and 4Wa respectively, the 1969 year class 17% and 11% respectively, and the majority of the other year classes less than 5%. The weighted length frequencies indicate the predominance of young fish with a modal length of 27-28 cm. in both areas as well as the greater representation of older fish in 4Vn with a second mode at 35 cm.

DISCUSSION

Catch Composition and Catch per Effort Trends.

Stobo et al (MS, 1973) analysed the year class composition of the Canadian catch from the 1969-70 to the 1972-73 fishing seasons. Substantial differences were found in the catch compositions between the two areas with young fish being exploited in 4Wa and older fish in 4Vn. The catch compositions in these years, and that of the 1973-74 catch, are presented in Table 8.

Since the beginning of the higher exploitation of the 4Vn component (Table 1) in 1971-72, the fishery has become more dependent on younger fish. In 1970-71 and 1971-72, fish less than 5 years old represented less than 20% of the catch. But in 1972-73, fish less than 5 years old represented almost 40% of the catch and in 1973-74 the 1970 year class alone accounted for 52%. Despite the fact that the catch composition suggests a large 1970 year class, the total catch in 4Vn in 1973-74 decreased by 11% from the 1972-73 catch and a substantial decrease in the CPUE also occurred (Table 3).

The 4Wa fishery was started in 1968-69 as a sardine fishery with the purpose of exploiting young fish. Only more recently has the fishing activity there been also directed to adults. Thus one would expect the catch to consist primarily of the younger year classes (Table 8). In 1973-74, the catch was substantially higher than the previous year with a much increased CPUE, probably due to large 1970 year class which accounted for over 70% of the catch.

Stock Relationships

It has been assumed that there are 3 components in the 4Vwa stock, one in each of the ICNAF Divisions 4Vn, 4Vs, and 4Wa. However there is little evidence to support this hypothesis. The location of the spawning grounds and the migratory routes are unknown. The 4Vs component has virtually collapsed, with little discernible effect on the 4Vn and 4Wa components.

The fish appear in 4Vn in November and disappear from 4Wa in February-March. But the geographical distribution of the fisheries in the two areas are discontinuous in most years, in part due to extraneous factors such as the Christmas cessation and ice conditions. Thus these data neither prove nor disprove the hypothesis that the 4Wa fishery is based on fish moving southwest from 4Vn.

Differences in year class composition however imply that if such a migration occurs there has been a substantial age differential, with a higher proportion of juveniles being taken in 4Wa than 4Vn. This poor representation of juveniles in the 4Vn catches in the first two years of the fishery is difficult to explain by the above hypothesis. However the fishing effort was directed at different age groups in these two areas early in the fishery, and in the last two years the catch compositions in the two areas have become much more similar. Thus the hypothesis cannot be rejected solely by catch composition comparisons.

Further stock identity studies, by both direct (i.e. tagging) and indirect methods, are urgently required to resolve the stock interrelationships.

1975 Catch Level

Considering the 4Vn, 4Vs, and 4Wa components as a single management unit, the collapse of the 4Vs adult fishery and the trend towards a dependency of juveniles in 4Vn, combined with declining catch rates despite the appearance of a strong 1970 year class, imply that the adult abundance in the ICNAF Division 4Vwa stock complex has been substantially reduced. (The November-January catch level was 11% lower than the previous year and the CPUE for large purse seiners in 4Vn was 120 mt. in 1971-72, 101 mt. in 1972-73, and only 67 mt. in 1973-74, a decline of 44% in two years.)

The increase in CPUE in 4Wa over the two previous years and the appearance of the apparently strong 1970 year class warrants some optimism for the future. However, if the fisheries are indeed exploiting the same stock, then the exploitation of these younger fish should not be increased in order to protect the future adult stocks. Thus, if the present stock interrelationships are valid, an increased 1975 catch is difficult to justify.

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Table 1. Canadian monthly herring catch (metric tons) in ICNAF Division 4Vn for the period 1968-74. Fishing season is based on a July 1 - June 30 period.

Month	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74
7	56	42	13	5	28	18
8	-	7	-	545	10	3
9	-	-	10	8	3	-
10	271	-	-	318	-	20
11	-	-	8	953	5084	3988
12	102	-	1	4311	7683	10955
1	136	1431	1569	3991	1434	363
2	687	1624	1348	-	54	-
3	848	-	-	-	-	-
4	25	1834	16	370	624	-
5	100	11	56	60	2165	-
6	51	43	44	101	94	-
Total	2276	4992	3065	10662	17179	15347

Table 2. Canadian monthly herring catch (metric tons) in ICNAF Division 4Wa for the period 1968-74. Fishing season is based on July 1-June 30 period.

Month	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74
7	126	96	59	28	-	12
8	60	62	19	28	-	16
9	2	-	1	2	-	27
10	1	-	6	15	-	9
11	-	-	-	119	42	164
12	-	2033	3629	4200	164	1243
1	3729	5504	14676	10788	7248	16697
2	10920	6773	13965	4051	392	9623
3	8169	6667	13535	5905	-	-
4	2016	5919	6571	449	17	-
5	26	11	40	53	43	-
6	63	42	34	18	15	-
Total	25112	27107	52535	25656	7921	27791
Canadian Catch 4VWa	27388	32099	55600	36318	25100	43138

Table 3. Canadian monthly catch per unit effort values (CPUE) for herring in ICNAF Divisions 4Vn and 4Wa during the 1971-72 to 1973-74 fishing seasons. The CPUE is given for 3 categories: purse seiners greater than 70 feet in length (HPS), purse seiners less than 70 feet (hps), and midwater trawlers (MWT). Unit of effort used was days actually fishing and is given in parentheses.

Month	Fishing Season								
	1971-72			1972-73			1973-74		
	HPS	MWT	hps	HPS	MWT	hps	HPS	MWT	hps
<u>4Vn</u>									
August		54.5 (10)							
October		38.8 (9)							
November	100.3 (8)	36.3 (6)		80.8 (62)	19.1 (4)		61.6 (60)		14.1 (2)
December	106.9 (37)	88.7 (4)		99.5 (74)		24.7 (6)	88.8 (124)	35.4 (3)	27.6 (13)
January	154.0 (11)	129.1 (15)		122.9 (13)	43.6 (1)		51.9 (9)		
April		181.5 (1)							
<u>4Wa</u>									
November				14.0 (3)				54.7 (3)	
December	70.6 (46)	34.4 (8)	67.3 (10)	81.9 (2)		43.6 (3)	165.2 (4)	54.5 (1)	
January	78.6 (107)	51.8 (44)	37.4 (47)	74.6 (89)	43.6 (9)	5.5 (1)	133.1 (116)	94.7 (13)	27.2 (1)
February	79.7 (48)	36.6 (14)	28.1 (1)	97.1 (3)			128.4 (74)	54.5 (2)	11.8 (1)
March	68.2 (63)	38.1 (13)							
April	57.2 (6)	89.2 (3)							

Table 4. Mean weights (gms.) of herring by month at age taken in the 4VWa fishery between November, 1973, and February, 1974. The number of observations are given in parentheses.

		YEAR CLASS													
		1972	1971	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959+
1973	Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14+
	November (395)	36.2 (1)	83.5 (59)	145.0 (138)	186.9 (35)	234.5 (25)	265.7 (20)	281.7 (28)	324.8 (21)	335.6 (27)	369.1 (20)	386.9 (10)	342.9 (5)	405.3 (4)	434.8 (2)
	December (1113)	(0)	88.6 (90)	146.9 (383)	174.1 (155)	218.4 (82)	258.8 (73)	296.1 (61)	351.0 (67)	368.0 (92)	381.5 (57)	395.0 (33)	399.7 (11)	369.8 (4)	408.8 (5)
1974	Age	2	3	4	5	6	7	8	9	10	11	12	13	14+	
	January (1637)	35.5 (101)	83.0 (238)	135.3 (954)	180.6 (170)	227.2 (53)	268.3 (40)	295.2 (30)	324.3 (26)	325.7 (16)	308.3 (2)	393.5 (5)	(0)	357.0 (0)	
	February (1265)	33.3 (29)	75.5 (154)	124.7 (795)	173.4 (142)	221.4 (50)	261.4 (33)	278.0 (17)	314.3 (18)	322.8 (20)	344.3 (3)	336.2 (4)	(0)	(0)	

Table 5. Age-length distribution of the November-December, 1973, samples from ICNAF Division 4Vn

Length Group (cm)	Year class (Age)														Total
	72 (1)	71 (2)	70 (3)	69 (4)	68 (5)	67 (6)	66 (7)	65 (8)	64 (9)	63 (10)	62 (11)	61 (12)	60 (13)	59+ (14+)	
16	1														2
17	6	4													10
18	3	2													5
19	3	4													7
20	9	4													13
21	17	9													26
22	35	4		2											41
23	51	5		3											59
24	19	26		5											50
25	5	45		11											61
26	1	84		10											97
27		145		17	2										164
28		124		33	2	2									161
29		69		52	8	2									131
30		12		40	18	4									74
31				17	41	22	1								82
32				6	28	27	8								69
33		1			7	27	27	11							81
34					1	9	37	19							92
35						1	12	34							85
36							4	20							92
37								2							64
38								1							49
39															18
40															2
41															1
Total	1	150	538	196	109	94	90	88	119	77	43	16	8	7	1536

Table 6. Age-length distribution of the January-February, 1974, samples from ICNAF Division 4Wa.

Length Group (cm)	Year Class (Age)													Total
	72 (2)	71 (3)	70 (4)	69 (5)	68 (6)	67 (7)	66 (8)	65 (9)	64 (10)	63 (11)	62 (12)	61 (13)	60+ (14+)	
12	2													2
13														4
14	2	1	1											12
15	12													37
16	37													49
17	45	4												32
18	24	8												18
19	10	8												36
20	2	33	1											73
21		71	2											127
22		102	25											227
23		112	115											249
24		42	207											291
25		10	281											328
26		1	322	5										364
27		1	336	28	2									365
28			296	66	1									248
29			142	105	13	2								106
30			22	69	37	6								79
31			1	35	39	12								62
32				6	10	28								53
33					1	24								73
34			1		1	3								50
35														18
36														9
37														2
38														1
39														1
Total	134	393	1753	314	103	75	47	44	36	5	9	2		2915

Table 7. Numbers (thousands) of herring at age removed during the 1973-74 4VWa fishery for specified time periods (and geographical areas when necessary¹). Totals may differ from summed values due to rounding to thousands of fish.

Time Interval	Age														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14+	
November (4Vn)															
11-24		365	2700	1302	776	652	759	740	1133	747	405	141	75	49	9852
18-30	28	815	7677	1868	305	130	24	7	5						10866
Total	28	1181	10378	3170	1082	782	783	748	1139	747	405	141	75	49	20718
December (4Vn)															
1-15	9	965	25866	8574	2596	1688	1894	1649	2107	1445	770	246	124	81	48019
16-31	3	1238	2538	892	255	154	141	126	173	136	107	29	36	28	5863
Total	12	2203	28404	9466	2852	1843	2035	1776	2281	1581	877	276	160	109	53882
January (4Vn)															
1-10		1	75	5713	2789	1143	1261	1241	1884	1868	361	1388	29	564	18322
1-22 (4Wa ²)		1930	2701	8905	2304	402	229	136	195	178	37	44	9	9	17084
6-12 (4Wa)		0	301	13017	2126	602	401	228	202	171	14	40	3	9	17119
20-31 (4Wa)		61	1568	33641	4509	1088	767	540	459	361	49	63		30	43142
Total		1993	4646	61278	11729	3236	2659	2145	2741	2580	462	1536	41	613	95667
February (4Wa)															
1-9		203	2087	28834	3069	463	295	199	146	119	15	12		20	35469
10-23		311	1783	22041	2383	473	367	268	243	210	33	26		5	28150
Total		515	3870	50876	5453	937	663	468	389	330	49	39		25	63620
Nov-Dec 1973															
	40	3384	38728	12636	3934	2625	2818	2524	3420	2328	1282	417	235	158	74600
Jan-Feb 1974															
	2508	8516	112154	17182	4173	3322	2613	3130	2910	511	1575	41	638		159287

¹ Geographical areas determined by comparison of length frequency samples between areas. The general location of the time intervals are indicated in the table.

² Chedabucto Bay

Table 8. Year class composition of the 4Vn and 4Wa fisheries from 1969-74. The 1973-74 composition was derived from the calculated numbers at age. The compositions for earlier years were derived from weighted age-length distributions (Stobo et al, MS 1973)

	1972	1971	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960+
<u>4Wa</u>													
1969-70	-	-	-	1.4	14.3	22.8	35.1	9.9	10.0	3.5	1.8	1.2	0.1
1970-71	-	-	0.4	25.6	22.1	10.4	15.3	7.7	10.1	4.5	1.8	1.0	1.2
1971-72	-	-	2.6	11.0	33.7	11.8	15.3	10.8	8.6	3.6	1.4	1.3	-
1972-73	-	10.7	28.4	31.9	8.1	5.1	7.1	2.8	2.1	2.0	1.2	0.5	0.1
1973-74	1.6	5.4	70.4	10.8	2.6	2.1	1.6	2.0	1.8	0.3	1.0	-	0.4
<u>4Vn</u>													
1970-71	-	-	-	-	0.7	5.8	12.3	14.7	13.9	19.5	5.4	12.4	15.3
1971-72	-	-	-	1.5	4.7	3.5	8.6	9.4	17.0	14.3	17.2	18.7	5.1
1972-73	-	0.1	5.9	14.5	19.2	9.0	8.5	5.8	15.0	11.0	6.5	2.0	2.5
1973-74	0.1	4.6	51.9	16.9	5.3	3.5	3.8	3.4	4.6	3.1	1.7	0.6	0.5

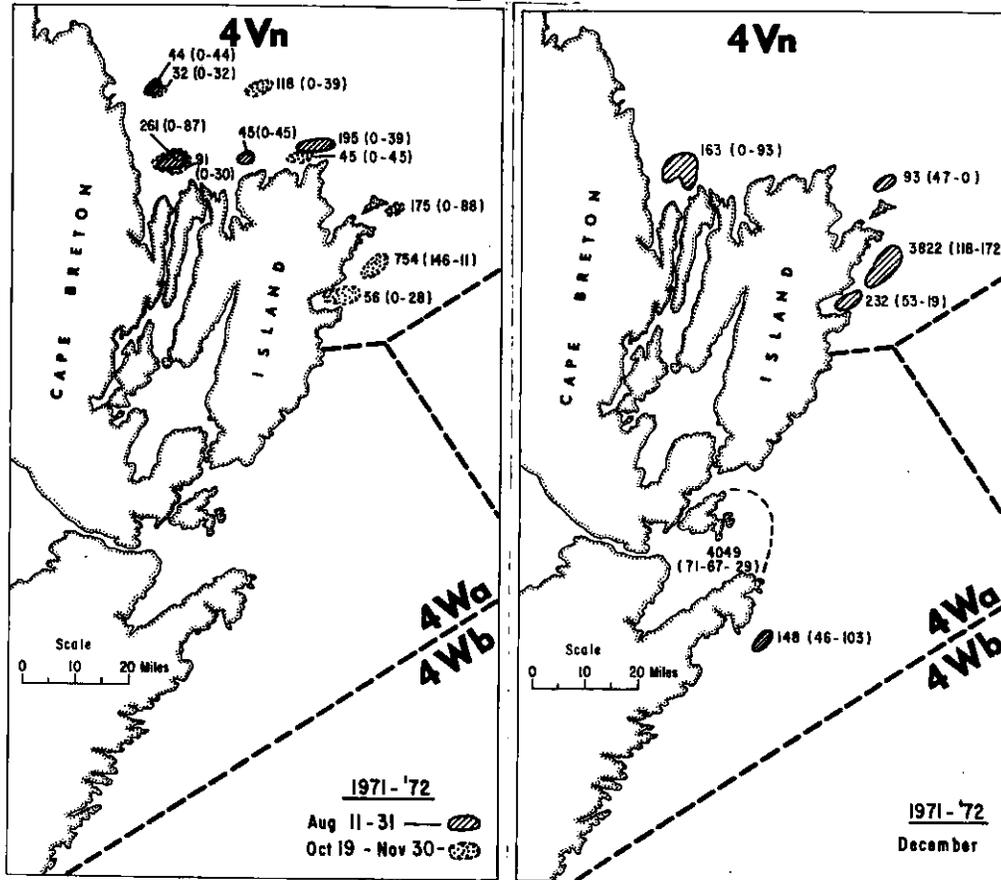


Fig. 1a. Geographical distribution of the 4Vn herring fishery for specified time intervals in 1971-72. The catch (metric tons) and the catch per unit effort (in parentheses) are given respectively for purse seiners >70' and midwater trawlers, and purse seiners <70' if they participated. Total catch and effort are given for Chedabucto Bay, but catch and effort are also given for portions of the total catch having more exact locations.

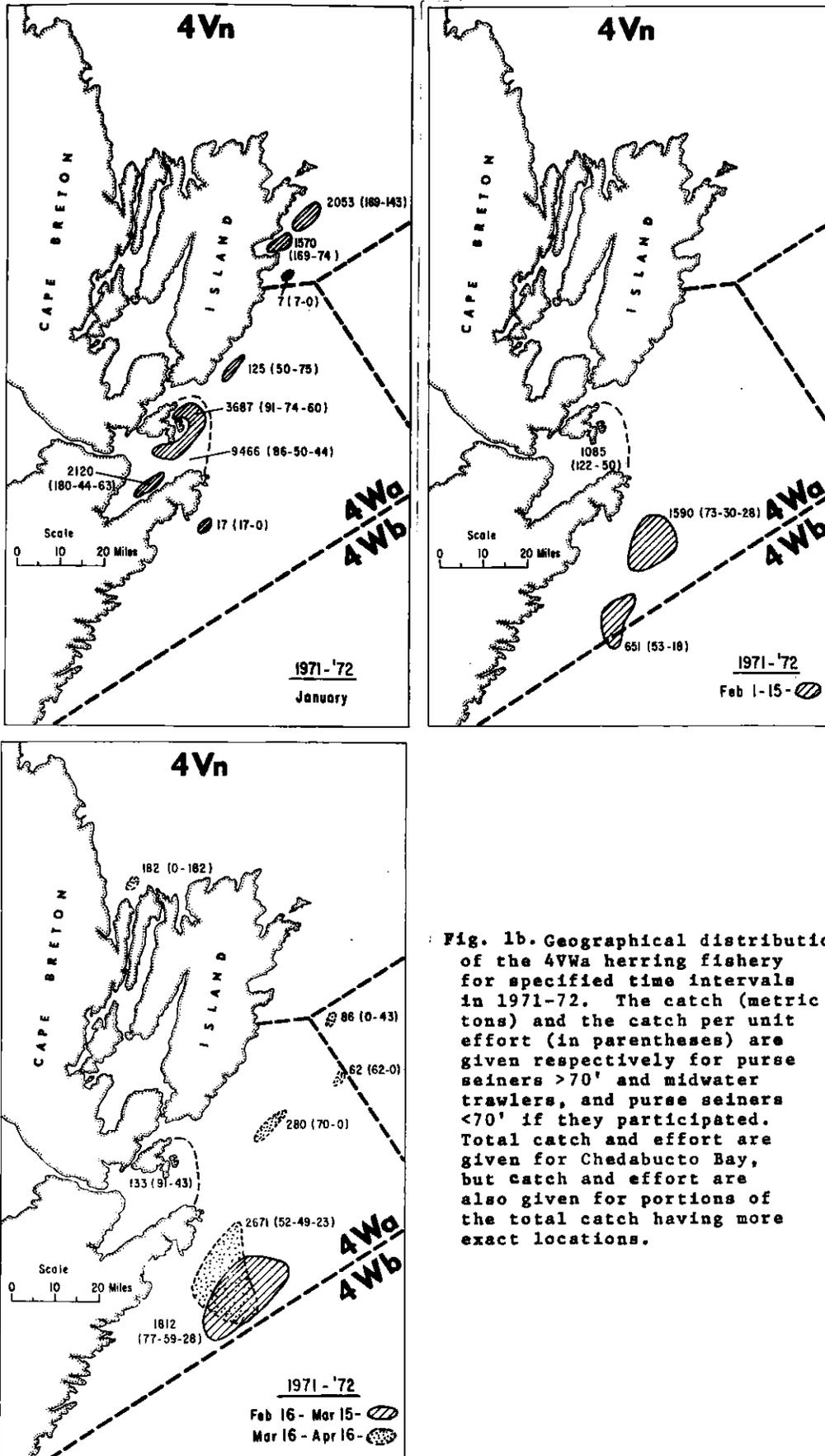


Fig. 1b. Geographical distribution of the 4VWa herring fishery for specified time intervals in 1971-72. The catch (metric tons) and the catch per unit effort (in parentheses) are given respectively for purse seiners >70' and midwater trawlers, and purse seiners <70' if they participated. Total catch and effort are given for Chedabucto Bay, but catch and effort are also given for portions of the total catch having more exact locations.

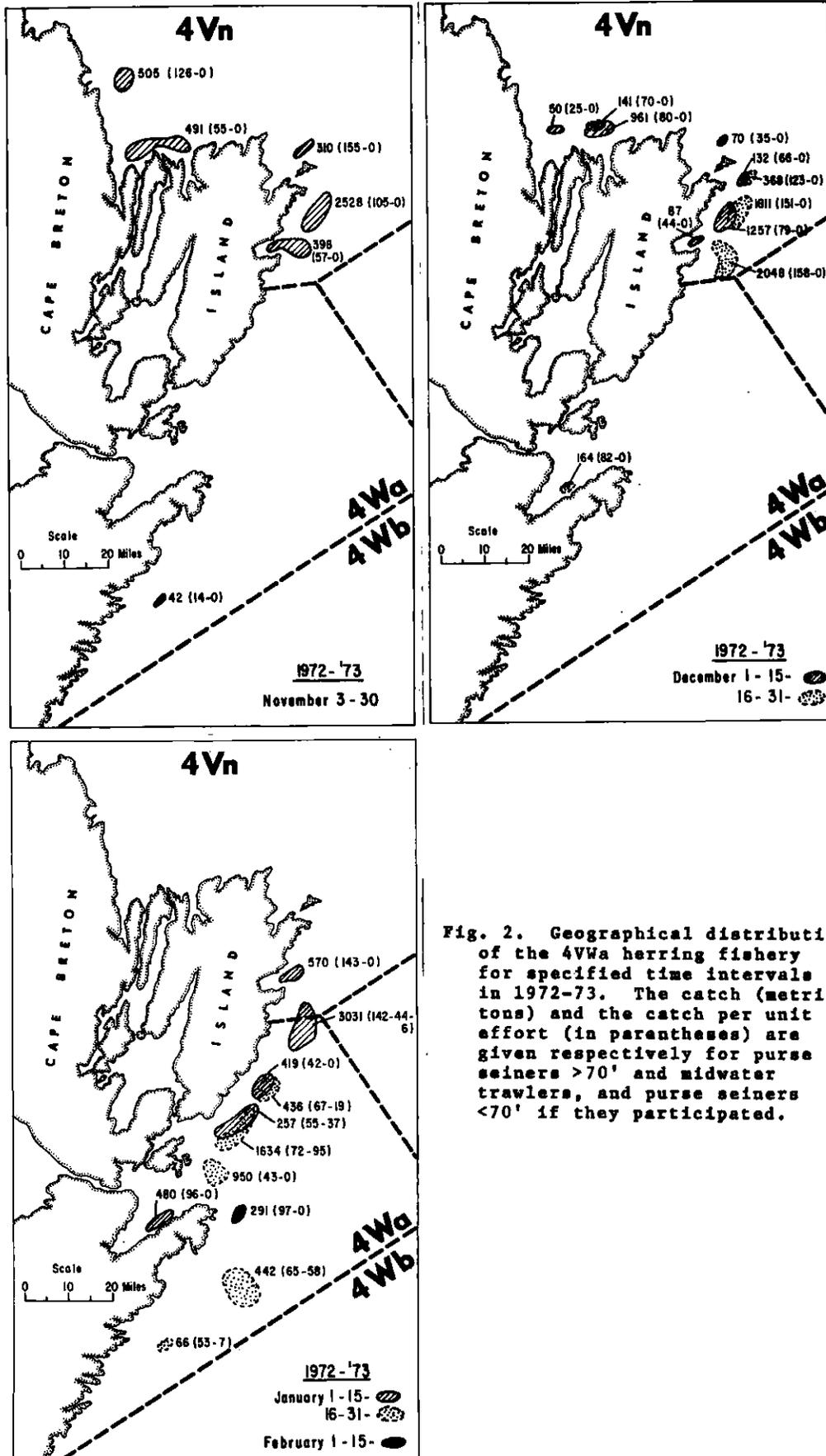


Fig. 2. Geographical distribution of the 4VWa herring fishery for specified time intervals in 1972-73. The catch (metric tons) and the catch per unit effort (in parentheses) are given respectively for purse seiners >70' and midwater trawlers, and purse seiners <70' if they participated.

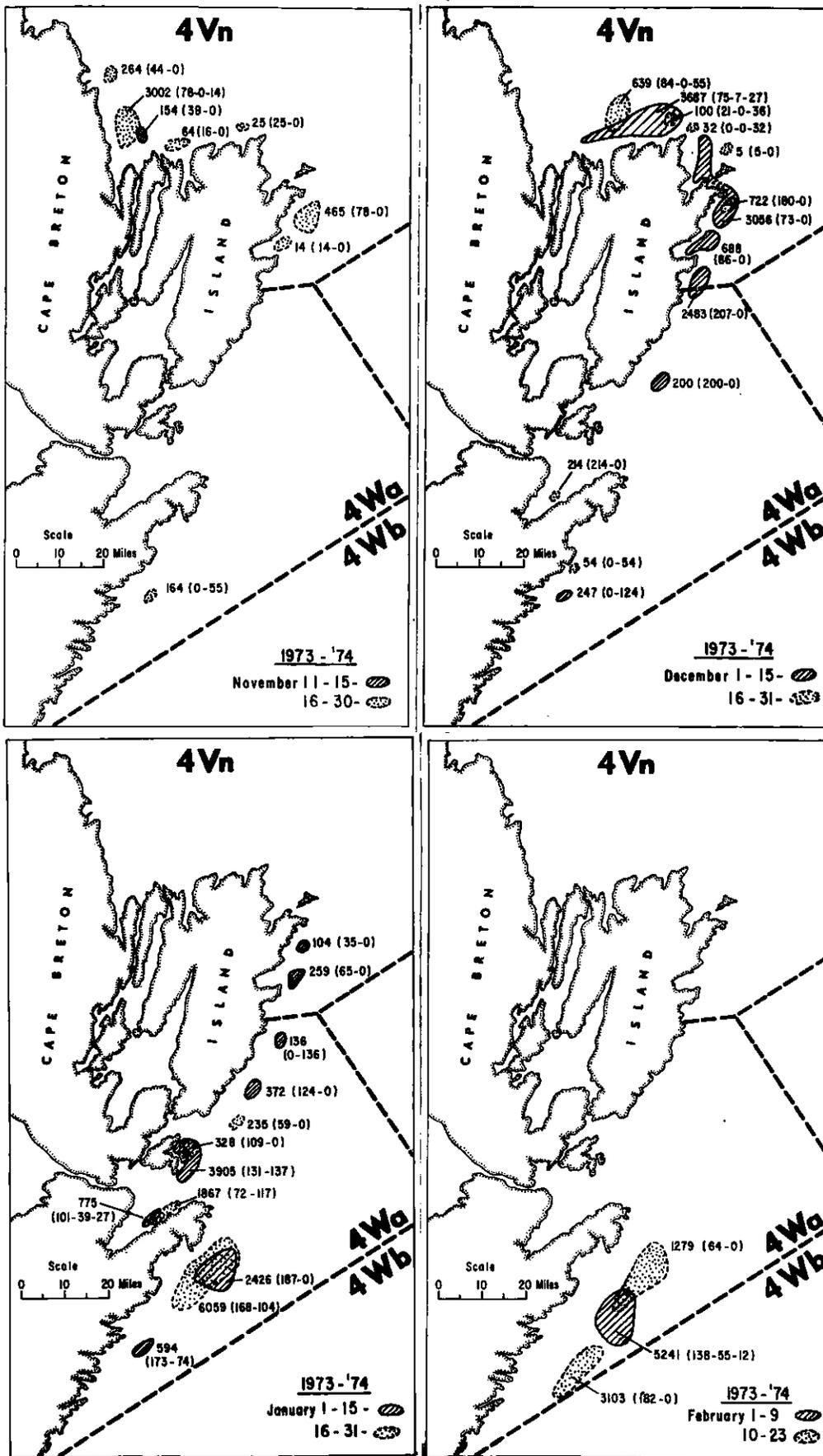


Fig. 3. Geographical distribution of the 4Vn herring fishery for specified time intervals in 1973-74. The catch (metric tons) and the catch per unit effort (in parentheses) are given respectively for purse seiners >70' and midwater trawlers, and purse seines <70' if they participated.

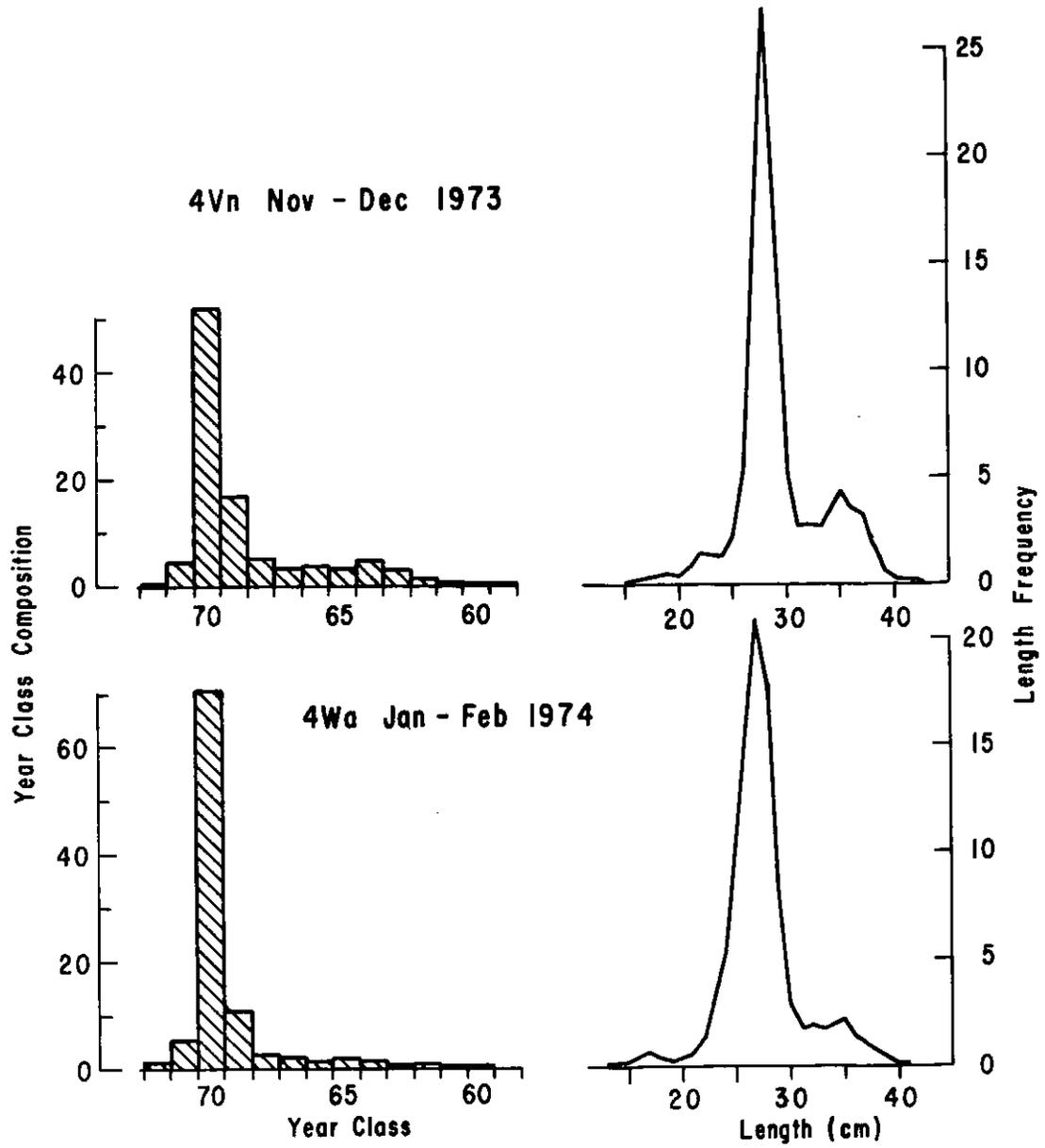


Fig. 4. Weighted year class composition and length frequency of the 4VWa removals during the 1973-74 fishery.

