



## SCIENCE ADVICE ON HARVESTING OF NORTHWEST ATLANTIC GREY SEALS (*HALICHOERUS GRYPUS*) ON HAY ISLAND



Adult male and female (foreground) grey seal.  
Photo: W. D. Bowen

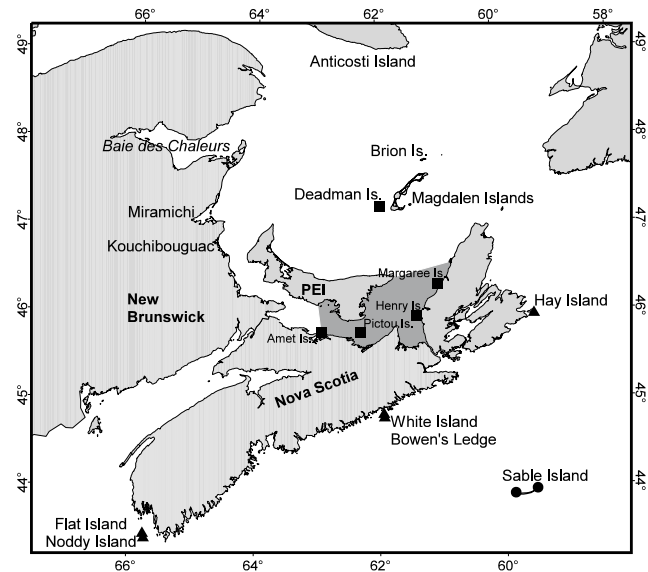


Figure 1: Southern gulf of St Lawrence and Scotian Shelf showing location of Sable Island (●), Eastern Shore (▲), Gulf (■) grey seal colonies and general location of ice-breeding animals (dark grey area). The Eastern Shore encompasses the east coast of Nova Scotia, from approximately Noddy Island to Hay Island.

### Context :

There is a small commercial hunt for grey seals in the southern Gulf of St. Lawrence and on Hay Island, the largest colony along the Eastern Shore of Nova Scotia. Grey seals on Sable Island are currently protected. The status of the population was assessed in 2007. Hay Island is located not far from the coast, but is still difficult to access. Harvesters travelling too early to the island will not encounter a sufficient number of moulted animals for harvesting and may disturb lactating females. At the same time, if there is a delay in visiting the island, animals will begin to disperse reducing yield. This advice was developed to examine the timing of births on Hay Island to assist in identifying appropriate timing for harvesting to occur. The request for advice was to identify when it was expected that 90% of the pups had been weaned.

### SUMMARY

- Grey seals form a single genetic population that is divided into three groups based on the location of breeding sites. Most pups (81%) are born on Sable Island, 15% are born in the Gulf and 4% are born along the Eastern Shore of Nova Scotia. This distribution has changed

over time, with a decline in the fraction of the population born on the ice compared to that born on small islands, and an increase in the proportion of animals born on the Eastern Shore, compared to the Gulf.

- Using aerial surveys, total production of Northwest Atlantic grey seals in 2007 was 67,500 (SE=1,400). This includes 54,500 (SE=1,300) pups born on Sable Island, 3,000 (SE=40) along the eastern shore of Nova Scotia (mainly Hay Island), and 9,900 (SE=600) in the Gulf of St. Lawrence.
- To determine the date of weaning and departure of pups from Hay Island, data on changes in the proportion of pup in age-related stages and stage durations were used to model the distribution of births and weaning. Data on proportions in different stages were collected from Hay Island in 2000, 2007, and 2008.
- Pupping on Hay Island begins in late December, and 50% of births occurred on average by 10 January. Given that lactation lasts for 19 days, about 90% of pups will be weaned by 11-15 February. Fully moulted pups (beaters) will be encountered on the island beginning in February, assuming a mean age of 25 days. Beaters begin entering the water at about 8 February and almost all animals will have left by 4 March.
- A conceptual model provides guidance on when harvesting might occur. If harvesting activities begin too soon the pupping season may be disrupted, Waiting too long will result in animals dispersing from the island. Harvesting after 10 February would encounter few adults still nursing, would have a large proportion of beaters present and very few beaters are likely to have dispersed by that time.

## BACKGROUND

Grey seals have their young on the ice and some small islands in the Gulf of St. Lawrence, on Sable Island and on some small Islands along the eastern and southwestern shore of Nova Scotia. The largest pupping colony along the Eastern Shore is Hay Island with about 3 000 pups born in recent years. This is a relatively new colony that was first discovered in the early 1990s. There is interest in hunting the young of the year after they have moulted their white fur (lanugo). The young at this stage are called beaters.

Fisheries management requested advice on the timing of pupping and on an appropriate time for harvesting to occur.

### Species Biology

Grey seals are considered to be a coastal or continental shelf species. They haul out on exposed reefs or on beaches of undisturbed islands. These concentrations of animals are typically quite noisy, and are associated with vocalizations resembling growls and roars. These noises sometimes resemble the calling of a wolf, and this may be the source of the general French term “loups marins or sea wolves”.

Breeding occurs on islands, isolated beaches or on the pack ice. Pups are born with a white lanugo, which they begin to shed approximately 15 days after birth and is completely replaced with a black spotted, silver coat by the time pups are 25 days old. Canadian grey seals form a single population that is divided into three components (Gulf , Eastern Shore and Sable Island),

for management considerations based on the locations of the major pupping concentrations. Lactation in grey seals is variable. Noren et al (2008) estimated a mean duration of 19 days (range 16-22 days). After weaning, the YOY fast onshore for about two weeks then begin to enter the water and disperse. On Sable Island time from birth to dispersal averaged  $40 \pm 1.1$  (mean $\pm$ se) days, but was also quite variable (range 26-49 days).

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## **Human Induced Mortality**

Grey seals were at one time very abundant, and widely distributed along the Canadian east coast, and in the Gulf of St Lawrence where they were first hunted by Amerindians. Extensive hunting by Europeans, resulted in the depletion of the grey seal population by the mid-1800's. Up to the 1950's, the grey seal was considered uncommon or rare, but they continued to be hunted. Some grey seals were taken in a bounty program focused on harbour seals (*Phoca vitulina*). A grey seal culling program at the breeding sites in the Gulf of St. Lawrence and along the Eastern Shore occurred between 1967 and 1984, removing between 114 and 2,375 animals per year. From 1978 to 1990, a bounty was paid to licensed fishermen who submitted lower jaws from grey seals, and information on date and location of capture. A total of 4,379 individuals was taken during this program. Captures were initially quite high, but with the exception of a large number of returns in 1987 (753), they declined steadily until 1990, when only 79 returns were received.

There is a small commercial harvest for grey seals (Table 1). Over the last five years an average of 655 animals have been removed per year. Harvests occur in the Gulf of St. Lawrence and along the Eastern Shore. Grey seals are protected on Sable Island. Some grey seals have been killed under a Nuisance seal permit provision of the Marine Mammal Regulations. A total of 484 nuisance seal permits was issued in 2007, with 99% of these issued in Nova Scotia (the Maritimes Region). Only 91 seals have been reported killed, but statistics are incomplete. Some animals are removed as part of Department of Fisheries and Oceans scientific sampling programs to study diet, growth and reproductive rates. This program has removed 347 seals in the last 5 years. Grey seals may also be taken as incidental catch in commercial fisheries, but no data are available on the magnitude of this mortality.

Table 1. Reported removals from the NW Atlantic grey seal population over the last seven years.

	2003	2004	2005	2006	2007	2008	2009
Commercial harvest	6	0	579	1804	887	1472	200
Science collections	85	199	15	22	26	No Data	-
Nuisance seals	No Data	No Data	No Data	No Data	91	No Data	No Data
Incidental catch	No Data	No Data	No Data	No Data	No Data	No Data	No Data

## ASSESSMENT

A number of surveys have been completed on Hay Island to determine abundance (1996, 1997, 2000, 2004, and 2007), but sufficient data to determine the timing of births was collected only in 2000, 2007, and 2008.

Pups on Hay Island were assigned to one of 5 distinct age-related categories (listed below) based on a combination of morphometric and pelage features to model the distribution of births:

- Stage 1. Newborns still wet with birth fluids, pelage yellowish tint, skin in loose folds, locomotion awkward, (Mean duration=3.0, SE=0.64);
- Stage 2. Neck well defined, trunk of body cylindrical in shape, pelage white; (Mean duration=3.0, SE=0.65)
- Stage 3. Neck and trunk of body combine to produce a fusiform shape, pelage white to light grey; (Mean duration=11.8, SE=2.53).
- Stage 4. Lanugo being shed from any part of the body, excepting the face (Mean duration=7.6, SE=1.98).
- Stage 5. Lanugo completely shed exposing the underlying juvenile pelage or isolated tufts of 5 cm diameter still present. (Age=25 days, cv set at 10%, se=2.5)

Hay Island was surveyed repeatedly and the change in the proportion of pups in each of the age-dependent categories was noted (Table 2). Two models were used to model the distribution of births. One model assumed that births followed a normal distribution and used the change in the proportion of pups in 3 different stage classes as the season advances to develop the distribution of births over time. The temporal distribution of births was also described assuming that the birth rate in a year can be adequately described by a continuous function of time. Pups pass through a series of 5 identifiable age-dependant stages of which the duration in each stage depend only on the current stage and the time so far spent in that stage.

Table 2. Number of animals in each age related morphometric category

Date	Newborn	Thin white	Fat-white	Ragged	Beater	Total
2000-01-06	17	51	18	0	0	86
2000-01-19	5	8	82	7	3	105
2000-02-09	0	6	119	176	139	440
2007-01-11	246	879	218	3	0	1346
2007-01-18	58	380	536	25	0	999
2007-01-31	0	28	165	131	37	361
2007-02-01	0	13	161	282	158	614
2007-02-06	0	55	260	536	496	1347
2007-02-10	0	4	126	324	422	876
2008-01-13	13	78	80	8	0	179
2008-01-24	3	21	91	14	1	130
2008-01-24	11	29	119	41	15	215
2008-01-24	2	14	156	56	26	254
2008-02-07	0	8	94	233	322	657

The stage models provided information on the timing of births. Lactation in grey seals is variable. Noren et al (2008) estimated a mean duration of  $19 \pm 0.2$  days (range 16-22 days). The young of the year (YOY) shed their lanugo to become beaters at the age of approximately 25 days. After weaning, the YOY fast onshore for several weeks then begin to enter the water and disperse. On Sable Island time to dispersal averaged  $40 \pm 1.1$  (mean  $\pm$  se) days, but was also quite variable (range 26-49 days).

There is some variability among years in the timing of births and the 3-stage Normal model estimated that 50% of births had occurred by 6 January 2000, 13 January 2007 and 9 January 2008 (Fig. 2). Births ended much earlier in 2000 (19 January), and a few days later in 2007 (26 January). Pooling the three years resulted in an estimate of 50% of the births occurring by 10 January. Virtually all births are complete by 24 January.

Using the pooled data only, 50% of the young will be weaned by 29 January (day 60). Nursing animals are still observed in February, but the estimated proportion of animals suckling (1-weaning) declined to 10% by 9 February (day 71). Near the end of lactation, the pups begin to moult. The first beaters are estimated to appear by late January (10% beaters: 24 January,  $se=3.5$ ). By 15 February ( $se=3.1$ ), virtually all (90%) YOY on the island are estimated to have reached the beater stage. The skewed distribution model similarly estimated that 90% of the pups would be beaters by 11 February.

YOY are estimated to begin leaving the island by 8 February or Day 70 ( $se=2.6$ ), with almost all animals having left by 4 March (Day 95). Visits to the island in early March have not observed YOY hauled out at this time.

The interaction between the timing of various stages is shown in Figure 2. Ninety percent of the pups would have been weaned by 9 February. At that time there would be a large number of beaters present and very few animals would have started to disperse (Fig.2).

## Sources of Uncertainty

The predictions from the model are based on three years of sampling, which do show some inter-annual variability in the timing of weaning. Some additional uncertainty is associated with the duration of the age related morphometric stages, but this may alter predictions for the timing of weaning by only a few days. The duration of lactation in grey seals can be as short as 16 days or as long as 22 days and the timing of dispersal from the island also likely has a greater impact on model predictions. On Sable Island dispersal can begin as early as 26 days of age but can be as late as 49 days (average 40 days) and is thought to be related to animal condition.

## ADDITIONAL STAKEHOLDER PERSPECTIVES

Timing for opening the harvest should consider the stage of animals to balance availability of beater stage animals against the dispersal of animals from the island. Local weather conditions may also be a factor where the timing of animals may not be optimal for harvest, but if poor weather conditions are imminent, where it may not be possible to access the island, animals might disperse before conditions improve resulting in loss of opportunity for harvest.

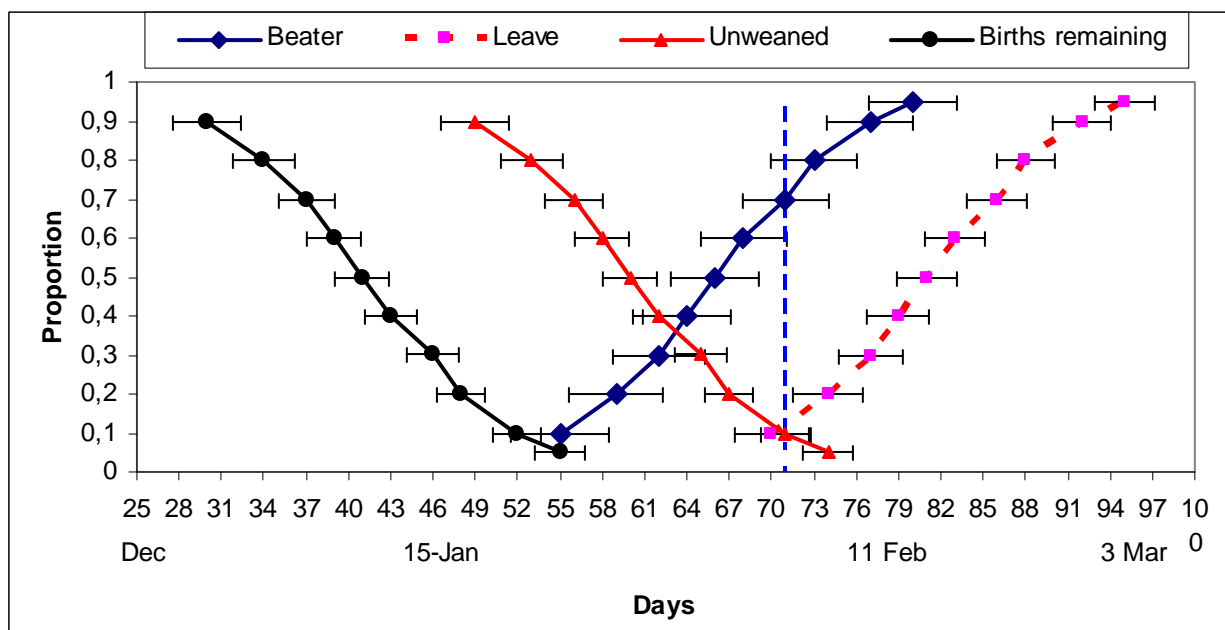


Figure 2. Model outlining the proportion of births remaining, weaned animals, beaters and when animals are expected to leave the island as a function of days since December 1. The vertical dashed line indicates when it is expected that approximately 90% of animals have been weaned, the proportion of beaters is about 55% and the number of animals that have left the island are predicted to be negligible.

## CONCLUSIONS AND ADVICE

The Hay Island colony is a relatively new one along the Eastern Shore of Nova Scotia. Pup counts are available since 1996, but pup stage data to determine the temporal distribution of

births are limited to three years (2000, 2007, 2008). It is evident that there is some interannual variability in the distribution of births, which cannot be fully appreciated based on the limited data set. Annual staging prior to the harvest could provide some improvement in the proportion of animals that have completed pupping. This could consist of a regular staging survey which involves a minimum of 3 surveys, interspersed over several days, or a single visit to see how the proportion of animals in each stage compares to the progression of births from earlier years. Ninety percent of animals should be weaned by 9 February (day 71).

## OTHER CONSIDERATIONS

There are several factors to consider. If harvesting activities begin too soon pupping may be disrupted, with some abandonment of pups. The number of beaters available for harvesting will also be very low. Significant beaters are expected to be available to hunters by the beginning of February, while pups would be expected to begin dispersing from the island by about 11 February. Local weather conditions may be a factor in deciding when to harvest, where delays due to poor weather may mean animals disperse from the island before harvesting.

## SOURCES OF INFORMATION

Noren, S.R., D.J. Boness, S. J. Iverson, J. McMillan, and W. Don Bowen. 2008. Body Condition at Weaning Affects the Duration of the Postweaning Fast in Gray Seal Pups (*Halichoerus grypus*). *Physiological and Biochemical Zoology* 81(3):269–277.

## FOR MORE INFORMATION

Contact:	Mike Hammill	Don Bowen
	Maurice Lamontagne Institute	Bedford Institute of Oceanography
	850, route de la Mer	1 Challenger Drive
	PO Box 1000	Dartmouth, Nova Scotia
	Mont-Joli, Quebec, G5H 3Z4	B2Y 4A2
Tel:	(418) 775-0580	(902) 426-8909
Fax:	(418) 775-0740	(902) 426-1509
E-Mail:	<a href="mailto:Mike.Hammill@dfo-mpo.gc.ca">Mike.Hammill@dfo-mpo.gc.ca</a>	<a href="mailto:Don.Bowen@dfo-mpo.gc.ca">Don.Bowen@dfo-mpo.gc.ca</a>

This report is available from the:

Centre for Science Advice (CSA)  
Quebec Region  
Fisheries and Oceans Canada  
Maurice Lamontagne Institute  
P.O. Box 1000, Mont-Joli  
Quebec, Canada  
G5H 3Z4

Telephone: (418) 775-0825

Fax: (418) 775-0679

E-Mail: [bras@dfo-mpo.gc.ca](mailto:bras@dfo-mpo.gc.ca)

Internet address: [www.dfo-mpo.gc.ca/csas](http://www.dfo-mpo.gc.ca/csas)

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