Notes

Evidence of Autumnal Harbour Seal, *Phoca vitulina*, Movement from Canada to the United States

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Harbour Seals, *Phoca vitulina concolor*, in the Bay of Fundy, New Brunswick, may move to New England during the autumn. Aerial counts of seals on haul-out sites along the Bay of Fundy coast revealed a linear decrease in numbers (75%) from mid-October to mid-December. A simultaneous, linear increase of the same order of magnitude was observed at the southern end of their range in New England.

Key Words: Harbour Seal, *Phoca vitulina*, movement, Bay of Fundy, New England.

Harbour Seals, *Phoca vitulina concolor*, have been described as non-migratory (Mansfield 1967; Bigg 1981). However, Gilbert and Wynne (1984) report that pups tagged in Nova Scotia and Maine have been resighted in southern New England. Observations of Harbour Seal numbers on haul-out sites in the Bay of Fundy indicate an annual decrease in numbers during the autumn and winter (Terhune and Almon 1983; Terhune 1985). Harbour Seals at the southern end of their breeding range (southern Maine) increased three to five times at 19 year-round sites during the winter of 1983–84. Seals were also recorded appearing at nine wintering sites along the New Hampshire and northern Massachusetts coast during the same period (Rosenfeld and George, unpublished data). Schneider and Payne (1983) report that Harbour Seals occur seasonally at Stage Point, Massachusetts (41°55′N, 70°32′W) from late October through May.

This suggests that a general southward movement of Harbour Seals along the Bay of Fundy–New England coast may be occurring during the autumn and early winter. We conducted independent aerial surveys over the northern and southern ends of this region during this time period. The numbers and rates of departures and arrivals in these areas support the hypothesis of an annual southward movement by Harbour Seals during autumn and early winter.

Methods

The southern aerial surveys were conducted over approximately 140 km of the New England coast. The flight path began at islands off Cape Ann, Gloucester, Massachusetts (42°37′N, 70°36′W), and continued northward to Cape Elizabeth, Portland, Maine (43°42′N, 70°18′W). All islands and shoals up to 8 km offshore were surveyed. The northern aerial surveys covered the coastline and adjacent nearshore islands in the Bay of Fundy between Saint John, New Brunswick (45°18′N, 66°20′W), and the Maine border (44°50′N, 67°0′W). The Wolves and Grand Manan islands were not surveyed. Approximately 150 km of shoreline were surveyed.

The southern flights were conducted in a highwing Cessna 172 or 182 single-engine aircraft. There were two or three experienced observers in addition to the pilot. Flights were timed so that the first haul-out sites were surveyed two hours before low tide. Surveys were conducted under conditions favourable for haul-out (good visibility, winds under 32 km/hr, waves 1 m or less, wind-chill corrected temperatures above -12°C (*see* Boulva and McLaren 1979). Ledges were searched at an altitude of 100–260 m. Groups of more than five seals were photographed using 35-mm cameras with 200 or 85 mm lenses.

The northern flights were similar except that the wind-chill corrected temperatures were all above

-1°C, counts began 1.5 hours before low tide, counts were conducted at a lower altitude (50–100 m) and only large groups of seals were photographed. One group entered the water before it could be counted or photographed. This group was estimated at 100 seals (30 October 1984).

Results

Flight dates (August to January) and numbers of seals seen for both sets of surveys are shown in Figure 1. The data were examined to determine whether the departures and arrivals were occurring at a linear rate (Terhune 1985). To compare the rates of emigration from the north and immigration to the south (Figure 1), the northern data were inverted using the formula $Y = 238 + (979 - Z)$, where Y is the inverted number of seals and Z is the number actually sighted per survey (maximum = 979, minimum = 238). The equation for the northern 1984 inverted data (as plotted in Figure 1) is $Y = 197.8 + 11.6X$ where X is the survey date (first date = 0). The correlation coefficient ($R = 0.98$) is significant ($F = 21.7$, $P < 0.01$). The equation for the southern 1983 data (Figure 1) is $Y = 179.0 + 8.5X$ ($r = 0.99$, $F = 33.2$, $P < 0.01$). The southern 1984 data do not correlate with a straight line ($r = 0.92$, $F = 5.2$, $P > 0.05$).

The overall changes in numbers and the rates of change per day are presented in Table 1. The southern data presented include the survey dates immediately prior to and following the northern 1984 survey period.

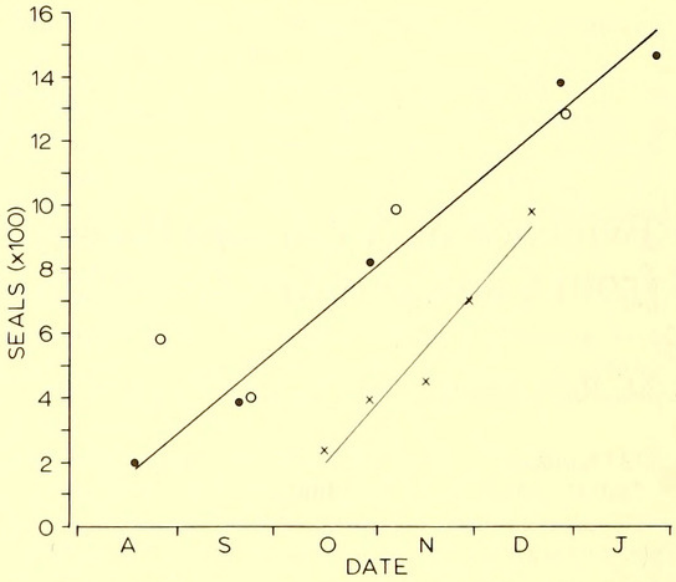

FIGURE 1. Changes in numbers of Harbour Seals on haul-out sites during autumn in the southern New England region (solid circles, 1983; open circles, 1984) and in the Bay of Fundy (Xs, 1984, inverted data, see text). The straight line equation for the southern 1983 data (heavy line) is $Y = 179.0 + 8.5X$. The equation for the Bay of Fundy 1984 data (thin line) is $Y = 197.8 + 11.6X$. For both equations, for the first day of each survey, $X = 0$.

Discussion

Although the northern and southern surveys were conducted independently, they shared many similar features. The differences in methodology mentioned above are not thought to be significant.

The linear nature of the decrease in seal numbers (as opposed to a rapid, short-duration exodus) on haul-out sites in the Bay of Fundy has previously been reported (Terhune 1985). The linear increase in numbers of seals in 1983 in New England supports this observation. Although the southern 1984 data differ significantly from fitting a straight line, the data points follow the same trend as those of the previous year (Figure 1).

The absolute numbers of seals leaving and entering the two areas, both per season and per day, are very similar (Table 1). The greater number of seals arriving in the south is probably due to animals also arriving from Maine (Gilbert and

TABLE 1. Changes in Harbour Seal numbers at the northern and southern ends of their distribution along the Bay of Fundy–New England coast during autumn. The numbers in brackets substitute a higher count obtained on 27 August 1984 for that obtained on 24 September 1984 (see Figure 1).

			Changes in Seal Numbers	
Area	Survey Period	No. of Days	per Period	per Day
South	20 September — 28 December 1983	99	995	10.1
South	24 September — 30 December 1984	97	879 (697)	9.1 (7.2)
North	17 October — 19 December 1984	63	-741	-11.8

Wynne 1984), the Grand Manan Island area, and Nova Scotia. The inverse nature of these numerical changes suggests a southward movement in the autumn.

A few Harbour Seals do, however, remain in the Deer Island, New Brunswick, area throughout the winter (Terhune and Almon 1983). Tagging or tracking studies will be required to confirm the movements and ascertain which individuals or groups are remaining behind.

Movements of Harbour Seal populations — pups (Gilbert and Wynne 1984) as well as adults — must be considered prior to formulating management plans for this species. Population control programs intended to reduce Harbour Seal interference with commercial fisheries (Mansfield 1967) could be severely hampered by such movements. The movement of Bay of Fundy seals into waters off New England would also require international co-operation to properly protect or manage this species.

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Literature Cited

Bigg, M. A. 1981. Harbour Seal, *Phoca vitulina* Linnaeus, 1758 and *Phoca largha* Pallas, 1811. Pages 1–27 *in* Handbook of marine mammals, Volume 2, Seals. *Edited by* S. H. Ridgway and R. J. Harrison. Academic Press, London.

Boulva, J., and **I. A. McLaren.** 1979. Biology of the harbor seal, *Phoca vitulina*, in eastern Canada. Bulletin of the Fisheries Research Board of Canada 200. 24 pp.

Gilbert, J. R., and **K. M. Wynne.** 1984. Harbor seal populations and marine mammal-fisheries interactions, 1983. Report to the Northeast Fisheries Center, United States National Marine Fisheries Service, Woods Hole, Massachusetts. Contract NA-80-FA-C-00029. 52 pp.

Mansfield, A. W. 1967. Seals of arctic and eastern Canada. Second edition. Bulletin of the Fisheries Research Board of Canada 137. 33 pp.

Schneider, D. S., and **P. M. Payne.** 1983. Factors affecting haul-out of harbor seals at a site in southeastern Massachusetts. Journal of Mammalogy 64: 518–520.

Terhune, J. M. 1985. A linear decrease of harbor seal numbers. Marine Mammal Science 1: 340–341.

Terhune, J. M., and **M. Almon.** 1983. Variability of harbour seal numbers on haul-out sites. Aquatic Mammals 10: 71–78.

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