Migratory Sea Mammals Populations in Lancaster Sound

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Arctic Biological Station
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This report presents concluding data and results obtained by Fisheries and Environment Canada for use by the Arctic Islands Pipeline Program. These investigations were carried out under the Environmental-Social Program, Northern Pipelines of the Government of Canada. While the studies and investigations were initiated to provide information necessary for the assessment of hydrocarbon transportation proposals, the knowledge gained is equally useful in planning and assessing other development projects.

RÉSUMÉ

Nous avons étudié la répartition, l'abondance et les migrations des mammifères marins, en particulier du béluga (Delphinapterus leucas) et du narval (Monodon monoceros), qui pénètrent dans le détroit de Lancaster en été, en mettant particulièrement l'accent sur les tracés qui pourraient éventuellement être choisis pour la traversée des détroits de Barrow et Bellot par un pipeline. Nous avons utilisé, entre autres, des relevés visuels et photographiques, faits à partir d'avions, des animaux concentrés à la limite de la banquise au printemps, de ceux qui dépassent les falaises du cap Hay sur l'île Bylot pendant leur migration du début de l'été, et de ceux qui se rassemblent dans les baies et les inlets pendant l'été.

Les bélugas pénètrent dans le détroit de Lancaster au début du printemps et s'y concentrent dans l'extrémité ouest en juillet et août, allant dans certaines baies et inlets afin d'y mettre bas ou de s'y nourrir. Cette espèce serait particulièrement sensible à des perturbations causées par l'homme dans des endroits tels que l'inlet Cunningham et la baie Creswell de l'île Somerset. Les narvals pénètrent dans le détroit de Lancaster au printemps, un peu plus tard que les bélugas, et se concentrent surtout, en été, dans les fjords profonds du nord de l'île Baffin. Par conséquent, cette espèce ne serait pas particulièrement sensible aux perturbations causées par un pipeline qui suivrait le tracé projeté. Des troupeaux de morses (Odobenus rosmarus) totalisant moins de 400 individus se trouvent dans les baies Maxwell et Radstock de l'île Devon ou aux environs, en été. Des dizaines de milliers de phoques du Groenland (Pagophilus groenlandicus) et un petit nombre (probablement moins de 50) de baleines boréales (Balaena mysticetus) pénètrent dans le détroit de Lancaster en été.

Toutes ces espèces ressortent du détroit de Lancaster à la fin de septembre et au début d'octobre pour se diriger vers les territoires d'hivernage dans la baie Baffin et le détroit de Davis.

ABSTRACT

We studied the distribution, numbers, and migrations of sea mammals entering Lancaster Sound in the summer months, particularly the abundant white whale *Delphinapterus leucas* and narwhal *Monodon monoceros*, paying particular attention to potential routes of pipeline crossings in Barrow and Bellot straits. Methods used included visual and photographic aerial survey of animals concentrated along the floe edge in spring, animals passing the cliffs of Cape Hay, Bylot Island in a migration in early summer, and animals concentrated in bays and inlets during summer.

White whales enter Lancaster Sound in early spring and concentrate at its western end in July-August, entering certain bays and inlets for the purpose of calving and others for feeding. This species is particularly vulnerable to possible man-made disturbance at sites such as Cunningham Inlet and Creswell Bay, Somerset Island. Narwhals enter Lancaster Sound somewhat later in the spring than white whales, and their main numbers in summer are found in the deep fjords of northern Baffin Island; consequently, the species would not be particularly vulnerable to disturbance by a pipeline following the route hitherto projected. Concentrations totalling less than 400 walruses *Odobenus rosmarus* are found in summer in or near Maxwell and Radstock bays, Devon Island. Tens of thousands of harp seals *Pagophilus groenlandicus* enter Lancaster Sound in summer and small numbers (probably less than 50) bowhead whales *Balaena mysticetus*.

All these species migrate out of Lancaster Sound in late September and early October to wintering areas in Baffin Bay and Davis Strait.

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1. INTRODUCTION

1.1 Objectives

This study examines the seasonal migration of white whales, narwhals and other migratory sea mammals into and out of Lancaster Sound, as well as their distribution and numbers within the system in summer.

1.2 Relation to Pipeline Development

Because a pipeline is proposed crossing Barrow and Bellot straits with supply harbours in the vicinity of its shore terminals, it is important that concentrations of sea mammals be located so that they will not be affected by pipeline activities.

2. CURRENT STATE OF KNOWLEDGE

Lancaster Sound and eastern Barrow Strait have long been known as important summering areas for a number of high-arctic Cetacea, as well as seabirds, but no special studies had been made of them other than limited observations around Bylot Island by Ellis (1957) and Miller (1955), while Anderson (1934) cites some earlier reports from the area.

We received from the Canadian Wildlife Service in the 1960's reports of large numbers of white whales in summer around Somerset Island. This information led to the start of our research in 1973 as described below.

Some of the research reported here has been published previously. Sergeant & Brodie (1975) summarised the status of white whales in the Canadian arctic, including Lancaster Sound. Hay & McClung (MS 1974) summarised their studies on white whales and narwhals in Lancaster Sound in 1975. Greendale & Brousseau-Greendale (MS 1976) carried out field studies of sea mammals migrating past Cape Hay, Bylot Island, in June and July 1976.

Concurrent with this study, independent studies of sea mammals in western Lancaster Sound were made by LGL Ltd. for Polar Gas in 1975 (Finley 1976), and in eastern Lancaster Sound for Norlands Petroleum Ltd. in 1975-1976 by Renewable Resource Consulting Services Ltd. (no date) and in 1976 by R. Webb Environmental Associates Ltd. (Webb, MS 1976) and LGL Ltd. (Johnson, Renaud, Davis & Richardson, MS 1976). We refer to but do not review these studies here.

3. STUDY AREA

The study area (Fig. 1) included the whole of Lancaster Sound and eastern Barrow Strait, including the main inlets that attract large summering populations of sea mammals, especially Cunningham Inlet, Radstock and Maxwell bays, Admiralty Inlet, and the Pond Inlet-Eclipse Sound area.

4. METHODS

4.1 Techniques

In order to study variations in breakup of ice in Lancaster Sound, satellite imagery was obtained for the area for the months March to September for the years 1973 (when ERTS, precursor of LANDSAT, was first orbited) to 1977 inclusive.

Aerial counts of concentrated white whales, in bays or river mouths, or along a floe edge, were estimated visually by from one to four observers in a Twin Otter aircraft. Estimates were sometimes checked using 35 mm colour slides, and once overlapping vertical aerial photographs of 23 x 23 cm format were taken from a light twin-engined aircraft. A remote-controlled model aircraft equipped with a remotely-operated 35 mm camera was used to photograph white whales in Cunningham Inlet in 1977. The technique is described by Sleno & Mansfield (MS 1978).

A 20 foot high, collapsible aluminum scaffold was used during the summers of 1974 and 1977 to study the behaviour of white whales at Cunningham Inlet. The behaviour study of 1974 is described by Hay & McClung (MS 1974).

4.2 Narrative

The senior author visited Resolute from 31 July to 7 August 1973. He made aerial surveys around the north and east coasts of Somerset Island, across Barrow Strait and Wellington Channel, along the west and south coasts of Devon Island, and in Admiralty Inlet and its tributary fjords. During these surveys he studied the distribution of white whales and narwhals. He visited by helicopter a concentration of white whales in Cunningham Inlet, north Somerset Island, numbering about 1,000 animals. Later this concentration was photographed vertically from the air, as was a similar concentration found in Creswell Bay, southeast Somerset Island.

In 1974 the junior author, together with R. McClung, spent the five weeks 6 July to 7 August at Cunningham Inlet in an intensive study of the behaviour of the white whale herd, using as an observation platform a 20-foot high, collapsible aluminum tower. Interest then shifted to a study of narwhals, principally carried out in the regions

of Arctic Bay and Pond Inlet. Using the Inuit kill of these animals as study material, K. Hay in 1974 through 1976 studied the life history of the species for a Ph.D. thesis; results will not be reported here. In late June through most of July 1976, R. G. Greendale and C. Brousseau-Greendale studied the migrations of narwhals and other sea mammals at Cape Hay, northern Bylot Island. At this time a number of aerial surveys were also being carried out by consultant companies, under contract to Polar Gas and other oil exploration companies, of sea mammals in Lancaster Sound, the results of which must be integrated with our own. In 1977, a return was made to Cunningham Inlet by a field party of four led by W. Hoek. In addition to renewed aerial survey of the coastlines surveyed in summer 1973, two remote sensing platforms (model aircraft, balloon) were tested for observing the behaviour of white whales. Similar work using higher level photography from a full sized aircraft had been carrid out by J. D. Heyland in 1973 (Heyland 1974).

5. RESULTS

5.1 Entry of Sea Mammals in Spring

Lancaster Sound is ice-covered in winter and it does not seem likely that white whales or narwhals winter there. A flaw lead is always present, however, between the landfast and pack ice. This is the initial route of entry of the sea mammals.

Smith, Taylor & Hahgagiak (MS 1976) recorded small numbers of white whales, with some young animals present, along the floe edge near Prince Leopold Island, 20 May to 1 June 1975. More complete surveys were made by us shortly afterward, on 5-6 June 1975, along the floe edges of Lancaster Sound. A total of 1,000 white whales but only 36 narwhals was seen. In view of the greater abundance of narwhals in summer (p. 12), these data indicate that white whales migrate through Lancaster Sound earlier than narwhals. This conclusion was confirmed by the studies of Greendale & Brousseau-Greendale (MS 1976) who observed the sea mammal migration from the cliffs of Cape Hay, Bylot Island from 21 June to 31 July 1976. All sea mammals observed were travelling west. A total of 183 white whales was recorded passing between 24 June and 5 July, but only three later on. In contrast the narwhal migration occurred between 21 June and 24 July, and totalled 6,145. Extrapolating for bad visibility, some 8,000-10,000 narwhals passed. Small numbers of bowhead whales and walruses passed by throughout the time of study. Harp seals passed in large numbers (15,000+) beginning on 3 July, and the migration had ended by 31 July. Small numbers of bearded seals also passed in late July.

5.2 Summer Distribution of Migratory Sea Mammals

White whales are found in aggregations at the mouths of streams in the general area of Barrow Strait-Prince Regent Inlet. Our studies in 1973 showed that the streams drained off lowland areas and were warm (about 10°C) in early August. White whales were absent from streams running off ice caps into deep fjords, as in Admiralty Inlet (Strathcona and Adams Sound). This phenomenon is common to the whole arctic, and the time of the aggregations coincides with the occurrence of newborn calves, although no births have yet been directly observed in the stream mouths. In Lancaster Sound the period of occupation of river mouths by white whales is from mid-July to early

or mid-August, although there is a variation of about two weeks in the dates of arrival and peaking of numbers (Fig. 3), depending on time of ice break-up which allows access to the river mouth.

A second type of aggregation of white whales occurs at the mouths of bays just before break-up of the fast ice in the bay, and among the loose ice thereafter. These aggregations only last a few days, and are clearly connected with feeding, as described by Vibe (1950) for the region of Thule, Greenland. Presumably, arctic cod *Boreogadus saida*, taking shelter under the fast ice, become highly vulnerable to the whales at break-up.

These aggregations, and the limited area of summer distribution of white whales, make their counting not difficult (Table 1). Few white whales are seen in deep water at this time. The total in various years approaches but does not exceed 9,000 animals.

Narwhals in summer are chiefly distributed in deep fjords of Lancaster Sound: in the Pond Inlet - Eclipse Sound - Navy Board Inlet complex and in Admiralty Inlet, all of which are deep inlets characterised by steep cliffs and tributary fjords. There are also fair numbers in Prince Regent Inlet. Inuit hunting of narwhals takes place from the settlements of Pond Inlet and Arctic Bay. Catches at the floe edge in spring (principally in Pond Inlet), and along the coasts during the summer usually consist of mature females and immature males. However, the observations at Cape Hay showed an abundance of adult males, recognised by their large tusks. Aerial observations also show a preponderance of males in mid channel. The mating season of narwhals is in May and calving is in July-August (Best & Fisher, 1974) and males evidently segregate to some extent in late summer. These tusked narwhals are occasionally seen in summer in the middle of Barrow Strait, as far south as Bellot Strait and even as far west as McLean Strait northwest of Bathurst Island in a large polynya in early September 1976 (Roe & Stephen 1977). Such extreme movements through open channels by adult males temporarily segregate them from the females and calves. The more obvious segregation is that between narwhals in deep, cold waters and white whales in the shallower, warmer waters, although the two species may mix occasionally when feeding in bays in loose ice.

In late summer the movements of white whales are more obscure, but they pass to the west of the breeding areas, since a large number always pass Resolute Bay between late August and late September, when they are hunted by Inuit. This movement is associated with a movement of arctic cod inshore in late summer.

At Creswell Bay, white whale numbers increase as the season progresses and according to Finley (MS 1976) may exceed 3,000 (Table 1). The bay functions both as a calving and a feeding site, arctic cod evidently being abundant here in late summer.

5.3 Autumnal Outward Migration

Webb (MS 1976) showed that migration of narwhals out of Lancaster Sound occurred in September and early October.

The question of wintering areas takes us outside the geographical scope of this study, but it is relevant to note that white whales have been seen in March and April in the "North Water" east of Devon Island, but narwhals to date have not; therefore the earlier entry of white whales into Lancaster Sound in spring may be connected with a shorter distance to migrate, and hence a difference in the wintering areas of the two species.

5.4 The Food Base

Arctic cod (*Boreogadus saida*, Lepechin) is the major or only food of white whales killed in Inuit hunts at Resolute Bay, Creswell Bay, and at Grise Fjord in Jones Sound.

K. Hay examined narwhals taken at the floe edge of Pond Inlet in early summer. The main food eaten by narwhals was arctic cod, with fair quantities also of a pelagic shrimp *Pasiphaea tarda*. The diet also included squid *Gonatus fabricii* and the mysid *Boreomysis nobilis*. Vibe (1950) at Thule in northwestern Greenland found the main food of narwhals to be arctic cod and Decapod shrimps.

5.5 Behaviour of Calving Concentrations of White Whales

Heyland (1974), using vertical aerial photography, and calibrating animal sizes from the data of Sergeant & Brodie (1969), was able to produce a length frequency

for white whales at Cunningham Inlet. Using a remote-controlled model aircraft equipped with a 35 mm camera, we were able in 1977 to take low-level photographs which showed distribution of whales by body colour (grey and white) and therefore, relatively, by age. The results (Table 2) show that, as well as adults and younger newborn calves, some of the grey, immature animals are also present. Observations at the site also show that adults include males, which can sometimes be seen in groups of about 10 animals. While births have not been seen, behaviour of adult females and their newborn young was recorded; *e.g.* two adults were observed assisting a calf to swim on 2 August 1977. While the whales, during the four weeks which they spend in Cunningham Inlet, are normally concentrated towards the head of the inlet and especially in the river mouth, occasionally the whole group may leave the inlet for periods up to 24 hours (Hay & McClung, MS 1974). This behaviour is associated with loose ice passing outside the inlet along Barrow Strait, so that it probably represents a need for the whales to feed.

5.6 Numbers of White Whales, Narwhals and Other Species

We have already assessed the numbers of white whales in western Lancaster Sound in summer as about 9,000. Numbers of narwhals passing Cape Hay in early summer, 1976 were at least 6,000 and probably some 8,000-10,000. Johnson *et al.* (MS 1976) in studying the distribution of narwhals across eastern Lancaster Sound in the summer of 1976, found that about 40% were close to the southern coast and would have been visible from Cape Hay on northern Bylot Island. A further 30% were observed close to the north coast, and the remaining 30% in mid channel. With these findings the number of narwhals in Lancaster Sound in summer would likely be closer to 20,000 than 10,000. However, studies by Renewable Resources Consulting Services Ltd. (no date) of sea mammals in Lancaster Sound during summer 1976, found about equal numbers of white whales and narwhals. Their estimate of white whales based on density per unit area was some 15,000. We may therefore assume that our surveys of white whales in river estuaries and bays were incomplete and that, as a first-order approximation, some 15,000 white whales and 15,000 narwhals are present in Lancaster Sound in summer.

We did not achieve complete counts of harp seals passing Cape Hay, Bylot Island into Lancaster Sound in summer, 1976 since the end of the migration was not seen; however up to 31 July, 16,000 animals were counted (Greendale & Brousseau-Greendale, MS 1976). Bowhead whales are still scarce in Lancaster Sound after industrial hunting up to the early twentieth century, but 23 were seen passing Cape Hay in 1976. Eighty-six walruses were seen passing Cape Hay westward in June and July 1976, as well as 169 bearded seals *Erignathus barbatus*, which shows that both species are at least partially migratory in this region.

In early August 1977, concentrations totalling about 400 walruses were found at Beechey Point and in Maxwell Bay, Devon Island.

6. DISCUSSION AND CONCLUSIONS

It is a truism in marine ecological studies that productivity can be measured most easily either at the lowest level by measurements of carbon fixation, or at the highest by calculation of yields of fish and other top predators; intermediate levels, *e.g.* the zooplankton, are much harder to study. In Lancaster Sound, measurements of primary production do not exist, although measurements of primary standing stock do (and these are indicative of high productivity). In the arctic, high level fish predators scarcely exist and most marine production is channeled into sea mammals and birds. By measuring their biomass and food intake some idea of the productivity of Lancaster Sound can be obtained.

A. W. Mansfield (Fish. Res. Board Can., Ann. Rept. Arctic Biological Station 1964-1965, p. 27) produced a length-weight relation for narwhals captured by netting in Milne Inlet, which should be a relatively unselected sample. The median weight was about 1300 kg. White whales occurring in Lancaster Sound are large animals, and from the data in Sergeant & Brodie (1969, Figs. 3 and 13) a median weight of about 1,000 kg is obtained. Conservatively, we will use 1,000 kg for both species. A population of some 15,000 narwhals and 15,000 white whales will then have a biomass of 30,000 x 1,000 or 30,000 metric tons. The major food of both species in Lancaster Sound is probably arctic cod taken over a period of about three months. The daily optimal ration of a cetacean of this body size is about 5% of body weight (Sergeant 1969), so that we may compute consumption by the two cetacean species in Lancaster Sound as about 30,000 x .05 x 90 or some 135,000 metric tons, the majority of it arctic cod. Additions may be made for other species (*e.g.* harp seals, ringed seals), the biomass of which is not as easily estimated, but must be considerably less (*e.g.* harp seals >15,000 x 100 kg = >1,500 metric tons), so that the consumption of arctic cod by sea mammals probably lies between 100,000 and 200,000 metric tons. (The added consumption by about three million sea birds--principally fulmars *Fulmaris glacialis* and murres *Uria lomvia* is no more than 10% of the sea mammal figure, because of the small biomass of the birds).

By comparison, a subarctic area, the Newfoundland-Labrador

shelf, yields a catch of a similar forage fish, capelin *Mallotus villosus*, of about 500,000 metric tons to fishermen plus a computed figure of 500,000 metric tons to sea mammals, perhaps 1,000,000 metric tons to carnivorous fish (Winters, MS 1975), or 2,000,000 metric tons in all, which puts the arctic production in perspective. Lancaster Sound remains, however, a productive region of the arctic. The Beaufort Sea, of much larger area, supports no more than 10,000 white whales (Sergeant & Hoek 1974) of about the same body size (Sergeant & Brodie 1969), and narwhals do not occur; thus standing stock of this type of carnivore is no more than 1/3 that of Lancaster Sound for the same season of occurrence.

7. IMPLICATIONS AND RECOMMENDATIONS

The population of narwhals west of Prince Leopold Island in summer is small: Finley (MS 1976) estimates a few hundred or so, so that potential pipeline impacts would fall largely on white whales, a large number of which spend the summer in the general area which is being considered for pipeline activity. Major concentrations exist at Cunningham Inlet, Creswell Bay, and near Resolute Bay at various seasons in summer.

We recommend that Cunningham Inlet not be used as the landing site for a pipeline, and that the north coast of Creswell Bay should not be used as a landing site for pipeline equipment, on the grounds that such activities would severely disturb two major white whale concentrations together making nearly half the Lancaster Sound calving population.

In addition, Maxwell and Radstock bays in southwest Devon Island are important feeding areas for white whales and harp seals, as well as walrus, and the development of either bay for industrial activities would have some impact on coastal sea mammals.

However, it is inevitable that some disruption of sea mammal activities would occur with industrial development in this region, and it is unreasonable to attempt to proscribe development in every area of contact so long as sufficient alternative sites for sea mammals still exist.

8. NEED FOR FURTHER STUDY

Since the major summering concentrations and migration routes of whales have been identified, there seems to be no urgent need for further study. Effects of pipeline development can best be mitigated by avoiding as far as possible concentrations of summering and migrating white whales and narwhals. Better assessments of numbers of white whales and narwhals are needed for the Lancaster Sound area, but such studies are of more importance for establishing sustainable yields for hunting than for pipeline or oil-related studies.

9. SUMMARY

White whales and narwhals enter Lancaster Sound from the eastward at ice break-up and penetrate westward throughout the summer as far as ice conditions permit. White whales enter Lancaster Sound between April and June. Their summer distribution is centered in Barrow Strait, Parry Channel and Prince Regent Inlet. Here there are about five major aggregations in bays or river estuaries which appear to be concerned chiefly with calving. Other more temporary aggregations in bays in which the fast ice has just broken are clearly related to feeding. The total population in this area is 9,000 at least and may be as high as 15,000, its distribution shifting southward and westward as the season advances. Outward migration occurs in late September.

Narwhals enter Lancaster Sound a little later than white whales, with the main movement in June and July. The majority of animals enter the deep fjords in the southeastern part of Lancaster Sound. Small numbers, however, occur in all the deep inlets: Prince Regent Inlet, Barrow Strait, Peel Sound (if ice conditions permit) and, exceptionally, McLean Strait in early September. Integration of counts of migrating animals at Cape Hay, Bylot Island with aerial surveys across Lancaster Sound at this longitude give a figure of about 15,000 narwhals entering annually. Narwhals leave Lancaster Sound at freeze-up in late September. Several thousand harp seals enter Lancaster Sound between July and October and feed, often together with the cetaceans, in disintegrating pack and fast ice. The commonest food of all three species is the arctic cod which is dominant as a partly pelagic, partly benthic species in all subarctic seas. Bowhead whales were hunted heavily in Lancaster Sound up to about 1910, and now number probably less than 100 animals. Their migrations parallel those of the two toothed cetaceans. Walruses are not numerous (<1,000). They are, to some extent, migratory into Lancaster Sound. Summer haul-out sites of 100 to 200 were identified at Beechey Island and Maxwell Bay, Devon Island.

In order to lessen disturbance to white whale herds, a

gas pipeline should not come ashore in Cunningham Inlet, and the north side of Creswell Bay should not form the site of a supply base for pipeline equipment.

10. REFERENCES CITED

Anderson, R. M. 1934. Mammals of the eastern arctic and Hudson Bay. pp. 67-108 *In*: Bethune, W. C. (ed.) Canada's Eastern Arctic. King's Printer, Ottawa.

Best, R. C. & H. D. Fisher. 1974. Seasonal breeding of the narwhal (*Monodon monoceros* L.). Can. J. Zool. 52: 429-431.

Ellis, D. V. 1957. Some observations on mammals in the area between Coppermine and Pond Inlet, N.W.T., during 1954 and 1955. Can. Field-Nat. 71: 1-6.

Finley, K. MS 1976. Studies of the status of marine mammals in the central district of Franklin, N.W.T. June-August 1975. Prepared for Polar Gas Project, Toronto, Ont. by LGL Ltd., Toronto. 183 pp. Mimeo.

Greendale, R. G. & C. Brousseau-Greendale. MS 1976. Observations of marine mammals at Cape Hay, Bylot Island during the summer of 1976. Canada Dept. Environ., Fish. Mar. Serv. Tech. Rept. 680, 25 pp.

Hay, K. & R. McClung. MS 1974. Observations on beluga and narwhal in the Canadian high arctic, summer 1974. Canada Dept. Environ., Fish. Mar. Serv. MS Rept. 1385, 55 pp.

Heyland, J. D. 1974. Aspects of the biology of beluga (*Delphinapterus leucas* Pallas) interpreted from vertical aerial photographs. pp. 373-390 *In:* 2nd Can. Symp. Remote Sensing, Guelph, April 29 May 1, 1974.

Johnson, S. R., W. E. Renaud, R. A. Davis & W. J. Richardson. MS 1976. Marine mammals recorded during aerial surveys of birds in eastern Lancaster Sound, 1976. LGL Ltd., Toronto for Norlands Petroleum Ltd., Calgary. Alta. 25 Dec. 1976. 180 pp. Mimeo.

Miller, R. S. 1955. A survey of the mammals of Bylot Island, N.W.T. Arctic 8: 167-176.

Renewable Resources Consulting Service Ltd. (No date, released in 1977). Aerial surveys of marine mammals of Lancaster Sound, 1975-76, 100 pp.

Roe, N. A. & W. J. Stephen. 1977. Narwhals (*Monodon monoceros*) observed near King Christian Island, Northwest Territories. Can. Field-Nat. 91: 309-310.

Sergeant, D. E. 1969. Feeding rates of Cetacea. Fisk. Dir. Skr. HavUnders. 15: 246-258.

Sergeant, D. E. & P. F. Brodie. 1969. Body size in white whales *Delphinapterus leucas*. J. Fish. Res. Board Can. 26: 2561-2580.

1975. Identity, abundance and present status of populations of white whales, *Delphinapterus leucas* in North America. J. Fish. Res. Board Can. 32: 1047-1054.

Sergeant, D. E. & W. Hoek. 1974. Seasonal distribution of bowhead and white whales in the eastern Beaufort Sea. pp. 705-719 *In*: The Coast and Shelf of the Beaufort Sea. J. C. Reed & J. E. Sater, (Eds.) Arctic Inst. N. America, Washington, D. C.

Sleno, G. A. & A. W. Mansfield. MS 1978. Aerial photography of marine mammals using a radio-controlled model aircraft. Canada Dept. Environ., Fish. Mar. Serv., MS Rept. 1457, 7 pp. Mimeo.

Smith, T. G., D. Taylor & Hahgagiak. MS 1976. Breeding habitat and population surveys of seals in the Viscount Melville Sound, Barrow Strait and Peel Sound areas. Interim Rept. Arctic Islands Gas Pipeline Project. 30 pp. Mimeo.

Vibe, C. 1950. The marine mammals and the marine fauna in the Thule District (Northwest Greenland) with observations on ice conditions in 1939-41. Medd. Grønland 150(6), 115 pp.

Webb, R. MS 1976. Sea mammal surveys in Baffin Bay and Davis Strait, September, 1976. R. Webb Env. Serv. Ltd., Richmond, B. C. Rept. to Shell Canada Resources Ltd., Calgary, Alta. 32 pp. Mimeo + Tab., + App.

Winters, G. H. MS 1975. Review of capelin ecology and estimation of surplus yield from predator dynamics Int. Comm. Northwest Atl. Fish. Res. Doc 75/2, ICNAF, Dartmouth, Nova Scotia. 25 pp. Mimeo.

Table 1. Numbers of white whales at river mouths and in bays in the Lancaster Sound region, July-August, 1973-1977.

Locality	1973[1]	1974[3]	1975[4]	1977[5]
Devon I.				
Maxwell Bay				
Fellfoot Pt.	750	72		
N part of Bay	1,250			2,500-3,000
Radstock Bay	500	few	367	few
Owen Point	10			
Subtotal	2,510	<100	367	3000
Somerset I.				
Cunningham Inlet	2,000	1,232	142	few
C. Inlet to Garnier B.	150		297	
Garnier Bay	120	. .	1,000	
S. of C. Clarence	30	. .		
Elwin Bay	800	. .	207	(500)
S. of E. Bay	30	. .		
Batty Bay	50	197	0	
Creswell Bay	1,050	3,464	3,094	5,000
Subtotal	4,230	(4,993)	4,740	5,500
Baffin I. (Brodeur Pen.)[2]				
NW coast	. .	180		36
C. Kater	250	677		
C. Kaye	2,000	. .		
Subtotal	2,250	857		
Total	8,990	>5,950	>6,402	8,500

[1] August 2 and 3
[2] J. D. Heyland, pers. comm.
[3] 24 July-3 August (J. D. Heyland, pers. comm.)
[4] from Finley (MS 1976)
[5] 27 July

Table 2. White whales in Cunningham Inlet, July-August 1977. Analysis of 10 vertical aerial photos for age composition of whales.

White		Grey		Neonate		Total
No.	%	No.	%	No.	%	Animals
548	58	240	26	149	16	937

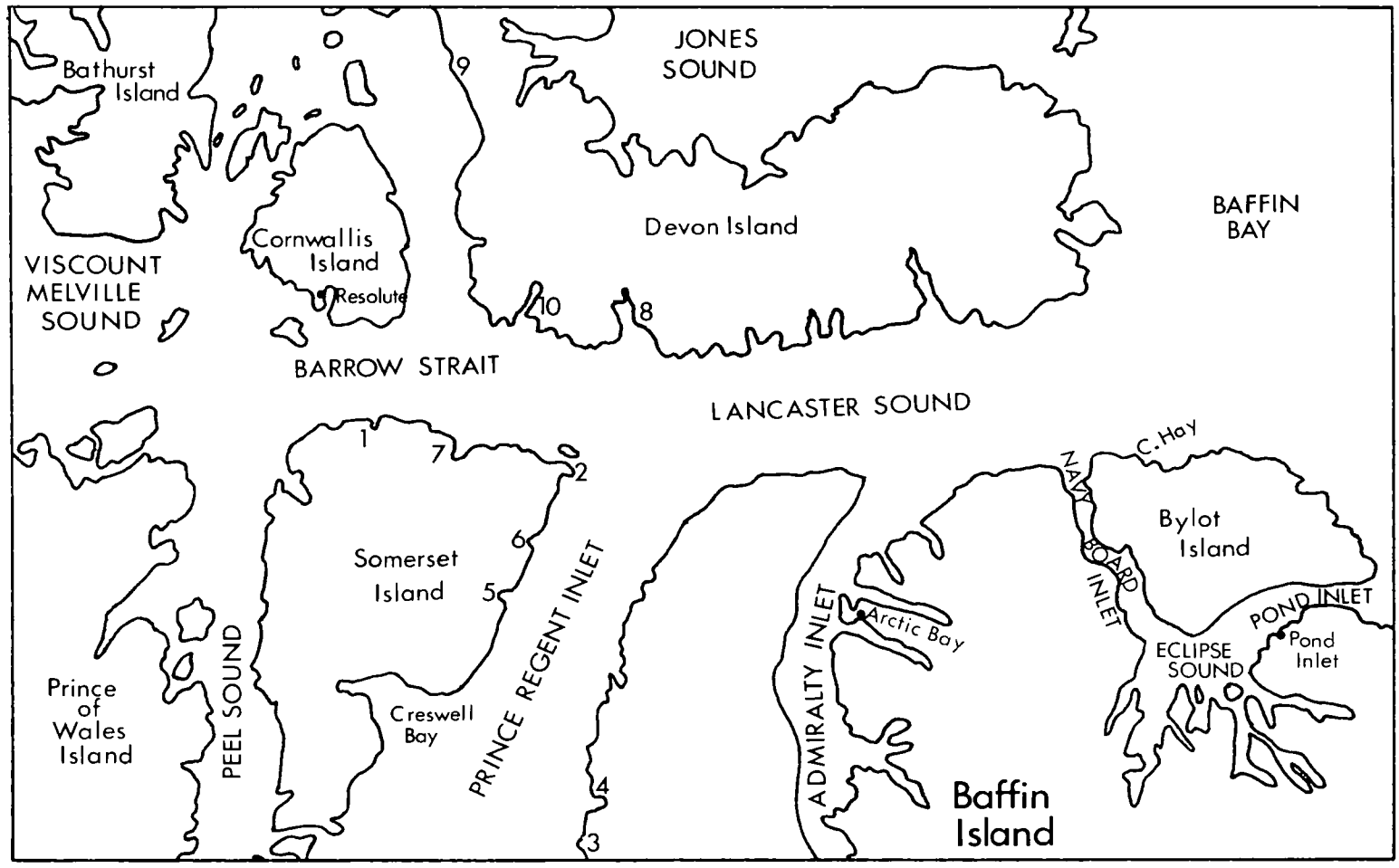

Fig. 1. Region of study showing place-names mentioned in text. Locations shown: 1 Cunningham Inlet, 2 Cape Clarence, 3 Cape Kater, 4 Cape Kaye, 5 Batty Bay, 6 Elwin Bay, 7 Garnier Bay, 8 Maxwell Bay, 9 Owen Point, 10 Radstock Bay.

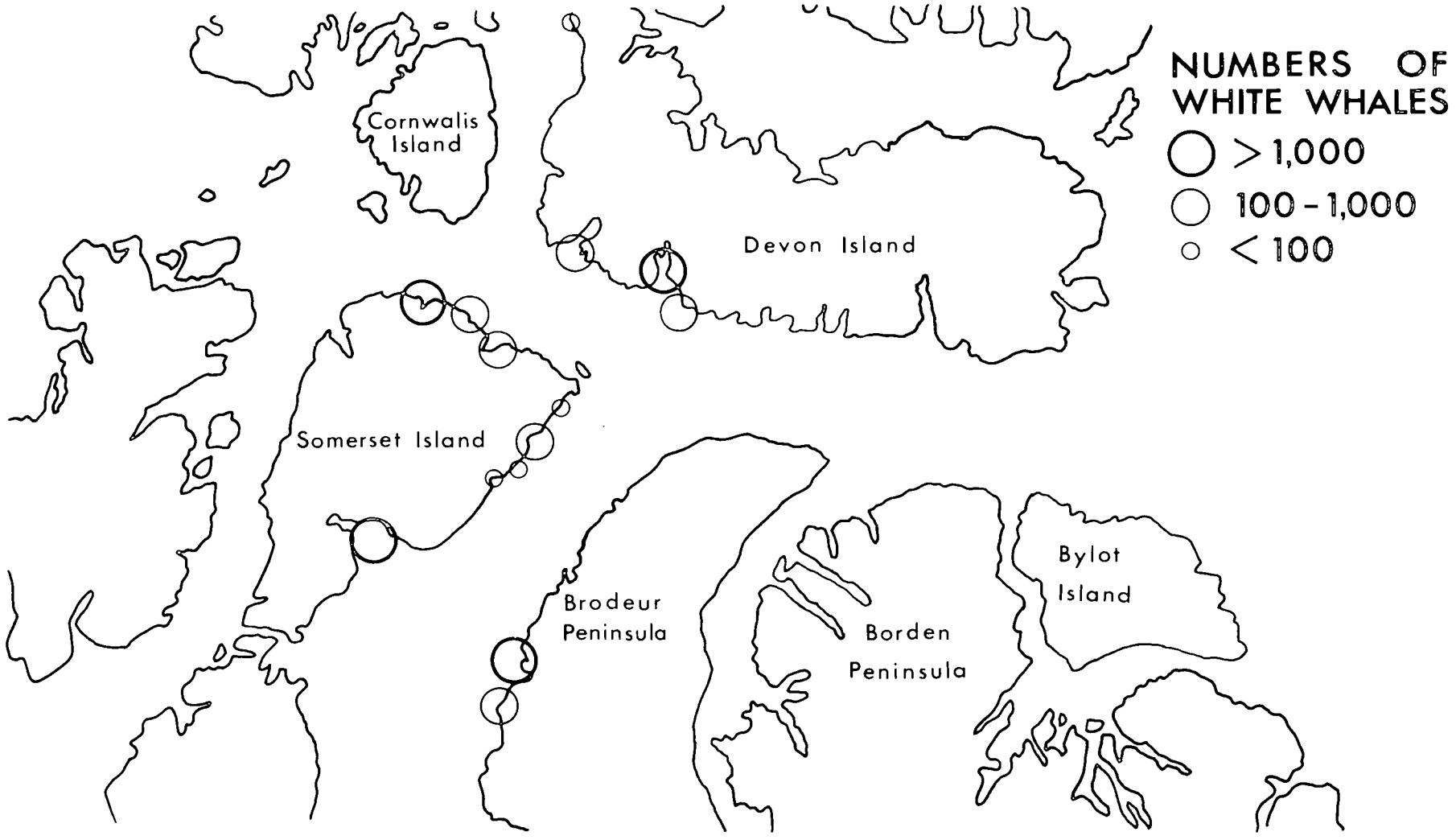

Fig. 2. Summer concentrations of white whales, early August 1973.

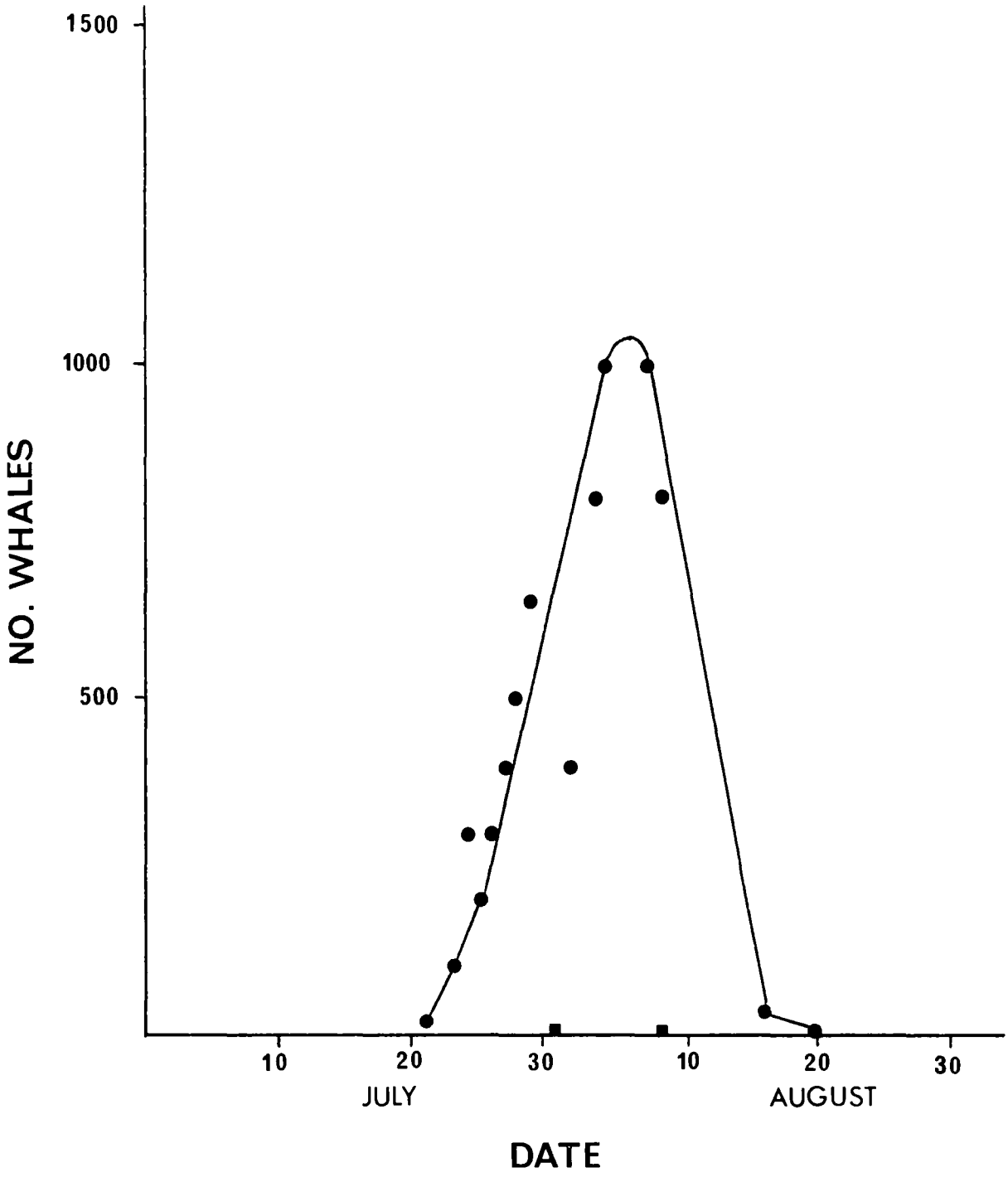

Fig. 3. Time sequence of white whale numbers in Cunningham Inlet, July-August, 1974. Squares indicate days when all the whales left the inlet (see p.12).