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Studies on harp seals of the
western North Atlantic population in 1977

by

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Abstract

Age samples of harp seals in 1977 came from the same sources in much the same proportions as in 1976. In general there is a strong representation of all recent year classes beginning with that of 1972, when the catch was controlled by quota. However a drop in representation of the 1976 as compared with the 1975 year-class is apparent in most 1977-caught samples. The combined catch of the 1976 year-class as young was 132,000 as compared with 141,000 in 1975, so that catches of young cannot be responsible. Annual natural mortality of young harp seals is believed to be rather constant. The most probable cause is believed to be the 1968 year-class, which supported a low pre-quota catch of young which it is known had a high survival rate. This year-class would have produced greatest numbers of progeny at about age 7, that is in 1975. Since succeeding year-classes up to and including 1971 were hunted more heavily, a transient fall in production could be expected for about 3 years.

The progeny of 1972 and succeeding year-classes subjected to lower catches again under the quota could thereafter be expected to contribute to increased production. Accumulating returns from tagged and branded animals continue to show mixing of young immature seals in winter-spring and accurate homing at mature ages.

Introduction

Research in 1976-77 has included no new types of study or analysis. Further tagging but not branding, has been carried out and returns of past tagging and branding analysed. Age samples have been collected and analysed from all available commercial sources of hunting. A proposed new method of determining production, based on results of both aerial photographic survey and of tagging of both subpopulations, is described in a separate document.

I. Harp Seals

A. Migrations as shown from tag and brand recoveries.

1) First northward migration.

In Feb-March 1977, 1,230 young harp seals were tagged at the Gulf of St. Lawrence with Dalton Rototags of green plastic (nos. A and E 1-999). All were tagged from the same original group, close to Brion I. and Bird Rocks, Magdalen Is.

There have been 11 recoveries in the same spring. Four were from Cape Breton I., from mid March to mid April, demonstrating an immediate southeasterly drift of part of this patch. The remainder came from northwest Newfoundland and south Labrador in late April and early May.

These recoveries indicate a rather early migration northward through the Gulf of St. Lawrence, in agreement with a relatively early disappearance of ice in the main part of the Gulf, south of the Strait of Belle Isle. The ice patrol noted a big concentration of moulting seals in late April in the northeast Gulf, which appears typical in years with an ice pattern of this kind, as observed by the writer in early April of 1966.

2) Summering.

Table 1 analyses arctic recoveries of harp seals tagged or branded at Newfoundland, by area of recovery (Greenland or Canadian Arctic) and age.

First and second year recoveries come mostly from West Greenland. The relatively few recoveries in the third and fourth year however show a shift to the Canadian arctic. Ten of eleven recoveries from the Canadian arctic come from the Baffin Island coast; and one from the Quebec coast of Hudson's Bay. Many harp seals enter Lancaster Sound in summer (Greendale and Brousseau-Greendale, MS 1976) but there are few fisheries here which might recover tags.

3) Autumn-Winter Migration.

Table 2 exemplifies the very wide spread in geographical range of both under-yearling and nearly 2-year-old seals in December and January. They may then be spread from 68°-69°N in West Greenland to the wintering grounds in Notre Dame Bay, Newfoundland (ca 51°N) with a proportion entering the Gulf of St. Lawrence.

4) Winter-Spring Distribution.

The net catch in White Bay takes a large proportion of its catch as 1 or 2 year olds in December, but this is not a large fishery; our sample of a few hundred animals annually is believed to represent nearly all of it.

The main winter-spring hunting for immatures, mainly one and two year old animals, takes place in Notre Dame and White bays. Judging by tag and brand recoveries this hunt begins in early February and continues to April or early May.

Table 3 shows the distribution of winter-spring recoveries of animals aged 1 to 6 years of age. The results update those given by the author in 1976 (ICNAF Res. Doc 76/x/124, Table 9). The results continue to show a high degree of cross-over of Gulf-born animals to the "Front" of northeast Newfoundland at 1 and 2 years of age, while most three year olds, and all of six animals aged 4 to 6 years of age returned to their native Gulf.

We have succeeded in tagging animals at the Front, in the last decade, only in 1973 and 1976. Among recoveries of Front-tagged young, one was entering the Gulf in late December at three years of age, while ten returned to N.E. Newfoundland in winter-spring at one year of age, and three at three years of age. Thus 93% of 14 Front-tagged young seals returned to the Front at 1-3 years of age.

One additional tag/recapture is of interest. In March 1976, as well as several hundred young seals, 113 adult harp seals were tagged in the Gulf of St. Lawrence - all but one, adult females. On March 16, 1977, one of these adult females was recaptured in the area of tagging, close to the Magdalen Islands.

Preliminary catch data for 1977 (Anon, MS 1977) show 19,425 out of 21,700 or 89.5% of harp seals older than one year taken on the Front. The percent of recoveries of immature, Gulf-bomseals at the Front in 1977 (from Table 3) was 17 out of 19 or also 89.5%. Taking all the tag recapture information into account, it seems simplest to regard the movements of immature seals of the two herds in winter-spring at 1-3 years as mixed or random, with a high percentage arriving at the Front. A homing tendency then appears to the area of birth, the full manifestation of which is delayed till sexual maturity is attained at about 5 years of age. Although this homing appears, from the limited number of recaptures, to be of great accuracy, we have no knowledge of its mechanisms. Either, some imprinting on "home" waters or coasts must be postulated, or an imprinting on older animals which have already made the migration.

Survival of Year Classes

Age Sampling, 1976-1977.

Sources of samples are given in Table 4. These are the same types of sample as we obtained in 1976. Sample 1 from southern Labrador in Dec 1976 is a small one. Samples of migrant harp seals along the North Shore of Quebec (sources 2 and 3) obtained in Dec 76-Jan 77 were deficient due to an early freeze-up and resulting small fishery. Only 74 animals were obtained from this source as compared with 216 in 1976, itself a low number. Early freeze-ups have usually lowered this source of material since 1972. This sample as usual shows a peak at age 5, due to a deficiency of immatures on this migration. Source 4 (St. Anthony, Newfoundland) gave a normal

sized sample of 487 which represents almost the entire fishery by nets along the extreme northeast coasts of Newfoundland from December to April. This sample includes all ages and both sexes but is not homogeneous, comprising mainly young immatures in December with older animals added from January onward. Sources 5 and 6 (Little Bay Islands and Pt. Leamington) totalling 424 animals represent a small fraction of the shot catch of immature seals taken by landsmen in Notre Dame and Green bays, northeast Newfoundland. Samples requested were 200 from each source and these numbers were attained in February soon after the catch began. The catch continues to April but was found in 1976 to be homogeneous and composed essentially of the first 5 age classes. Requested samples which were growing to expensive proportions were reduced in size as a result. One thousand could easily be obtained from each source. This hunting takes mainly immatures and includes many Gulf-born animals, since most tag and brand recoveries of animals marked in the Gulf come from this source. Sample 7 was obtained by purchase from the sealing vessel Carino taking moulting animals in Notre Dame Bay in mid April under special permit. As is normal at this date, immatures are heavily represented and adults must be chiefly males.

In 1977 samples, therefore, there is a bias towards immature animals. If samples of southward migrant animals (samples 1 to 3) could be balanced against samples of shot animals in Notre Dame Bay (samples 5 to 7) this bias could be neutralised.

Results.

Age frequencies from these 7 samples are shown in Table 5.

Sample 1 from southern Labrador (sample 1) in December 1976 shows a peak at 2-3 years which differs from that of 1976 only in having fewer one year olds.

Sample 2 (La Tabatière net fishery) cannot be expected to show survival of year classes younger than 5 years when full representation occurs. It shows a rather clear peak at age 5, indicating a strong 1972 year-class the first year after the quota came into effect. If results are compared with those of other recent years (Table 6), the representation of 5 year olds at 22.6% for year class 1972 is the highest shown of recent years inclusive of 1969. In 1973, no sample was obtained due to an early freeze up. We could therefore not test representation at 5 years of the 1968 year-class, which survived very well following a catch of 156,000 young, low for the pre-quota period. At 6 years of age in 1974, however, this year-class represented 29% of the sample, an exceptional rate. Low survival in years on either side of the sample, presumably, increased its relative showing in the sample. Sample 3, a shot sample from Godbout, Quebec is too small to analyse.

In all other samples, representation of year one can be compared with that of year two. Comparison is made with results obtained in 1976 (Sergeant, ICNAF Res. Doc. 76/x/724, Tables 16 and 17). In 1977 sample 4 (St. Anthony) showed age 2 years stronger than 1 year. This was the reverse of 1976. This evidence would suggest a weak return of 1 year old animals, since the sample is from a long-continued fishery and temporal variations within a season are therefore eliminated. Little Bay Islands (sample 5 in 1977 shows 1 year higher than 2 years; Pt. Leamington (sample 6) shows 1 year just higher than 2 years but equal to 3 years. In 1976, both samples showed a clear dominance of

1 year. This evidence would tend to fortify a belief that the 1976 year class was rather weakly shown in samples obtained a year later at least as compared with that of 1975. Yet, the catch of young animals in 1976 was 132,000, slightly less than in 1975 (Table 7).

Lastly, in the ship's Carino's catch (sample 7) one year olds are heavily represented, as is usual in this catch.

Representation of one and two year olds is compared in total samples and in ship's moulting samples in Table 8. Table 9 and 10 show source data. The years are not all the same in the 2 sets of samples. Year classes before and after the effect of the quota are indicated by a line in Table 8; the exceptional pre-quota year class of 1968 is also outlined. For the combined samples, the percentage of both one and two year olds in the samples has increased since the quota. The percentage of one year olds rose to a peak in 1976 (1975 year class) and has declined in 1977. The percentage of two year olds has risen steadily up to the 1975 year class. For ships' catches, the percentage of one and two year olds is more variable than for combined age samples. The percentage of one year olds in post-quota years has exceeded that in pre-quota years. However for two year olds, the 1968 year-class provided the highest representation to date.

In the samples of 1976 and 1977, shown together in Fig. 1, a healthy representation of post-quota year classes is seen with the expected stepwise increase of representation to younger ages. This has occurred in spite of an increase in ships catch from a mean of 115,000 in 1972-74 to 137,000 in 1975- 1976 (Table 7). In spite of the decrease of the sample from La Tabatière, 5 year olds have increased

from 4.4% in 1976 (for the 1971 age class) to 8.1% in 1977 (for the 1972 age class).

Does the relative decrease of one year olds in 1977, seen in samples 4, 5 and 6 and the overall sample, result from a more intensive fishery? The ships' catch has been relatively steady at 130-140,000 young since 1975, but the landsmen's catch many of which are of young sealiners aged 1-5 years has been increasing steadily since 1972 (Table 7). This could just possibly have affected recruitment, dependent on mature animals aged 5 and up. Returns of tagged animals from both Greenland in the first summer, and at Notre Dame Bay in the first winter, were in the same proportion to tagging conducted in 1975 and 1976, indicating no major change in hunting rate in either area.

Conclusions

The drop in strength of year-class 1976 as compared with 1975 is not likely due to sampling error, due to the variety of sampling sites and their similarity in 1977 and 1976. They could be due to a variation in natural mortality from year to year, but I do not think that this mortality varies much, because of the high negative correlation that exists between catch and subsequent year-class strength (Sergeant, 1975). Two sources of catch with appropriate lag times could contribute to a lowering of production: high catches of young seals before effective quota controls were imposed in 1972, and increasing catches of immatures and adults (mostly immatures) by longliners since 1972 (Table 11).

Since 1977 the catch of harp seals by Canadian longliners and landsmen has been controlled by means of a quota. Preliminary catch

figures (Anon, MS 1977) show 50,900 harp seals taken at Newfoundland (not including the Gulf) in this catch, of which 21,000 or 41.2% seals one year or older. Measures might be devised to reduce this part of the catch, because of the higher "reproductive value" of bedlamers and old seals than of young seals. Refined modelling of the population dynamics would help to ascertain whether such a restriction is in fact necessary.

However, it seems most likely that the high point reached in recruitment in 1975, and the slight diminution in 1976, results from the effect after one generation time of the 1968 year-class, which was a very strong year-class alone of several year-classes on the Front immediately before the Front quota was applied. This year-class would have produced its maximal number of pups, on present reproductive schedules, at 7 years of age, that is in 1975, and as its own mortality reduced its size, would have had a declining influence thereafter. The quota-protected 1972 year-class should begin to contribute pups in quantity beginning in 1977, so that one can forecast the downward trend to be temporary; 1978 and subsequent samples will tell.

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Carino Co. Ltd., St. John's, Newfoundland provided quarters for a second year on their sealing vessel Arctic Explorer and also collected an age sample of major importance from M/V Carino.

The ice reconnaissance flights of the Meteorological Branch of Fisheries and Environment Canada have again supplied us with most useful observations of seals.

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Table 1. Harp seals tagged or branded at Newfoundland. Locations of arctic recoveries G = Greenland, B = Baffin Island.

Year of marking	Year of Recovery											
	0		1		2		3		4		5	
	G	B	G	B	G	B	G	B	G	B	G	B
1966	26	1										
1968	7	-	4	-								
1969	5	-	2	-	2	-						
1970	1	-					-	1				
1972	4	-	2	1	1	1	1	1				
1973	7	-	2	-			-	1				
1974	2	-					2					
1975	10	1	2	2								
1976	6	0										
Total	68	2	12	3	3	1	1	5				
Percent Greenland	.97		.80		.75		.17					

Table 2. Some recent autumn-winter recoveries of tagged/branded harp seals aged <1 or <2 years.

Age	Date	Year	Locality	Latitude N
<1	26 Jan	1976	West Greenland	68°27'
	late Dec	1975	Port Burwell, Labrador	60°25'
	29 Dec	1975	St. Lewis Hbr., Labrador	52°22'
	10 Jan	1976	Cooks Hbr., Newfoundland	51°29'
	27 Dec	1975	Big Macatina, Quebec	50°46'
<2	16 Dec	1976	West Greenland	68°54'
	27 Dec	1976	C. St. Francis, Labrador	52°35'
	16 Dec	1976	St. Anthony, Newfoundland	51°21'

Table 3. Harp seals tagged or branded in the Gulf of St. Lawrence and recovered in winter and spring in the Gulf (ICNAF subarea 4) or the Front (subareas 2 and 3).

Year of marking	Year of Recovery											
	1		2		3		4		5		6	
	G	F	G	F	G	F	G	F	G	F	G	F
1966	7	12	1	1	-	-			1	-	2	-
1968	3	7	-	1	1	-						
1969	2	10	2	-	2	-						
1970	2	1	-	1	-	-						
1972	-	1	-	-	4	1	2	-	1	-		
1973	-	1	-	-	1	-						
1974	2	2	1	-								
1975	1	19	1	8								
1976	-	10										
Total	17	63	5	11	8	1	2	-	2	-	2	-
Percent Crossover		.79		.69		.11		0		0		0

Table 4. Sources of samples of 1976-1977.

- 1) Port Hope Simpson, Labrador, Dec. 1976.
- 2) La Tabatière, Quebec. Dec-Jan 1976-77.
- 3) Godbout, Quebec. Dec 1976.
- 4) St. Anthony area, N Newfoundland, Dec 76-Apr 77.
- 5) Little Bay Islands, NE Newfoundland, Feb 1977.
- 6) Pt. Leamington, NE Newfoundland, Feb 1977.
- 7) M/V Carino, mid April, 1977.

Table 5. Age samples of 1977. Localities given in Table 4.

Age yrs.	Sample No.							Total	
	1	2	3	4	5	6	7		
1	3	1	2	89	59	58	232	444	
2	20	6	4	96	38	47	122	333	
3	17	8	3	76	22	58	95	279	
4	9			56	19	40	78	210	
5	11	14	2	21	13	14	76	151	
6		9	1	20	7	8	37	82	
7		6		20	5	5	20	56	
8	4	3		21	2	3	17	50	
9		2		10	1		31	44	
10		2		4	3		10	19	
11		1		6	2	1	8	18	
12				4	2		10	16	
13		1		7		2	15	25	
14		1		8	5		17	31	
15				7	3	3	9	22	
16				5	1	1	13	20	
17				1			9	10	
18				5			5	10	
19				1			3	4	
20				5			2	7	
21				1			4	6	
22				3			2	5	
23 or +				11			10	22	
				(max 27)			(max 30)		
N	64	62	12	477	184	240	825	1,864	

Table 6. La Tabatière Net Sample.

Year Coll.	Total No.	5 years		Year applicable
		No.	%	
1977	62	14	22.6	1972
1976	126	16	12.7	1971
1975	390	71	18.2	1970
1974	210	17	8.1	1969
[1974	210	61	29.0	1968

Table 7. Catches (in thousands) of harp seals in the post quota period. (Catches for 1973 are newly revised from information provided by Environment Canada.)

Year	Young	Older	Total	Part of catch taken by small craft and landsmen
1972	117	13	130	24
1973	113	25	138	45
1974	114	32	146	40
1975	141	33	174	53
1976	132	33	165	65
1977 ¹	125	24	149	67

¹preliminary figures from Anon (MS 1977).

Table 8. Percentage of one and two year olds (a) in combined samples, (b) in ships' samples, 1967-1977.

(a)				(b)			
Year of sample	N	Percent		Year of sample	N	Percent	
		One yr	Two yrs			One yr	Two yrs
1977	1,864	.238	.179	1977	825	.281	.148
1976	1,589	.389	.173	1976	638	.467	.170
1975	1,547	.244	.165	1970	499	.242	.222
1974	790	.202	.092	1968	578	.145	.133
1970	2,734	.080	.071	1967	679	.259	.090
1967	2,141	.104	.071				

Table 9. Total age samples collected, 1967-1977.

Age yrs	1977	1976	1975	1974	1970	1967
1	444	601	378	160	220	222
2	333	276	256	73	193	153
3	279	178	162	27	217	95
4	210	124	96	30	205	98
5	151	70	107	40	231	145
6	82	53	93	91	131	184
7	56	49	108	37	98	171
8	50	44	67	51	152	119
9	44	24	33	37	165	104
10	19	31	47	35	173	77
11	18	21	29	27	117	83
12	16	16	31	27	104	60
13	25	15	32	24	84	56
14	31	13	27	20	60	69
15	22	21	15	18	84	59
16	20	10	16	24	74	48
17	10	11	9	18	67	48
18	10	7	16	11	51	46
19	4	6	8	9	50	39
20	7	6	4	7	54	39
21	6	2	4	8	26	21
22	5	3		7	20	16
23 or +	22	8	6	9	58	47
N	1,864	1,589		790	2,734	2,141

Table 10. Ships' samples of moulters.

Age yrs	1977	1976	1970	1967	1968
	Carino	C.A.E.	Kv. Th.	B.P. Th.	P. Kv. Th. B.
1	232	298	121	176	84
2	122	109	111	61	77
3	95	61	13	18	48
4	78	37	17	18	20
5	76	24	23	29	17
6	37	14	14	46	23
7	20	18	17	40	27
8	17	13	11	30	39
9	31	11	17	23	23
10	10	7	20	16	26
11	8	5	15	23	19
12	10	5	22	18	18
13	15	7	12	14	16
14	17	4	6	19	24
15	9	5	11	20	20
16	13	5	14	14	20
17	9	5	8	18	11
18	5	3	11	20	17
19	3	2	8	21	16
20	2	1	7	15	11
21	4	1	4	8	6
22	2	2	5	8	5
23 or +	10	1	9	20	11
N	825	638	499	679	578

Table 11. Catches of harp seals older than one year since 1972 by all agencies.

Year	Ships Canada	Ships Norway	Longliners+ Canada	Landsmen Canada	Total	Source
1972	260	1,386	2,535	8,892	13,073	ICNAF
1973	1,469	13,612	1,731	8,685	25,497	ICNAF
1974	3,500	18,328	1,904	9,078	32,810	ICNAF
1975	2,449	8,543	9,027	13,706	33,725	ICNAF
1976	2,256	2,320	17,789	10,552	32,917	National catch figures
1977*	1,135	713	15,000	6,000	22,848	Anon, MS 1977

*preliminary estimate for Front region only

+ships < 150 gross registered tonnage

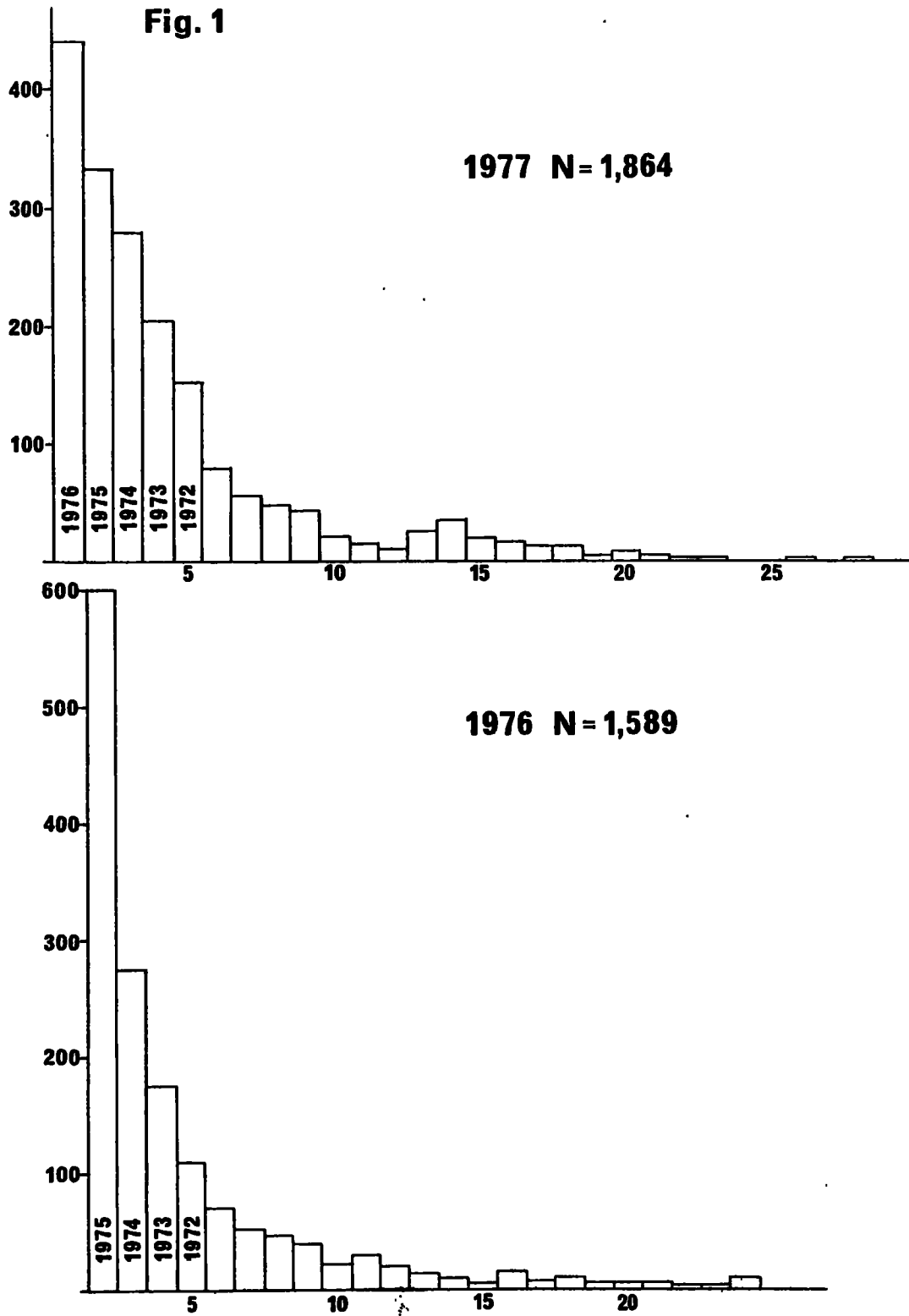


Figure 1. Combined age samples of harp seals, 1976 and 1977.