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CANADIAN STUDIES ON HARP SEALS IN 1971

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ABSTRACT

A range of estimates of production of young of the western harp seal herds in 1968 was from 260,000 to 295,000, decreasing by 25,000 annually. It is estimated that this rate of decrease will be slowed briefly only in about 1974. The Gulf of St. Lawrence population decreased sharply after 1969, a year of no ice and poor whelping in the Gulf, and in 1971 was believed to produce some 70,000 young only, the balance having apparently transferred to the Front. However in 1972 Front and Gulf herds were about equal in size, the Front herd apparently having decreased and the Gulf herd increased. These episodes may indicate irregular massive mixing between the two subpopulations.

1. Materials and Methods

First-hand effort in 1971 was devoted to the Gulf herd. A new explosive branding device was tested on hood seals and young harp seals after the sealing season had ended, as well as a portable rig for conventional heat-branding.

Samples were collected by purchase from two major localities, one each in the Gulf and on the Front, for comparative racial studies. Early signs of a failure of the fishery for migrant seals at La Tabatière on the Quebec North Shore due to an early freeze-up caused the Gulf site to be shifted to the fishery for wintering seals at Escoumains and Tadoussac in the St. Lawrence estuary, where samples from 150 seals were collected, including 20 animals frozen and trucked entire to the Arctic Station. From the Front wintering site around St. Anthony, Newfoundland complete data were obtained from 168 animals. Details of catches obtained from this site, whence merely an age sample had previously been collected, show that the fishery begins with young year classes in January (which are known from tag recoveries to pass south into White Bay) whereas the bulk of the catch is obtained from adults in March and early April. Reproductive data from females from the Front site were a welcome addition to the last Canadian collections, made in 1968, allowing an adequate series for comparison with large Gulf samples collected during 1965-69. Additional age samples, but no other data, were purchased from southward migrants in southern Labrador and from La Tabatière.

It was found that length measurements obtained secondhand in this way are not accurate enough for critical study of length between adults of the two populations. Moreover, the Tadoussac collection was from seals shot in the water, so that skulls were damaged, reducing effectiveness of a craniological comparison. However, other evidence discussed below (reproductive, age frequency) is so overwhelmingly in favour of extensive if irregular mixing of stocks, that it is doubtful if such studies would be profitable. Biochemical studies of muscle proteins from whitecoats from both areas were begun by Dr. T. G. Dilworth of the University of New Brunswick.

Samples of tissue for mercury analysis were collected from accurately aged animals for the Freshwater Institute, Winnipeg, of the Fisheries Research Board.

2. Whelping in the Gulf of St. Lawrence

The circumstances of the fishery made a direct estimate possible of the number of young born in the southern Gulf in 1971. The seals whelped so close to the Magdalen Islands that shoremen took 31,000 whitecoated young, while ships took another 33,000 in the immediate vicinity. They were unable to find more, while for our branding experiments we were unable to find more than some 50 whitecoats which had become stranded on rafted ice on Deadman Island as the ice passed by. There had been severe storminess before and during the early stages of the fishery (which began on March 12) and it must therefore be asked whether any large escapement had been carried away from this area. However, aerial surveys by industry and government, low catches of young seals by ships elsewhere in the Gulf, and by landsmen around Cape Breton Island, do not suggest any large escapement. We may therefore put production in the southern Gulf in 1971 at near 70,000 young. This compares with our estimate of some 75,000 estimated from capture-recapture analysis together with aerial photo survey in 1970 (Sergeant, MS 1971, p. 3, Table 2).

3. Results of Analysis of Age Samples in 1971 (see Figure 1)

Three samples are of southward migrants, one either made up of the mixed herds or possibly (since it is an inshore sample) of animals heading for the Gulf. Two are of animals which have entered the

Gulf. All these are similar in showing a strong 1968 age class, and a rather strong 1966 age class, which previously has appeared in the same series of samples. In the single age sample from the Front, the 1966 age class is very weak, as in past Front samples, and the 1965 age class is rather strong.

Catches in 1966 were higher than normal on the Front, normal in the Gulf.

This evidence would tend to suggest that the animals born in the Gulf in 1966 have returned there subsequently, on the Front similarly.

Moreover, it shows that a kill of 84,000 young in the Gulf in 1966 left a fair to good number of survivors. Yet this evidence is hard to relate to the finding in the Gulf in 1971 that after a kill of 64,000 young, only negligible numbers of survivors could be found.

Let us suppose, however, that in the year of no ice, 1969, many (Sergeant, MS 1971, p. 7 estimated nearly two-thirds) of the whelping females moved to the Front to whelp. Let us suppose also that many of these animals remained there in subsequent years. Let us also suppose that the young would have "imprinted" on the area where they were brought up. Then most of the 1969 year class at least will have crossed to the Front in 1970.

The 1966 Gulf year class however were 3-year-old immatures in 1969 and were not affected by the lack of ice. The same would have been true for the large year class of 1968, then one year old. These year classes at least should continue to return in strength. About one-fifth of the females of the 1966 year class will have started to whelp in 1971. We should see an increase in numbers of the Gulf whelping animals with particular increase in 1974 (when many of the 1968 year class start to whelp at 6 years of age), and an unusual number of young adult females, which can be recognized by their spotted pelage. It will therefore be possible to test this hypothesis over the next few years.

4. Calculation of Production and its Changes

The representation of the one-year-old 1970 year class was small in the Gulf at Tadoussac in 1971 whereas one year olds were well represented there in 1969. One year olds in the Front sample in 1971 were 9.8% of the sample. Addition of this datum to previous data (Table 1) would produce estimates of production on the same basis as calculated previously (Sergeant, MS 1971, p. 6), as follows:

Let us assume that production of young is proportional to the number of females producing them, and that natural mortality of young is constant. Then the largest variable will be survival due to catch, which has recently varied by a factor of 2:1. The ratio of one year olds to total sample gives a measure of survival of young to one year, since the total population cannot vary greatly over a short span of years. Plotting this index against catch is found to give a straight line and projection of the line to zero survival gives an estimate of production. Uniform series of samples must be used because of bias sampling.

Figure 2 shows estimates from the two samples of St. Anthony and Front moulters. However no Canadian sample of Front moulters was collected in 1971 (for the 1970 year class) and results of analysis of a Norwegian sample must be awaited.

Results are as follows for estimates of total production of young:

	Sample	
Mean Year Class	St. Anthony	Front moulters
1967	285,000	320,000
1969	235,000	(270,000)?
Decrease	50,000	(50,000)
Mean annual decrease	25,000	

Reference to Figure 1 will show that all recent year classes younger than 9 years on the Front are weak, with the exception of that for 1968. With inadequate recruitment of the younger mature age classes, it is easy to see why the current decline is rapid. Gulf year classes are numerically too small to make much difference, since the Gulf provides only some one-third of production. Some transitory slowing of the decline will probably take place when the 1968 year class on the Front becomes mature (beginning in 1973), but this will be a short-lived respite. It is clear that current catch levels must be decreased by at least 25,000 annually even to keep pace with the decline in populations.

5. Reproductive Studies

A sample of ovary pairs collected from moulting female harp seals at the Front in 1968 had not solved the problem of mean age at sexual maturity of Front females, because of a lack of the critical five-year-old animals (due to the weakness of year class 1963 after a heavy fishery). In a sample collected from wintering animals at St. Anthony in 1971 the same deficiency exists, due to the weak year class 1966. However the two samples when pooled give an adequate result (Table 2). The median age at sexual maturity, when 50% of females are mature, lies between 4 and 5 years. The same median age (4-5 years) was obtained from samples collected in the Gulf between 1968 and 1969 (Sergeant, MS 1971, Table 1). On the basis of age at female sexual maturation, there are therefore no grounds for regarding Gulf and Front animals as distinct.

Sexual maturation of males in 1971, based on the inflection in weight increase of testes, occurred at from 4 to 6 years (median near 5 years). This compares with 6 to 9 years for equivalent testis weights found by Dr. H. D. Fisher and the writer from comparable sampling in 1952-57, and confirms conclusions from female data (Sergeant, 1966) that thinning of the population produced an acceleration in maturation rate.

6. Conclusions

Overall production of young by the northwest Atlantic harp seal herds is estimated to have been some 285,000-320,000 in 1967, decreasing to 235,000-270,000(?) by 1969 or by 25,000 annually. Production in the Gulf fell drastically after 1969 when lack of ice caused about two-thirds of the adult females normally whelping in the Gulf to move to the Front, and these have apparently not returned, accounting for the low production estimates in the Gulf of some 75,000 in 1970 and 70,000 in 1971. Immature age groups were not affected and continue to show a homing tendency, so that Gulf production is forecast to increase again when two strong or rather strong year classes (1966 and 1968) start to contribute adult, whelping females. However there is no comparable 1966 year class at the Front, and the strong year class

of 1968 is not enough to do more than slow temporarily the decline in production at the Front, beginning in about 1973.

There is no difference in the median age of sexual maturity between Gulf and Front females. While the homing may normally be rather strong, mass movements of whelping adults, followed by imprinting of both adults and probably of the young also on the adoptive herd, such as is postulated to have occurred in 1969, would be sufficient to swamp any variation in morphological characters between the two herds.

In 1972, visual inspection showed Gulf and Front herds to be about equal in size. Aerial photographic surveys were carried out on both herds, and the counts will allow at least minimal estimates of herd size in each case. In 1970 from aerial photographic survey, and also in 1971 from catch figures, the ratio of production in the two areas was about 2 on the Front to 1 in the Gulf. However in 1972, ice conditions were abnormally heavy, the converse of 1969. It is therefore conceivable that wintering animals were displaced southwards to a degree and mounted the nearest available ice to whelp, namely in the southern Gulf of St. Lawrence.

In 1972, branding of 500 adult female harp seals and 525 young harp seals was carried out in the Gulf of St. Lawrence. In 1973, a similar experiment is planned for the Front. Such experiments should eventually afford direct proof either for or against mixing between populations. Note, however that shore fisheries, especially net fisheries, must be retained to allow recoveries of branded animals, especially the key adult females.

7. Management Implications

The western stock of harp seals is clearly dropping rapidly in numbers at current levels of catch of young, which have been as follows(thousands):

Year	Gulf	Front	Total	5-Year Mean
1967	92	184	276	218
1968	57	98	155	226
1969	33	187	220	216
1970	72	145	217	
1971	71	140	211	

Survival of one-year-old seals rose dramatically after the reduced catch of 1968. Management should aim at no more than the 1968 catch figures, which themselves now represent more than half the estimated production and are probably too high. Judging by 1971 catch figures, a reduction in quotas, probably represent the same reduction in the catch of young harp seals. The effects of reduced quotas can be monitored from age samples and direct surveys which can be made available three months after survey, or 15 months after catching.

8. References

Sergeant, D. E. 1966. Reproductive rates of harp seals, Pagophilus groenlandicus (Erxleben). J. Fish. Res. Bd. Canada 23(5): 757-766.

———— MS. 1971. Calculation of production of harp seals in the western North Atlantic. ICNAF Res. Doc. 71/7 (Serial No. 2476), 23 p. Mimeo.

Table 1. Catches of young harp seals and indices of survival at one year in age samples, 1965-1971.

Catch of young $X10^3$			Number and percent of juveniles in samples from:					
			St. Anthony			Front icefields		
Year Class	Front	Total	1 yr	Total	Ratio	1 yr	Total	Ratio
1966	180	264	18	315	.057	77	403	.190
1967	184	276	7	201	.035	84	576	.145
1968	98	155	87	205	.424	62	107	.579
1969	187	220	41	571	.072	105	431	.244
1970	145	217	39	399	.098	--	--	--*

*Norway may be expected to provide a frequency.

Table 2. Reproductive data for Front females, 1968 and 1970.

		Mature	
Age (yrs)	Total No.	No.	%
1	27	27	100
2	30	30	100
3	17	17	100
4	5	1	10
5	3	2	67
6	9	7	78
7	11	11	100
8	9	9	100
9	16	16	100
10	18	17	95

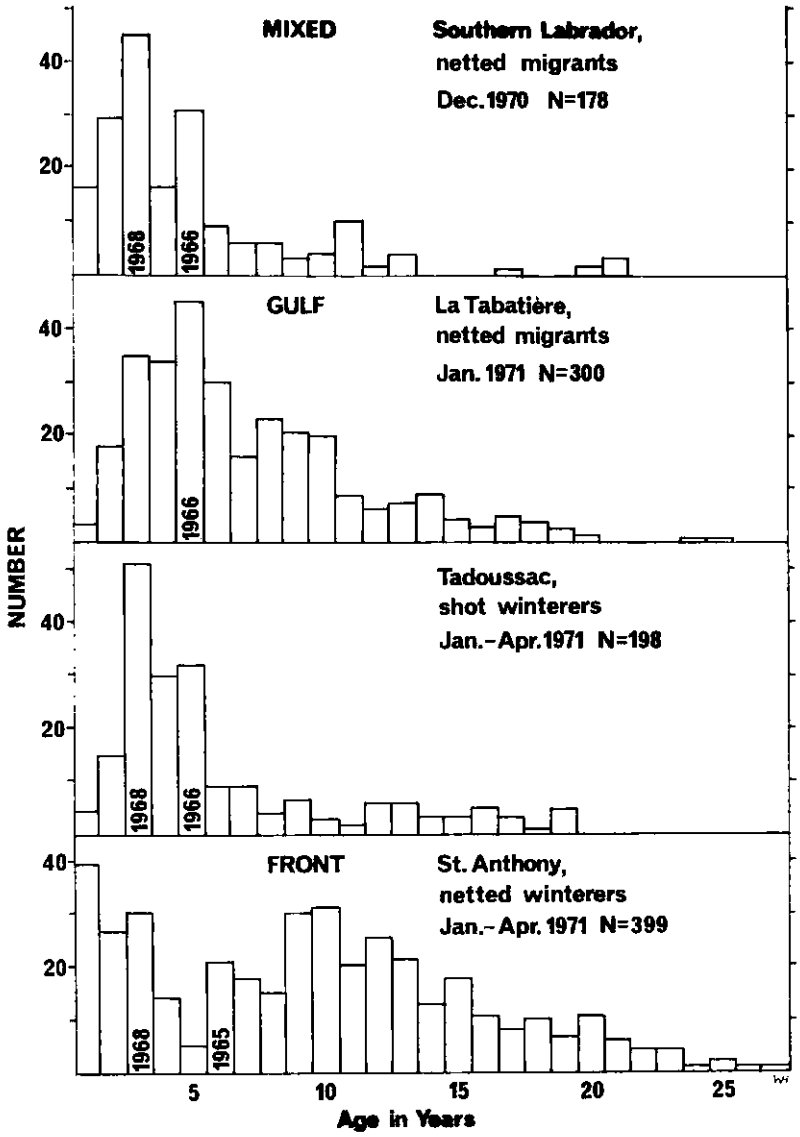

Fig. 1. Canadian age samples of harp seals, 1970-71 winter season.

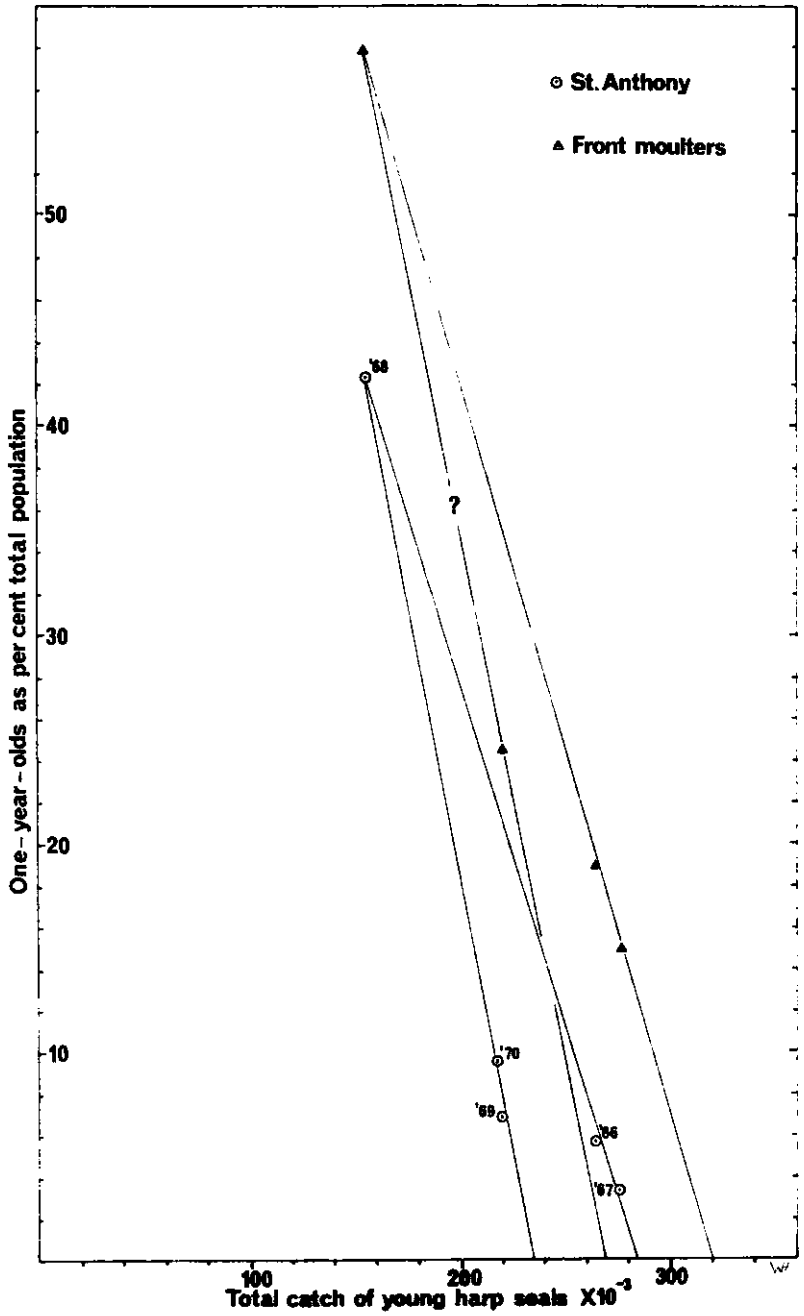

Fig. 2. Calculation of production of young harp seals from two sets of age samples, for age classes 1966-1970.