

STATUS OF 4Vn HERRING FISHERY - 1978-79

by

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INTRODUCTION

From November to January there is a purse seine fishery, predominantly in the Sydney Bight area (Figure 1a), on overwintering herring. The small catches of herring in 4Vn by fixed gear in other seasons are assumed to belong to unrelated local stocks. However, the identity of the stock or stocks overwintering in this area (or passing through), and the possible contribution of local stocks to the winter catch, is not established. Inability to associate the 4Vn winter catch to catches of the same stock(s) during other seasons causes difficulty in doing an analytical assessment. Thus to date, quotas have been based on historical catch and catch rate trends.

Considerable effort has been expended by the Marine Fish Division during 1977 and 1978 in tagging operations during the winter fishery in order to identify the stock(s) with herring fisheries in other areas at different parts of the migration cycle. In addition, to aid in stock delineation, the biological characteristics of the overwintering population have been analyzed in some detail.

Catch and Effort

The annual winter catch by the Canadian purse-seine fleet from 1969 to the present is shown in Table 1 in relation to the historical foreign catch and the local fixed gear catch. The fluctuations in the total mobile gear winter catch (Figure 1b) is a function of both effort changes and population abundance. Foreign catches in 4Vn have only been significant in 1968/69 and 1969/70, about 11,000 t each year. The more recent decline appears to be due to both the effect of weather on the fishing effort expended (e.g., the 1975/76 low) and decreasing overwintering population size in the Sydney Bight area (decline in catch rates from 1971/72 to the present).

The CPUE trend (metric tons per night fishing) was calculated from the log records (Figure 2). The 1975/76 trough in the CPUE curve was previously interpreted as being anomalously low due to bad weather, in that CPUE during the following two fishing seasons appeared to level

off at a higher value. However, the precipitous drop in CPUE for the 1978/79 fishery, during which the weather was moderate, suggests that the relatively high 1976/77 and 1977/78 values may not indicate a stabilizing of the population. Certain purse-seine captains believe that the low CPUE value recorded this year is partially due to a change in the fleet composition (several of the more experienced vessels for this region, from Caraquet, did not participate this year). Because of the above-mentioned complications (influence of weather and changes in fleet composition), a three-year running mean of CPUE data is appropriate (Table 2 and Figure 2). This treatment of the data suggests a continuous decline in catch rates from 1971/72 to the present.

The age composition data support this conclusion. The sampling of the winter catch in 4Vn has been excellent since 1971, so that estimated age composition (Figure 3) and numbers-at-age removed (Table 3) are reliable. To a large degree, the 1970 year-class has supported this fishery since 1973/74, in contrast to the Chedabucto Bay winter fishery (4Wa) in which both the 1970 and 1973 year-classes have been important. Since no strong year-classes have recruited to the 4Vn fishery, the major part of the catch, by weight, in 1978/79 is made up of fish nine years and older.

Stock Characteristics

Maturity stage data for the 4Vn and 4Wa winter fisheries were analyzed in an attempt to identify the period of spawning (Figure 4). Except for 1974/75 when the fully mature 1970 year-class was at its peak, between 50 and 75% of the fish caught in 4Vn were in the spent stage (Figure 4) at the time of the fishery (November, December predominantly). This strongly suggests that the fishery is based on autumn spawners. During the year when a smaller proportion of the fish were spent, stage 3 (recovering) was dominant. This suggests that the more recently matured fish (age 4) recover more quickly or spawn earlier than the older year-classes, such that they are in the recovering stage by late autumn. This interpretation contradicts the general observation that there is a decrease with time in size (or age) of fish on the spawning grounds during a given spawning season. A second interpretation for the higher proportion of stage 3 fish at a period when the 1970 year-class was 3, 4 and 5 years of age (Figure 4) is that many of these fish were spawning for the first time the subsequent year and, thus, had just entered maturity stage 3 for the first time.

In the autumn of 1974, a two-vessel larval survey was carried out to evaluate whether there is evidence of local fall spawning and the relative magnitude of such spawning. The herring larval distribution from the vessel which sampled the near shore area is shown in Figure 5. Larvae were found at every station, but in relatively small numbers. Essentially, no larvae were observed in the offshore waters at the same time (Dr. T.D. Iles, St. Andrews Biological Station, personal

communication). Three areas of relatively higher larval abundance were indicated -- Tor Bay, Mira Bay and Glace Bay. Sameoto (1972) also observed a concentration of larvae near Tor Bay in the only other reported larval survey on the Scotian Shelf. Unfortunately, length frequency information is not available from the 1974 survey, such that the time of spawning is difficult to define. The larval population size observed, however, in relation to the 4Vn and 4Wa catches, suggests that it is associated with small local stocks and is unrelated to the bulk of the overwintering fishery in 4Vn and 4Wa.

The average weights at age for 4Vn and 4Wa from 1972 to the present are shown in Figure 6. The similarity in the overall pattern since 1973 suggests a common origin for the fish in the two regions or separate stocks responding to similar environmental trends. Consistently larger fish at each age are observed in 4Vn relative to 4Wa (Table 4).

The results of the two tagging operations on the 4Vn fishery during the 1977/78 and the 1978/79 fishing season are summarized in Table 5. The results for the two years are not consistent. A large proportion of the tag returns from the first operation came from the subsequent fishing in the Chedabucto Bay area within three months of tagging. Also, a year later, tagged fish were caught in the area of tagging and in Chedabucto Bay. The returns in the summer were sparse and most ($\approx 80\%$) came from the low effort fixed gear fishery along the Halifax to St. Mary's Bay shore. There were also two tags returned from the Gulf and two from the upper Bay of Fundy. No fish tagged in 4Vn turned up in the large S.W. Nova Scotia herring fishery which supposedly comprises fish which have migrated from Chedabucto Bay (where large numbers of 4Vn tagged fish were caught in the winter). This suggests that the 4Wa fishery is not solely comprised of S.W. Nova Scotia spawning fish. Returns from the second operation outside of the tagging area are few in number yet. A proportionately much smaller number of returns came from the subsequent fishery in Chedabucto Bay than was the case for the first tagging operation. The spring-summer returns have come predominately from two sources -- the fixed gear fishery in 4Vn - 4Wa (seven returns) and the edge fishery in the Gulf (eight returns). The recaptures in 4Vn of fish tagged in other area have been minimal (Table 5), with approximately equal recaptures from the Gulf of St. Lawrence and southwest Nova Scotia. The combined tagging results suggest that the recent 4Vn winter fishery is based on a mixture of stocks (fish which spend a part of their migratory cycle in the Gulf, along the Atlantic shore of Nova Scotia and some of which come from local stocks in the Cape Breton area). A second conclusion is the movement of fish from 4Vn to 4Wa during the winter fishery, albeit to a variable degree, from year to year. The small ratio of summer returns (0.52% in the first operation and 0.40% for the second) suggests that a portion of the stock mixture in 4Vn during the winter migrates to an area where there is no or little summer Canadian fishery. In this respect, it is worth recalling the short-lived foreign herring fishery on Banquereau (4Vs) (Table 6).

The biological data presented above do not permit clear identification of the 4Vn overwintering stock (or stocks). They are predominantly fall spawning fish but have probably spawned in another area earlier in the autumn prior to their migration to Sydney Bight, since larval data suggest low level of spawning within Sydney Bight. The age composition data and the weight at age temporal trends show both similarities and differences with the 4Wa fishery. The results from the 1977/78 and 1978/79 tagging operations neither support nor rule out strong affinity of 4Vn fish with the S.W. Nova Scotian spawning stock. However from $\approx 50,000$ tagged fish in 4WaX, there have only been five returns in 4Vn. If the strong 1970 year-class has a 4X affinity, one would have expected more evidence of this during the tagging program.

Management Considerations

It is recognized that it is questionable to regulate this fishery at any particular level without reasonable data on stock identity and what controls its abundance. However, the continued decline in catch rates coincident with lack of recruitment is clearly cause for concern. It is clear from the results that the recent winter fishery is based on a mixture of predominantly autumn spawning stocks, both migratory and "local". The reported summer catches by fixed gear have not declined in parallel with the winter fishery but no effort information is available. Because of the significant contribution (as inferred from tagging results) of "local stocks" to the recent winter fishery low fishing mortalities are recommended. The trade-off, however, is a loss of yield from the non-local stocks.

Following this reasoning, a minimal quota is suggested for the 1979/80 fishing season. Some fishing effort is required to provide information on age composition and catch rates so that the possible recovery can be followed.

REFERENCES

Sinclair, M., K. Metzals, and W. Stobo. 1979. 4WX herring assessment
CAFSAC Research Document 79/19

Sameoto, D.D. 1972. Distribution of herring (Clupea Harengus) larvae
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Canada 29:607-515

Table 1 Fishing season (Oct-Oct) herring landings (t) in Subdivision 4Vn.

	62/63	-64	-65	-66	-67	-68	-69	-70	-71	-72	-73	-74	-75	-76	-77	-78	-79
Canadian inshore	503	408	200	94	298	235	235	82	138	164	126	213	226	74	110	307	-
Canadian mobile	-	-	-	-	-	-	2044	5342	2917	10036	17537	16285	14298	7947	12831	7879	3661
Foreign	-	-	18	-	17	-	11465	11050	344	1	10	588	270	188	-	-	-
Total	503	408	218	94	315	235	13744	16474	3399	10201	17673	17086	14794	8209	12941	8186	3661

TABLE 2 - CPUE (t/night) and Effort (nights) for 4Vn Herring

	CPUE Running Mean	CPUE	EFFORT (from CPUE running mean)
	<hr/>	<hr/>	<hr/>
71/72	105	115	102
73	96	94	179
74	83	79	185
75	69	76	239
76	68	52	81
77	66	77	194
78	55	68	129
79	45	21	82

Table 3.. Catch at Age ($\times 10^{-3}$).

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2	2159	5980	0	0	10	41	151	1	0	0	0
3	9355	854	295	1994	8372	3508	6190	667	16	7	23
4	5037	7404	201	4288	6117	40206	4935	1544	2986	110	441
5	9595	285	3169	3283	10745	13100	39265	1846	5103	2377	1415
6	18230	854	2253	5062	4727	4078	7582	7840	4136	2800	1444
7	5997	4841	2049	3659	8855	2721	2785	2570	17602	1442	879
8	5037	285	2712	6530	6067	2921	2711	1122	8379	7623	848
9	2878	1709	570	4214	8490	2617	2735	892	3401	4056	1703
10	1439	854	913	4027	8418	3546	3599	1005	2431	1202	1840
11+	6956	5410	877	9783	8071	4582	6531	3411	5451	3098	1889

Table 4. Comparison of mean weights at age of Subdivision 4Vn and 4Wa herring from the 1977-78 winter fishery.

<u>Age</u>	<u>Mean weight (gm)</u>	
	<u>4Vn</u>	<u>4Wa</u>
3	98.7	84.0
4	175.3	132.0
5	220.3	165.7
6	242.9	190.2
7	273.8	217.8
8	307.3	247.5
9	346.2	292.7
10	377.7	337.4

Table 5. Tagging Recapture Summary for 4Vn Fishery.

Recaptures from 3993 herring tagged in Subdiv. 4Vn, Nov. 9 - Dec. 2, 1978

<u>Recapture Location</u>	<u>Nov. 9 - Dec. 31/78</u>	<u>Jan. 1 - Mar. 30/79</u>	<u>Apr. 1 - July 31/79</u>
Subdiv. 4Vn	62	-	2
Subdiv. 4Wa	4	5	5
Edge (Subdiv. 4TF)	-	-	8
St. Georges Bay (Subdiv. 4RD)	-	-	1

Recaptures from 3063 herring tagged in Subdiv. 4Vn, Nov. 26 - Dec. 15, 1977

<u>Recapture Location</u>	<u>Nov. 26- Dec. 1/77</u>	<u>Jan. 1 - Mar. 31/78</u>	<u>Apr. 1 - July 31/78</u>	<u>Aug. 1 - Oct. 31/78</u>	<u>Nov. 1 - Mar. 31/79</u>	<u>Apr. 1 - July 31/79</u>
Subdiv. 4Vn	8	2	-	-	14	-
Subdiv. 4Wa	-	69	-	-	9	-
Hfx. - St. Mary's Bay	-	-	10	3	-	-
N. S. Fundy Shore	-	-	2	-	-	-
Edge (4TF)	-	-	-	-	-	1
Souris, P.E.I.	-	-	-	1	-	-

RECAPTURES WITHIN SUBDIVISION 4Vn OF

HERRING TAGGED IN OTHER AREAS

<u>Tagging Location</u>	<u>Date</u>	<u>Recapture Time</u>		
		<u>Winter 1977-78</u>	<u>Summer 1978</u>	<u>Winter 1978-79</u>
Campobello Island	July/74		1	
Gaspe Coast	Aug.-Sept./76	2		2
Southwest N. S.	Aug.-Sept./77			4
Subdivision 4Wa	Jan./78			1
Souris, P.E.I.	Oct./78			1

Table 6. Foreign herring catches in Subdivision 4Vs (metric tons)

1968	7,904
1969	106,853
1970	26,540
1971	7,029
1972	2,382
1973	1,902
1974	850
1975	1,381
1976	357

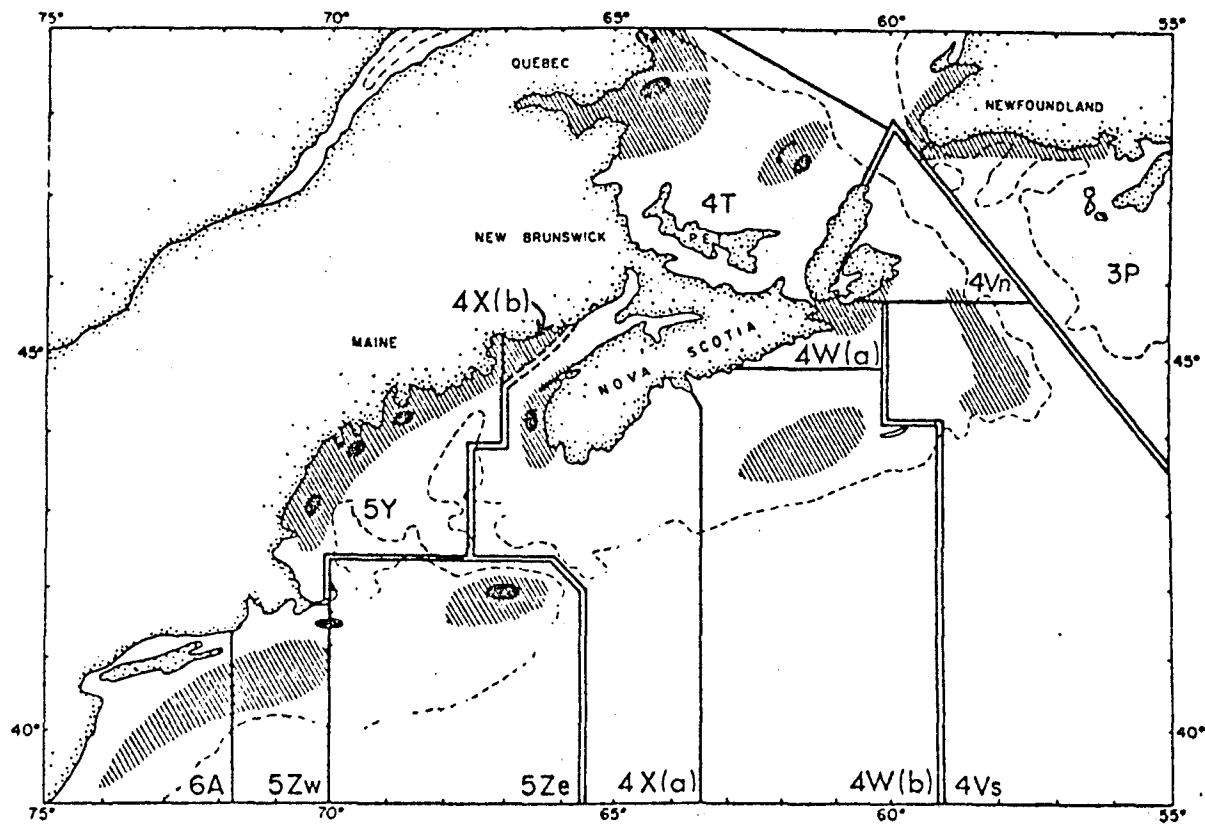


Fig. 1 a. Herring stock structure in Subareas 4 and 5 and Statistical Area 6. (Double lines indicate stock management areas; solid black areas indicate the general spawning grounds.)

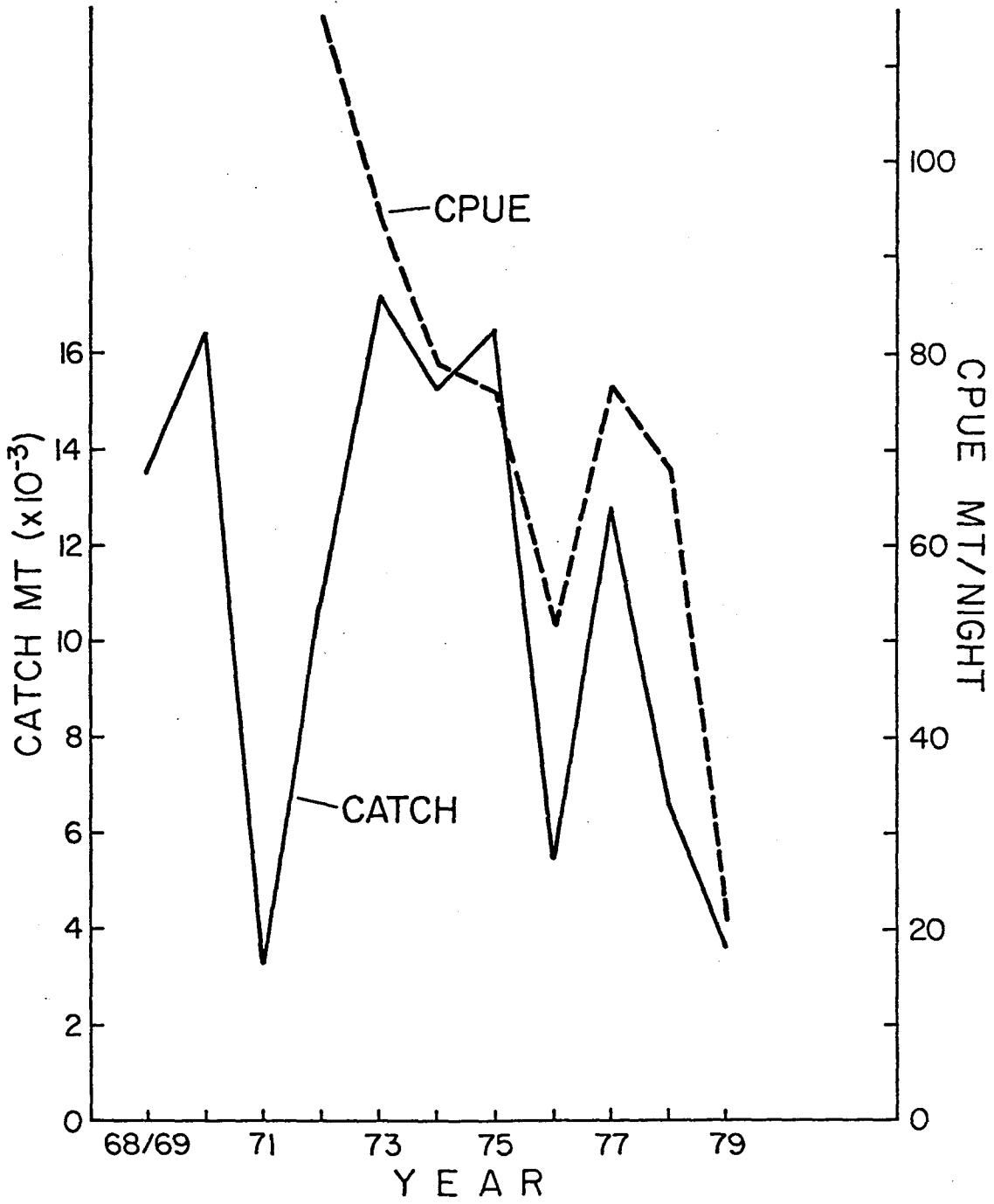


FIG. 1b. MOBILE GEAR CATCH TRENDS

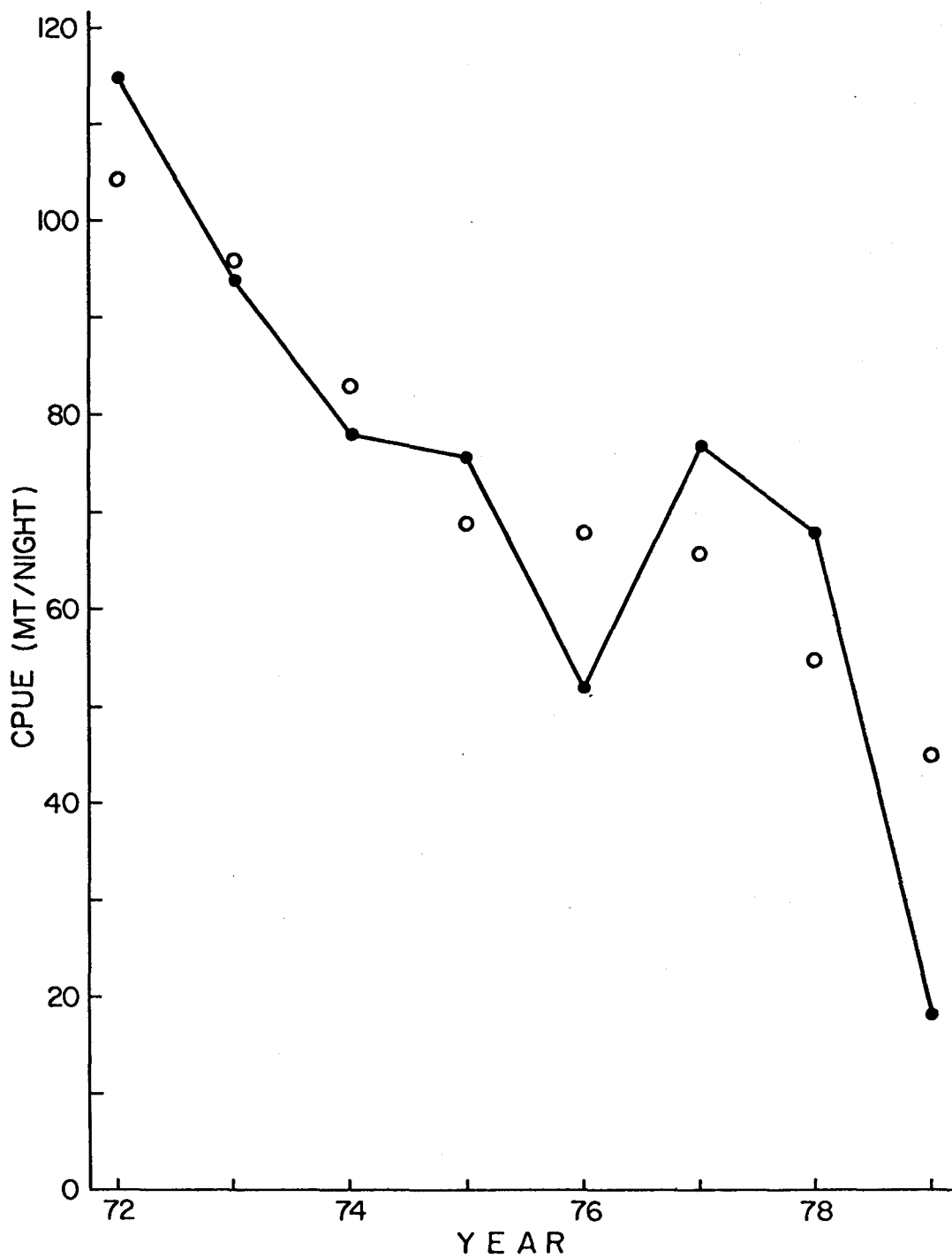


FIG. 2: CPUE DISTRIBUTION

(the open circles represent the three-year running means)

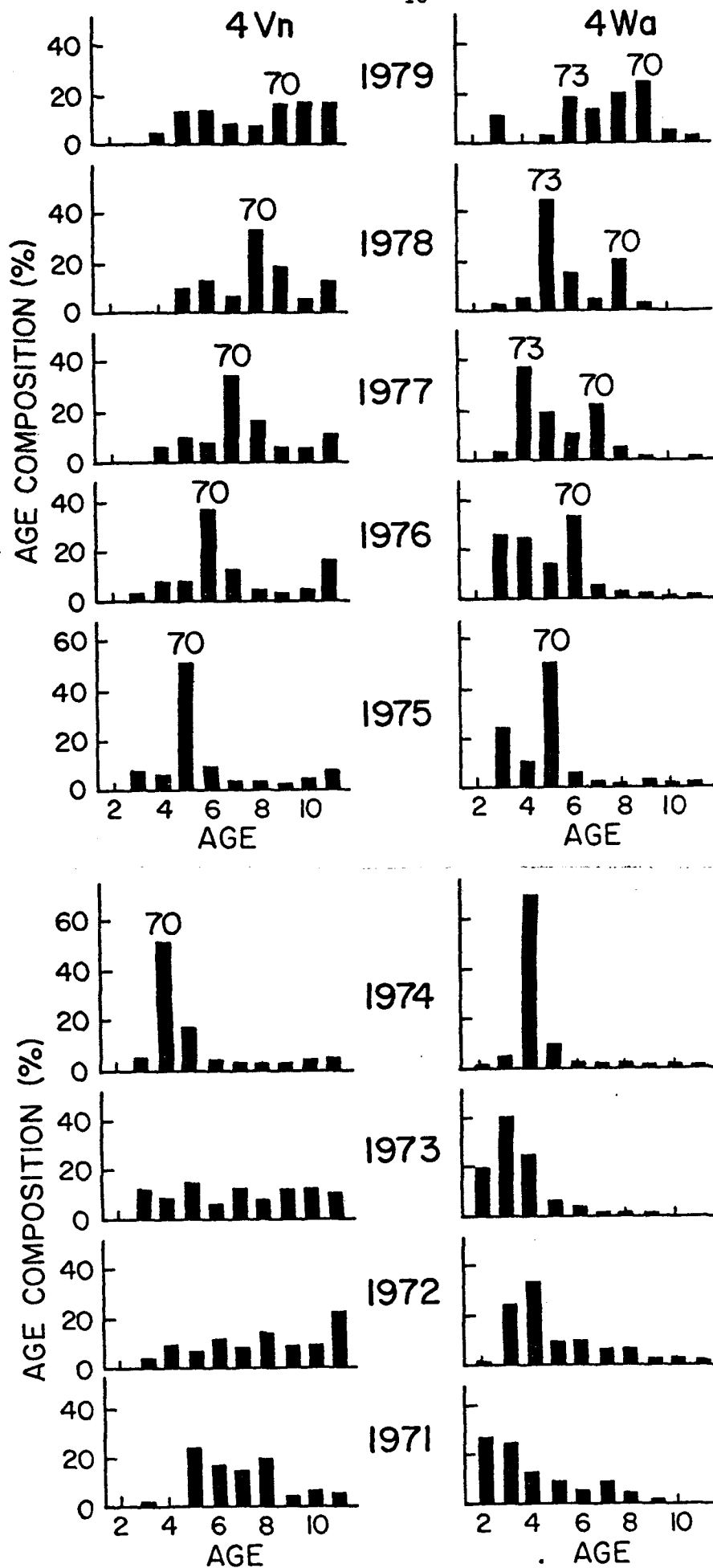


FIG. 3: % AGE COMPOSITION OF REMOVALS BY 4Vn AND 4Wa PURSE SEINE FISHING

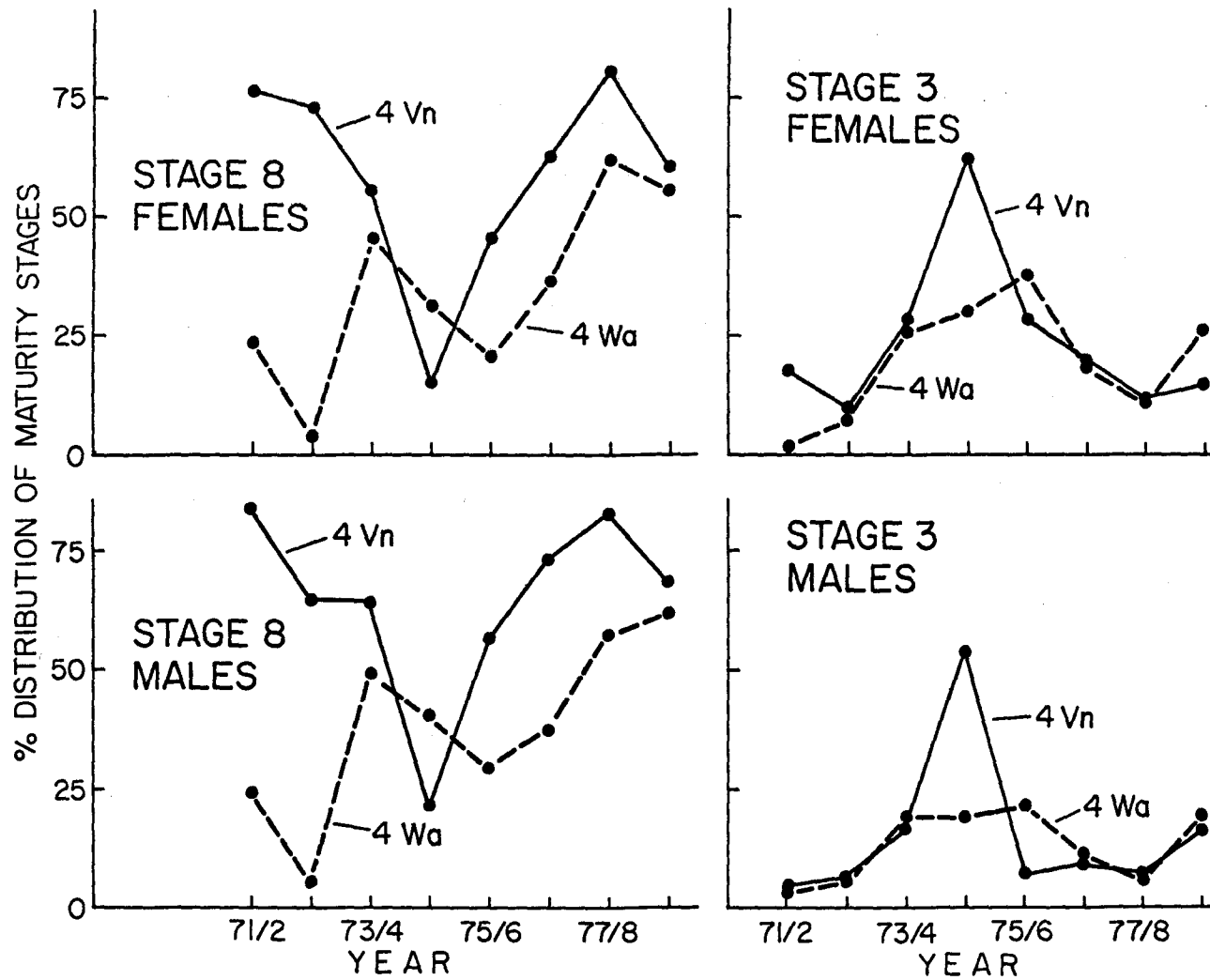


FIG. 4: % DISTRIBUTION OF MATURITY STAGES 3 AND 8
IN THE 4Vn and 4Wa WINTER CATCHES

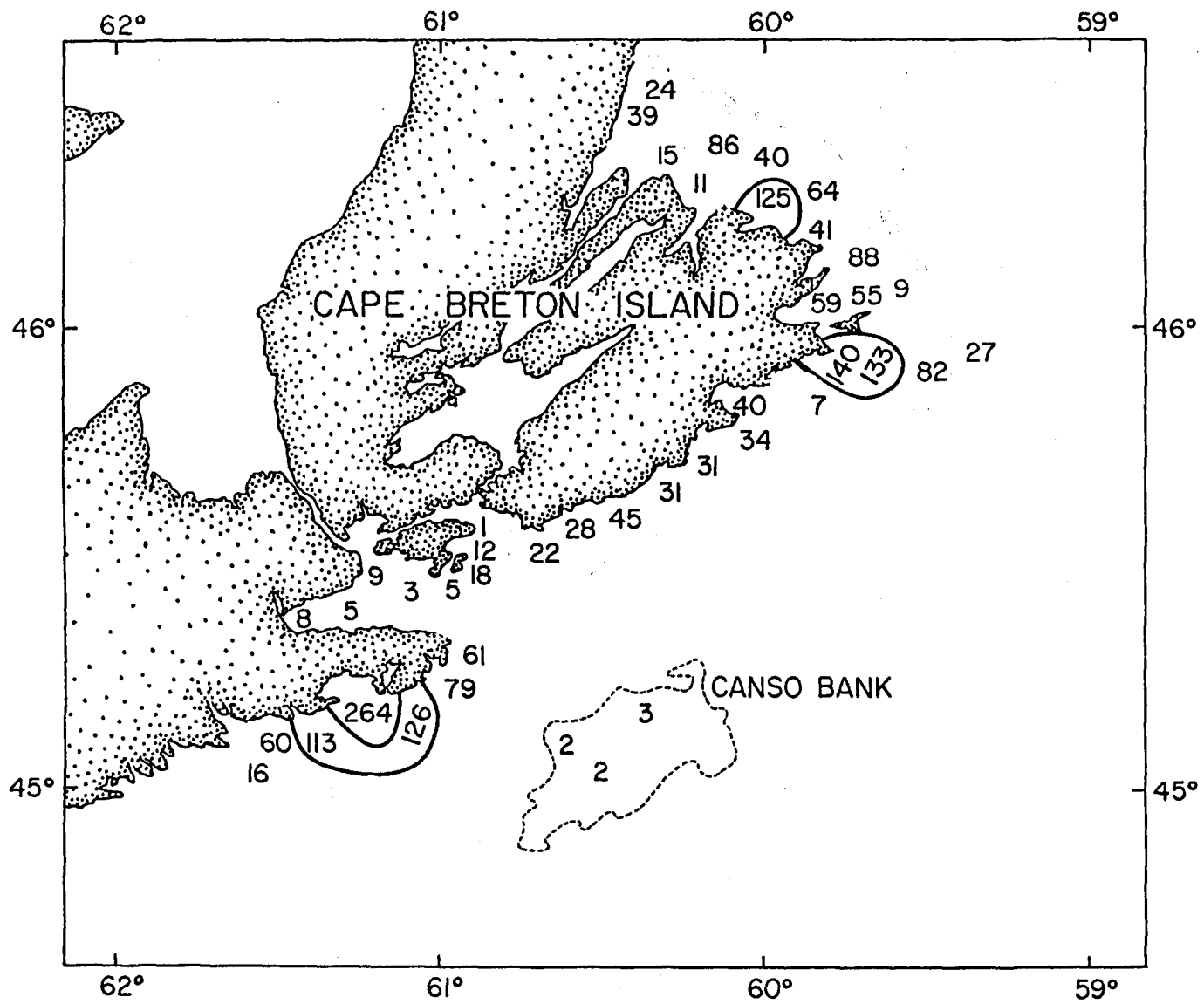


FIG. 5: HERRING LARVAL DISTRIBUTION OBSERVED IN OCTOBER, 1974 (#/10M²)