

COMMITTEE ON THE
STATUS OF ENDANGERED
WILDLIFE IN CANADA

OTTAWA, ONT. K1A 0H3
(819) 997-4991

COMITÉ SUR LE STATUT
DES ESPÈCES MENACÉES
DE DISPARITION AU
CANADA

OTTAWA (ONT.) K1A 0H3
(819) 997-4991

**STATUS REPORT ON THE HARBOUR SEAL
(LACS DES LOUPS MARINS HARBOUR POPULATION)
*PHOCA VITULINA MELLONAE***

IN CANADA

QL
88

S73

Vol. 10

BY

RICHARD J. SMITH

**STATUS ASSIGNED IN 1996
VULNERABLE**

REASON: **UNIQUE ENDEMIC SUBSPECIES OF HARBOUR SEALS WITH
LIMITED RANGE AND LOW NUMBERS, MAKING IT
VULNERABLE TO HUMAN IMPACT AND NATURAL
CATASTROPHIC EVENTS.**

OCCURRENCE: QUEBEC

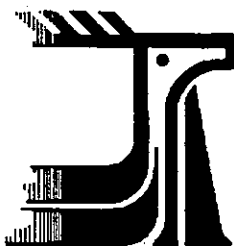
COSEWIC - A committee of representatives from
federal, provincial and private agencies which
assigns national status to species at risk in
Canada.

CSEMDC - Un comité de représentants d'organismes
fédéraux, provinciaux et privés qui attribue un
statut national aux espèces canadiennes en péril.

Rég. Québec Biblio. Env. Canada Library



38 508 587



COMMITTEE ON THE
STATUS OF ENDANGERED
WILDLIFE IN CANADA

OTTAWA, ONT. K1A 0H3
(819) 997-4991

COMITÉ SUR LE STATUT
DES ESPÈCES MENACÉES
DE DISPARITION AU
CANADA

OTTAWA (ONTARIO) K1A 0H3
(819) 997-4991

JUNE 1994

NOTES

1. This report is a working document used by COSEWIC in assigning status according to criteria listed below. It is released in its original form in the interest of making scientific information available to the public.
2. Reports are the property of COSEWIC and the author. They may not be presented as the work of any other person or agency. Anyone wishing to quote or cite information contained in status reports may do so provided that both the author and COSEWIC are credited. Reports may be cited as in the following example:

Bredin, E.J. 1989. Status report on the Northern Prairie Skink, Eumeces septentrionalis, in Canada. Committee on the Status of Endangered Wildlife in Canada. 48 pp.

3. Additional copies of this report may be obtained at nominal cost from The Canadian Nature Federation, 1 Nicholas Street., Suite 520, Ottawa, Ontario, K1N 7B7 or from the Co-ordinator, COSEWIC Secretariat, c/o Canadian Wildlife Service, Environment Canada, Ottawa, Ontario., K1A 0H3.

DEFINITIONS

SPECIES:	"Species" means an indigenous species, subspecies, variety or geographically defined population of wild fauna and flora.
VULNERABLE: (V)	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
THREATENED: (T)	A species likely to become endangered if limiting factors are not reversed.
ENDANGERED: (E)	A species facing imminent extirpation or extinction.
EXTIRPATED: (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
EXTINCT: (X)	A species that no longer exists.
NOT AT RISK: (NAR)	A species that has been evaluated and found to be not at risk.
INDETERMINATE: (I)	A species for which there is insufficient scientific information to support status designation.

COSEWIC - A committee of representatives from federal, provincial and private agencies which assigns national status to species at risk in Canada.

CSEMDC - Un comité de représentants d'organismes fédéraux, provinciaux et privés qui attribue un statut national aux espèces canadiennes en péril.

3617498I

**STATUS REPORT ON THE HARBOUR SEAL
(LACS DES LOUPS MARINS HARBOUR POPULATION)
*PHOCA VITULINA MELLONAE***

IN CANADA

QL
88
73
Vol. 10

BY

**RICHARD J. SMITH
DEPARTMENT OF ZOOLOGY
UNIVERSITY OF GUELPH
GUELPH, ONTARIO
N1G 2W1**



**STATUS ASSIGNED IN 1996
VULNERABLE**

Status of the Lacs des Loups Marins Harbour Seal, *Phoca vitulina mellonae*, in Canada

R.J. SMITH

Department of Zoology, University of Guelph, Guelph, Ontario, N1G 2W1

Smith, R.J. 1996. Status of the Lacs des Loups Marins Harbour Seal, *Phoca vitulina mellonae*, in Canada. Report to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Canadian Wildlife Service, Ottawa, Ontario K1A 0H3.

The Lacs des Loups Marins Harbour Seal (*Phoca vitulina mellonae*) is a subspecies that occurs in the area of Lacs des Loups Marins (Lower Seal Lakes) (56-57°N, 73-74°W), 160 km east of Hudson Bay, on the Ungava peninsula of northern Québec. With the possible exception of Lake Iliamna, Alaska, it is the only known Harbour Seal population that is resident in freshwater year-round. Written references to the unique appearance and behaviour of this seal date back to 1818. The subspecies was described primarily on the basis of its unique morphology and presumed long-time geographic isolation from neighbouring oceanic Harbour Seals. Estimates of the population's size are imprecise, and range from 100 to 600 animals. Little is known of the seals' habitat requirements other than that they seem to feed exclusively in freshwater, and are likely reliant on some specific environmental features such as under-ice air pockets to sustain them through the winter. Pupping seems to take place substantially earlier (mid-April to mid-May) than in other Harbour Seal populations at similar latitudes. The only known cause of human-induced mortality is occasional hunting by aboriginal peoples. *Phoca vitulina mellonae* is potentially vulnerable because of its small population size, restricted range, and susceptibility to disturbance.

Les phoques communs des Lacs des Loups Marins (*Phoca vitulina mellonae*) sont une sous-espèce que l'on trouve dans la région des Lacs des Loups Marins (Lower Seal Lakes) environ au 56-57°N, 73-74°O à 160 km à l'est de la Baie d'Hudson, sur la péninsule d'Ungava, au nord du Québec. À l'exception, peut-être, du Lac Iliamna en Alaska, c'est la seule population de phoques communs connue qui reste dans les eaux douces toute l'année. On dispose de références écrites sur l'apparence et le comportement uniques de ce phoque depuis 1818, et on a d'abord décrit cette sous-espèce à partir de sa morphologie particulière et selon l'hypothèse qu'elle est depuis longtemps géographiquement isolée des phoques communs océaniques avoisinants. Les estimations de leur population sont minces et donnent entre 100 et 600 individus. On en connaît peu sur les exigences des phoques quant à leur habitat à part le fait qu'ils semblent dépendre de certaines caractéristiques environnementales précises comme des poches d'air sous la galce pour qu'ils puissent passer l'hiver. La naissance de petits seble subvenir sensiblement plus tôt dans leur cas (mi-avril à mi-mai) que dans celui d'autres phoques à des latitudes comparables. Les seules causes de mortalité connues sont quelques références historiques ou contemporaines, à des prises de chasse par des Autochtones. Sa petite population, son aire restreint et sa vulnérabilité aux dérangements justifient qu'on accorde à cette espèce un statut de vulnérable.

Key Words: Phocidae, pinniped, *Phoca vitulina*, Harbour Seal, freshwater seals, *phoque commun*, Lacs des Loups Marins, northern Québec, endangered species.

The Lacs des Loups Marins Harbour Seal, *Phoca vitulina mellonae* (Atkinson, 1818) [Figure 1], is confined to the area of Lacs des Loups Marins (Lower Seal Lakes), approximately 160 km east of Hudson Bay, on the Ungava peninsula of northern Québec (Figure 2) [Doutt 1942; Anderson 1946; Scheffer 1958; Bigg 1981].

While there are numerous references to Harbour Seals occurring in freshwater worldwide (Erlandson 1834; DeKay 1842; Allen 1880; Browne 1909; Grenfell 1910; Prichard 1911; Strong 1930; Dunbar 1949; Fisher 1952; Wheeler 1953; Harper 1956; Harper 1961; Beck et al. 1970; Paulbitski 1974; Roffe and Mate 1984; Williamson 1988), *Phoca vitulina mellonae* is the only known Harbour Seal population resident in freshwater year-round (Atkinson 1818; Clouston 1820; Hendry 1828; Finlayson 1830; Low 1898; Lewis 1904; Flaherty 1918; Twomey 1938; Doutt 1942; Manning 1946; Doutt 1954; Graburn 1969; Power and Gregoire 1978; Smith and Horonowitsch 1987; Consortium Gilles Shooner & Associés et al. 1991). A freshwater population is found in Lake Iliamna, Alaska, but it is the Pacific subspecies *Phoca vitulina richardsi*, and it is not certain whether it is landlocked (Everitt and Braham 1980).

Written references to the unique appearance and behaviour of *Phoca vitulina mellonae* date back to Atkinson (1818). The subspecies was described primarily on the basis of an unusually dark pelage and an enlarged coronoid process on the mandible (Doutt 1942), with the presumption that the population had been isolated for 3000 to 8000 years, trapped by the Ungava peninsula's isostatic rebound since the retreat of the Laurentian ice sheet. Other authors disputed this interpretation, however, arguing that supposed morphological anomalies of *Phoca vitulina mellonae* are merely artifacts of a small sample size, and that the seals are likely able to travel freely between salt and freshwater (Mansfield and McLaren 1958; Mansfield 1967; Smith and Horonowitsch 1987; also see Honacki et al. 1982; King 1983; Wiig 1989; Reeves et al. 1992). Other work, the majority of it recent, strongly supports the validity of *Phoca vitulina mellonae*'s subspecific designation (Davies 1958; Consortium Gilles Shooner & Associés et al. 1991; Smith et al. 1994, 1996; Smith 1996).

Distribution

This is clearly a population with restricted distribution (Figure 2). There are historical references to the presence of this seal in Lac Minto, at the head of Rivière aux Feuilles (Flaherty 1918; Manning 1947), Lac Beneta, situated in the basin of Rivière aux Mélézes (Manning 1947), Petit Lac des Loups Marins (Atkinson 1818; Clouston 1820; Doutt 1942), and Lacs des Loups Marins (Hendry 1828; Finlayson 1830; Low 1898; Lewis 1904; Doutt 1942; Doutt 1954; Power and Gregoire 1978; Berrouard 1984; Smith and Horonowitsch 1987). Several sightings have been made by Hydro-Québec employees and contractors in the Rivière aux Feuilles, Lac Melvin and Rivière Delay (Consortium Gilles Shooner & Associés et al. 1991). Inuit hunters, interviewed by Hydro-Québec contractors, reported seeing or killing freshwater seals in Lac Guillaume-Delisle, Rivière Nastapoca, Rivière Boniface, Rivière Niagurnaq, Rivière Kuunga, Rivière Longland, Lac Tasialuk, and Lacs des Loups Marins (Archéotec inc. 1990). The Cree nation of Whapmagoostui considers the range of *Phoca vitulina mellonae* to be Lacs des Loups Marins, Petit Lac des Loups Marins, and Lac Bourdel, with some reports of animals having once been in Lac à l'Eau Claire (Clearwater Lake) (J. Petagumskum, Whapmagoostui, Québec, personal communication).

Hydro-Québec has recently compiled observations made of these freshwater seals between 1970 and 1990 (Consortium Gilles Shooner & Associés et al. 1991). Though the preponderance of their survey efforts have been concentrated in Lacs des Loups Marins, Hydro-Québec's data nevertheless indicate the presence of seals in Rivière Nastapoca, Lacs des Loups Marins, Petit Lac des Loups Marins, Lac Bourdel, Lac à l'Eau Claire, and Petite Rivière de la Baleine. In addition, evidence from recordings of underwater vocalizations suggests the presence of seals in Rivière aux Feuilles, Rivière aux Mélézes, Rivière du Gué, Grande Rivière de la Baleine and La Grande Rivière (Consortium Gilles Shooner & Associés et al. 1991).

During the autumn of 1995, 4 seals were captured in Lacs des Loups Marins and affixed with satellite-linked time-depth recorders (Wildlife Computers, WA). All four tags transmitted from early September to mid-November, and during that time all four seals remained within Lacs des Loups Marins or in the immediate vicinity (R.J. Smith, unpublished data).

Protection

Because Canada possesses no specific marine mammal or endangered species legislation, and because it is unclear whether *Phoca vitulina mellonae*, a marine mammal in freshwater, falls within a provincial or federal jurisdiction, the population currently has minimal legal protection. Specific protection, if required, could be provided under the Marine Mammal Regulations pursuant to the Fisheries Act of 1867. Freshwater seals north of the 55th parallel are listed as a protected species under the James Bay and northern Québec Agreement (Québec 1976); however, this protection does not have the force of law (J. Gunn, Ministère de l'Environnement et de la Faune, Radisson, Québec, personal communication). *Phoca vitulina mellonae* was recently listed by the International Union for the Conservation of Nature and Natural Resources (IUCN) as being "insufficiently known", meaning that it is "suspected but not definitely known to be endangered, vulnerable, or rare due to a lack of reliable information" (Reijnders et al. 1993). The government of Québec has listed the population as "likely to be designated as threatened or vulnerable" (Québec 1992a), and is considering whether to give legal protection to a portion of *Phoca vitulina mellonae*'s habitat (Dubreuil 1983; Québec 1992b). This protection should be a priority given that the proposed Grande Baleine hydroelectric development could have an adverse impact on a large portion of this population's range (Rosenthal and Beyea 1989; Rougerie 1990; Woodley et al. 1992; Smith et al. 1994).

Population Size And Trends

Estimates of the size of this small population are imprecise. A maximum of 500 animals was the "guess" of Douth (1957), cited in Scheffer (1958). Power and Gregoire (1978) estimated 200 and 600 animals by two different summations. The most recent estimate by Consortium Gilles Shooner & Associés et al. (1991) was approximately 100 animals, or 0.1 seals/km², in Lacs des Loups Marins and Lac Bourdel. Population trends over time obviously cannot be calculated.

Habitat

Little is known of the habitat and ecological requirements of this subspecies.

The few dead animals that have been examined were found to have salmonid

(*Salvelinus* sp.) otoliths in their stomachs (Consortium Gilles Shooner & Associés et al. 1991; Smith et al. 1996). Comparisons of the stable-isotope ratios and fatty acid profiles of the tissues of *Phoca vitulina mellonae* and Harbour Seals collected from oceanic locations indicate that, over a two year period, *Phoca vitulina mellonae* seemed to be feeding exclusively in freshwater (Smith et al. 1996).

Recent investigations found no permanent haulout sites on Lacs des Loups Marins and Lac Bourdel (Consortium Gilles Shooner & Associés et al. 1991). In winter, when the vast majority of the lakes and rivers are covered in ice, the seals may rely on several physical features for their sources of air: areas that remain ice-free because of strong currents, fissures in the ice, and air pockets created by the shoreline's complicated geometry or by the undulations in the bottom of the sheet ice on the lake's surface (Smith and Horonowitsch 1987; Consortium Gilles Shooner & Associés et al. 1991; Dean Consulting & Research Associates Inc. 1991).

None of the habitat of this population is protected. It is entirely on Crown land that could be adversely affected by Hydro-Québec's construction of the proposed Grande Baleine hydroelectric project (Woodley et al. 1992) which, though indefinitely postponed by the current provincial government, has not been cancelled altogether. One of the results of the Grande Baleine environmental assessment process has been that Hydro-Québec is now required to evaluate properly the likely impacts of the project on the population, prior to construction (Review Bodies 1994). Some of these potential impacts include the disappearance of ice-free areas and under-ice shoreline shelters, upon which the seals may rely in the winter, in water courses with altered flows arising from hydroelectric development. The Grande Baleine project may also affect the distribution and abundance of the seals' prey, and contaminate the animals with methyl mercury released from the flooded, decomposing vegetation (Woodley et al. 1992). The negative effects of this habitat destruction could lead to a decline in the seal population and an impoverishment of its genetic diversity (Alfonso and McAllister 1994).

General Biology

Reproduction probably occurs between mid-April and mid-May in the Lacs des Loups Marins area; substantially earlier than other Harbour Seal populations at a similar latitude (Doutt 1942; Archéotec inc. 1990; Consortium Gilles Shooner & Associés et al. 1991; Temte et al. 1991; Smith et al. 1994). Since the lakes are still iced over at the time of pupping, and no births have been observed on the ice, several authors have postulated that pupping takes place in under-ice shelters (Consortium Gilles Shooner & Associés et al. 1991), like those of ringed seals (*Phoca hispida*) (Smith and Stirling 1975).

The only known cause of human-induced mortality is occasional hunting of the seals by aboriginal peoples (Clouston 1820; Low 1898; Flaherty 1918; Doutt 1942; Doutt 1954; Consortium Gilles Shooner & Associés et al. 1991; J. Petagumskum personal communication).

Seasonal movements of the population are poorly known, though the sporadic observations of Gilles Shooner & Associés et al. (1991) hint at seals spending the winter months in larger bodies of water like Lacs des Loups Marins, Lac Bourdel, and Petit Lac des Loups Marins, with some dispersal into outlying, smaller bodies of water upon the melting of the ice. These investigators report finding many worn trails between bodies of water frequented by the seals, some as long as 0.15 km, and on inclines as steep as

25°. There is no evidence that animals move between the area of Lacs des Loups Marins and Hudson or Ungava Bays. However, though there are a number of impassable waterfalls on the Rivière Nastapoca, some authors believe that if the seals could move into the more placid rivers that flow north into Ungava Bay, this would be a feasible avenue of exchange between the fresh and saltwater populations (Mansfield 1967; SOGEAM 1985; Smith and Horonowitsch 1987).

Preliminary evidence from DNA sequencing of region I of the mitochondrial D-loop indicate that *Phoca vitulina mellonae* has haplotypes that are unique when compared to Harbour Seals in the eastern Canadian arctic and Northwest Atlantic (Smith 1996).

Animals hauled out in the spring months are usually in small groups, whereas at the end of the summer, they are usually hauled out singly or in pairs: This behaviour is probably related to the moulting process (Consortium Gilles Shooner & Associés et al. 1991).

Limiting Factors

The tendency of Harbour Seals to be distributed in small local populations makes them vulnerable to disturbance (Maine Seal 1994). There are a number of examples of local Harbour Seal populations being extirpated, or their numbers drastically reduced, by human activity. For example, a small population that seemed to frequent Lake Ontario was eliminated by the early 1800s (DeKay 1842; Allen 1880); the population in Greenland is practically extirpated (Teilmann and Dietz 1993; R. Dietz, personal communication), an important reason being the intensity with which it has been hunted and entangled in fishing gear; the population in Hokkaido, Japan, is very small, with removals from incidental catches in fishing gear exceeding recruitment (Reijnders et al. 1993). Given such evidence, the Lacs des Loups Marins seal population is likely sensitive even to limited disturbance by humans.

Special Significance Of The Subspecies

This population of Harbour Seals is unique, in that it is the object of reverence by the aboriginal peoples of northern Québec (Posluns 1993; Archéotec inc. 1990; M. George, Whapmagoostui, Québec, personal communication); it is the object of a wealth of historical references, and seems to be unusual in a number of ways, including aspects of its biology (Consortium Gilles Shooner & Associés et al. 1991; Smith et al. 1994, 1996; Smith 1996). The population has also acquired something of a public profile over the last few years (e.g. Dubreuil 1987).

Evaluation

It is essential for the future viability of this subspecies that the potential impacts on the population from the Grande Baleine hydroelectric project, and any other future development in Québec's north, be eliminated or seriously mitigated.

Because of the inaccessibility of the population, there is no known trade in the subspecies, legal or otherwise.

Acknowledgements

I thank D.M. Lavigne for his support. The comments and criticisms of R.R. Campbell and two other members of COSEWIC's Fish and Marine Mammal Subcommittee were also helpful. G. Luste provided some of the more obscure

references. Funding for the production of this manuscript was provided by the Natural Sciences and Engineering Research Council of Canada and the International Marine Mammal Association Inc., Guelph, Ontario.

Literature Cited

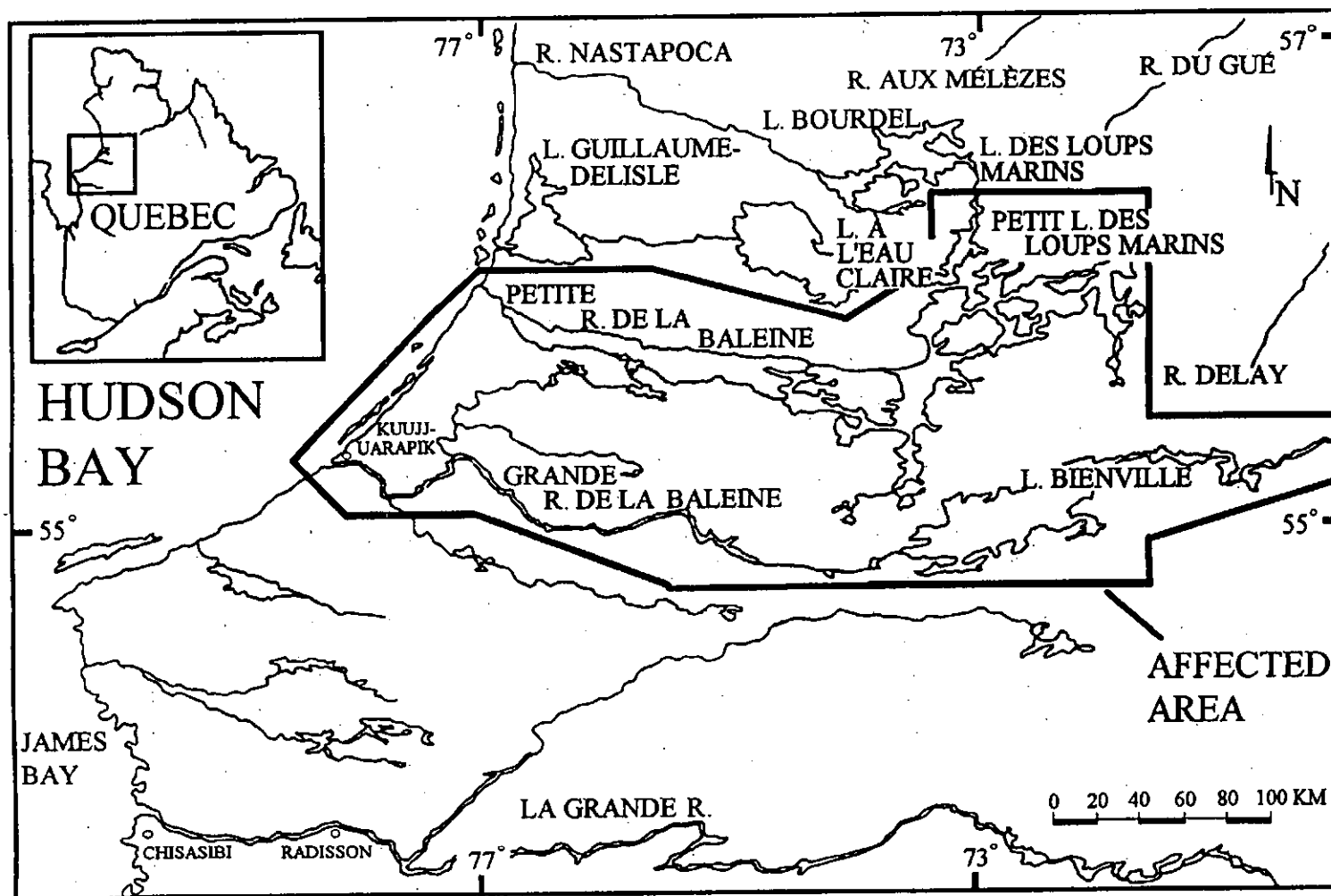
- Alfonso, N., and D.E. McAllister. 1994. Biodiversity and the Great Whale hydroelectric project. Great Whale Environmental Assessment: Background Paper No. 11, Great Whale Public Review Support Office. 75 p.
- Allen, J.A. 1880. History of North American pinnipeds - A monograph of the walruses, sea-lions, sea-bears and seals of North America. U.S. Geological and Geographical Survey of the Territories. Miscellaneous Publication No. 12. 785 p.
- Anderson, R.M. 1946. Catalogue of Canadian recent mammals. National Museum of Canada Bulletin No. 102. King's Printer, Ottawa. 238 p.
- Archéotec Inc. 1990. Complexe Grande-Baleine, Avant-projet, Phase 2, Le phoque d'eau douce: Éléments pour une compréhension de son utilisation par les Autochtones du Nouveau-Québec, vice-présidence Environnement, Hydro-Québec. 145 p.
- Atkinson, G. 1818. Journal of George Atkinson II. Page 61 in Northern Quebec and Labrador journals and correspondence 1819-35. 1963. Edited by K.G. Davies and A.M. Johnson. The Hudson's Bay Record Society, London. 415 p.
- Beck, B., T.G. Smith, and A.W. Mansfield. 1970. Occurrence of the harbour seal, *Phoca vitulina*, Linnaeus in the Thlewiaza River, N.W.T. The Canadian Field-Naturalist 84:297-300.
- Berrouard, D. 1984. Résultats d'une reconnaissance aérienne dans le but de repérer des sous-populations de phoques communs (*Phoca vitulina*) dans la région des lacs des Loups Marins. Ministère de l'Environnement, Direction régionale du Nouveau-Québec. 19 p.
- Bigg, M.A. 1981. Harbour seal - *Phoca vitulina* Linnaeus, 1758 and *P. largha* Pallas, 1811. Pages 1-27 in Handbook of marine mammals, Vol. 2: Seals. Edited by S.H. Ridgeway and R.J. Harrison. Academic Press, London.
- Browne, P.W. 1909. Where the fishers go - The story of Labrador. The Musson Book Company Ltd., Toronto.
- Clouston, J. 1820. Second journal of James Clouston. Pages 29-68 in Northern Quebec and Labrador journals and correspondence 1819-35. 1963. Edited by K.G. Davies and A. M. Johnson. The Hudson's Bay Record Society, London. 415 p.
- Consortium Gilles Shoener & Associés, SOMER et Environnement Illimité Inc. 1991. Complexe Grande-Baleine, Avant-projet Phase 2, Bilan des connaissances sur le phoque d'eau douce. Vice-présidence Environnement, Hydro-Québec. 150 p.
- Davies, J.L. 1958. Pleistocene geography and the distribution of northern pinnipeds. Ecology 39:97-113.
- Dean Consulting & Research Associates Inc. 1991. Investigations of the under-ice habitats of fresh-water seals in the Lacs des Loups Marins region. A Report for Hydro-Quebec, Service Hydraulique, Division Hydrometrie. Dean Consulting & Research Associates, Inc. Norwich, Vermont. 36 p.
- DeKay, J.E. 1842. Natural history of New York, Part I. Zoology. D. Appleton and Co. and Wiley and Putnam, New York, NY.

- Doutt, J.K. 1942. A review of the genus *Phoca*. *Annals of the Carnegie Museum* 29:61-125.
- Doutt, J.K. 1954. Observations on mammals along the east coast of Hudson Bay and the interior of Ungava. *Annals of the Carnegie Museum* 33:235-249.
- Dubreuil, C. 1983. Un statut de conservation pour le phoque commun habitant les eaux douces du Quebec. Ministère de l'Environnement, Direction des réserves écologiques et des sites naturels. 7 p.
- Dubreuil, C. 1987. Des phoques d'eau douce "menacés" par la baie James II? *FrancNord* 4(2):30-35.
- Dunbar, M.J. 1949. The pinnipedia of the Arctic and Subarctic. *Bulletin of the Fisheries Research Board of Canada* 85:1-22.
- Erlandson, E. 1834. Journal of Erland Erlandson. Pages 247-259 in *Northern Quebec and Labrador journals and correspondence 1819-35*. 1963. Edited by K.G. Davies and A.M. Johnson. The Hudson's Bay Record Society, London. 415 p.
- Everitt, R.D., and H.W. Braham. 1980. Aerial survey of Pacific harbor seals in the southeastern Bering Sea. *Northwest Science* 54:281-288.
- Finlayson, N. 1830. Journal of Nicol Finlayson. Pages 101-176 in *Northern Quebec and Labrador journals and correspondence 1819-35*. 1963. Edited by K.G. Davies and A.M. Johnson. The Hudson's Bay Record Society, London. 415 p.
- Fisher, H.D. 1952. The status of the harbour seal in British Columbia, with particular reference to the Skeena River. *Bulletin of the Fisheries Research Board of Canada* 93. 58 p.
- Flaherty, R.J. 1918. Two traverses across Ungava peninsula, Labrador. *Geographical Review* 6:116-132.
- Graburn, N.H.H. 1969. Eskimos without igloos - Social and economic development in Sugluk. Little, Brown and Company, Boston.
- Grenfell, W.T. 1910. Labrador - The country and the people. The MacMillan Company, New York, NY.
- Harper, F. 1956. The mammals of Keewatin. University of Kansas Museum of Natural History Miscellaneous Publication 12:1-94.
- Harper, F. 1961. Land and fresh-water mammals of the Ungava peninsula. University of Kansas Museum of Natural History Miscellaneous Publication 27:1-178.
- Hendry, W. 1828. Journal of William Hendry. Pages 69-99 in *Northern Quebec and Labrador journals and correspondence 1819-35*. 1963. Edited by K.G. Davies and A.M. Johnson. The Hudson's Bay Record Society, London. 415 p.
- Honacki, J.H., K.E. Kinman and J.W. Koepl. 1982. Mammal species of the world. Allen Press and the Association of Systematics Collections, Lawrence, Kansas.
- King, J. 1983. Seals of the world. 2nd Edition. British Museum (Natural History) and Cornell University Press, Ithaca, NY.
- Lewis, A. 1904. The life and work of the Rev. E.J. Peck. Hodder and Stoughton, London. 345 p.
- Low, A.P. 1898. Report on a traverse of the northern part of the Labrador peninsula from Richmond Gulf to Ungava Bay. *Geological Survey of Canada Annual Report (n.s.)* 9:1-43.
- Maine Seal. 1994. Boater etiquette around harbour seals. Maine Seal,

- Lincoln, MA. 2 p.
- Manning, T.H. 1946. Bird and mammal notes from the east side of Hudson Bay. *The Canadian Field-Naturalist* 60:71-85.
- Mansfield, A.W., and I.A. McLaren. 1958. Status of the harbour seal in the eastern Canadian Arctic. Pages 46-50 in Fisheries Research Board of Canada, Arctic unit, annual report and investigators' summaries. Edited by H.D. Fisher. Fisheries Research Board of Canada, Montreal, Quebec.
- Mansfield, A.W. 1967. Distribution of the harbor seal, *Phoca vitulina* Linnaeus, in Canadian arctic waters. *Journal of Mammalogy* 48:249-257.
- Paulbitski, P.A. 1974. Pinnipeds observed in rivers of northern California. *California Fish and Game* 60:48-49.
- Posluns, M. 1993. *Voices from the Odeyak*. NC Press Limited, Toronto. 230 p.
- Power, G., and J. Gregoire. 1978. Predation by freshwater seals on the fish community of Lower Seal Lake, Quebec. *Journal of the Fisheries Research Board of Canada* 35:844-850.
- Prichard, H.H. 1911. *Through trackless Labrador*. William Heinemann, London.
- Québec (Province). 1976. James Bay and northern Québec Agreement.
- Québec (Province). 1992a. Liste des espèces de la faune vertébrées susceptibles d'être désignées menacées ou vulnérables. Ministère de l'Environnement et de la Faune, Québec. 107 p.
- Québec (Province). 1992b. Réseau des réserves écologiques au Québec (projets et réalisations). Ministère de l'Environnement, Direction de la conservation et du patrimoine écologique.
- Reeves, R.R., B.S. Stewart and S. Leatherwood. 1992. *The Sierra Club handbook of seals and sirenians*. Sierra Club Books, San Francisco, CA.
- Reijnders, P.J.H., S. Brasseur, J. van der Toorn, P. van der Wolf, I. Boyd, J. Harwood, D. Lavigne, L. Lowry and S. Stuart, *Editors*. 1993. *Seals, fur seals, sea lions and walruses: status of pinnipeds and conservation action plan*. IUCN, Gland, Switzerland.
- Review Bodies responsible for the environmental assessment of the proposed Great Whale hydroelectric project. 1994. Joint report on the conformity and quality of the environmental impact statement for the proposed Great Whale River hydroelectric project. 120 p.
- Roffe, T.J., and B.R. Mate. 1984. Abundances and feeding habits of pinnipeds in the Rogue River, Oregon. *Journal of Wildlife Management* 48:1262-1274.
- Rosenthal, J., and J. Beyea. 1989. Long-term threats to Canada's James Bay from human development. Environmental Policy Analysis Department Report No. 29. National Audubon Society, New York, NY.
- Rougerie, J.-F. 1990. James Bay development project. *Canadian Water Watch* 3:56-58.
- Scheffer, V.B. 1958. *Seals, sea lions and walruses - A review of the pinnipedia*. Stanford University Press, Stanford, California.
- Smith, R.J., K.A. Hobson, H.N. Koopman and D.M. Lavigne. 1996. Distinguishing between populations of fresh and saltwater harbour seals (*Phoca vitulina*) using stable-isotope ratios and fatty acid profiles. *Canadian Journal of Fisheries and Aquatic Sciences* In Press.
- Smith R.J. 1996. *Abstract*. Population structure and habitat use of the Lacs des Loups Marins harbour seal (*Phoca vitulina mellonae*). Eleventh Biennial Conference on the Biology of Marine Mammals, 14-18 December, 1995, Orlando, FA.
- Smith, R.J., D.M. Lavigne and W.R. Leonard. 1994. Subspecific status of the

- freshwater harbor seal (*Phoca vitulina mellonae*): A re-assessment. Marine Mammal Science 10:105-110.
- Smith, T.G., and G. Horonowitsch. 1987. Harbour seals in the Lacs des Loups Marins and eastern Hudson Bay drainage. Canadian Technical Report of Fisheries and Aquatic Sciences 1539.
- Smith, T.G., and I. Stirling. 1975. The breeding habitat of the ringed seal (*Phoca hispida*): The birth lair and associated structures. Canadian Journal of Zoology 53:1297-1305.
- SOGEM. 1985. Caractéristiques hydro-géomorphologiques des lacs des Loups Marins. Ministère du Loisir, de la Chasse et de la Pêche, Direction générale de la Faune Rapport 3700-14. 21 p.
- Strong, W.D. 1930. Notes on mammals of the Labrador interior. Journal of Mammalogy 11:1-10.
- Teilmann, J., and R. Dietz. 1993. Status of the harbour seal (*Phoca vitulina concolor* L.) in Greenland. Greenland Environmental Research Institute, Technical Report. 33 p.
- Temte, J.L., M.A. Bigg and O. Wiig. 1991. Clines revisited: the timing of pupping in the harbour seal (*Phoca vitulina*). Journal of Zoology, London 224:617-632.
- Twomey, A.C. 1938. Needle to the north: The story of an expedition to Ungava and the Belcher Islands. Herbert Jenkins Ltd., London. 151 p.
- Wheeler, E.P. 1953. Notes on pinnipedia. Journal of Mammalogy 34:253-255.
- Wiig, O. 1989. A description of common seals, *Phoca vitulina* L. 1758, from Svalbard. Marine Mammal Science 5:149-158.
- Williamson, G.R. 1988. Seals in Loch Ness. Scientific Reports of the Whales Research Institute 39:151-157.
- Woodley, T.H., R.J. Smith, and D.M. Lavigne. 1992. Potential impacts of hydroelectric development on marine mammals of northern Quebec. IMMA Technical Report No. 92-02. International Marine Mammal Association Inc., Guelph, Ontario. 9 p.





List of Figures

Figure 1. Lac des Loups Marins Harbour Seal (photograph by Paul Heaven).

Figure 2. Known range of *Phoca vitulina mellonae* in relation to Hydro-Québec's proposed Grande Baleine hydroelectric project.