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DE DISPARITION AU
CANADA

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STATUS REPORT ON THE NORTHERN BOTTLENOSE WHALE (GULLY POPULATION) *HYPEROODON AMPULLATUS* IN CANADA

BY

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ANNICK FAUCHER
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AND

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STATUS ASSIGNED IN 1996
VULNERABLE

REASON: A RESTRICTED DISTINCT POPULATION OF THE NORTHERN BOTTLENOSE WHALE FOUND IN THE GULLY OFF THE SCOTIAN SHELF VULNERABLE TO OIL AND GAS DEVELOPMENT AND HUMAN ACTIVITY IN THE AREA.

OCCURRENCE: ATLANTIC OCEAN

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STATUS REPORT ON THE NORTHERN BOTTLENOSE WHALE (GULLY POPULATION) *HYPEROODON AMPULLATUS* IN CANADA

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Status of the Northern Bottlenose Whale, *Hyperoodon ampullatus*, in the Gully, Nova Scotia.

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Whitehead, Hal, Annick Faucher, Shannon Gowans, and Stephen McCarrey. 1996. Status of the Northern Bottlenose Whale, *Hyperoodon ampullatus*, in the Gully, Nova Scotia. Report submitted to the Committee on the Status of Endangered Wildife in Canada. Canadian Wildlife Service, Ottawa, Ontario.

A population of approximately 213 Northern Bottlenose Whales, *Hyperoodon ampullatus*, uses the Gully, a prominent submarine canyon on the edge of the Scotian Shelf. These animals use the Gully throughout the year. Approximately 57% of the population reside in a 20km x 8km core area at the entrance of the canyon at any time. The Gully animals seem to be largely or totally distinct from the population seen off northern Labrador: they are smaller and appear to breed at a different time of year. This is the only population of beaked whales in the world that is the subject of long-term research on individually-identified animals. Threats to the population include commercial shipping, fishing and oil and gas developments. One oil and gas discovery of commercial interest, the Primrose field, lies about 5km from the core area of this population. The population is vulnerable because of its small size, location at the extreme southern limit of the species' range, and year-round dependence on a small and unique sea area. It is threatened by plans for the development of the oil and gas fields close to the Gully.

Une population d'environ 213 Baleines à Bec Communes, *Hyperoodon ampullatus*, se trouve dans le Gully, un canyon sous-marin important situé sur le bord de la Plate-forme Néo-Ecossaise. Les animaux fréquentent le Gully à l'année longue. Environ 57% de la population réside en tout temps dans une aire de 20km x 8km à l'entrée du canyon. Les animaux du Gully sont en grande partie sinon totalement distincts de ceux des populations arctiques de cette espèce, étant plus petits et semblant se reproduire à une période de l'année différente. Ils constituent la seule population de baleines à bec au monde faisant l'objet de recherche à long terme sur des animaux identifiés individuellement. Les facteurs menaçant la population comprennent la navigation commerciale, la pêche et la présence de ressources pétrolières et gazières potentiellement exploitables. L'une des découvertes de pétrole et de gaz d'intérêt commercial, le gisement Primrose, se situe à 5km de l'aire principale de cette population. Cette dernière est vulnérable de par son petit nombre d'individus, sa situation à la limite extrême sud de l'étendue de distribution de l'espèce et sa dépendance à l'année longue envers une petite zone marine unique. La population est menacée par des projets de développement de gisements de pétrole et de gaz à proximité du Gully.

Key Words: Northern Bottlenose Whale, baleine à bec commune, *Hyperoodon ampullatus*, Cetacea, Odontoceti, the Gully, submarine canyon.

In this report we evaluate the status of the population of Northern Bottlenose Whales, *Hyperoodon ampullatus* (Forster, 1770) whose members are found in the Gully, a submarine canyon on the edge of the Scotian Shelf. The Northern Bottlenose Whale is a 6 to 9m member of the beaked whale family (Ziphiidae) resident only in the northern regions of the North Atlantic. Its closest relative is the Southern Bottlenose Whale (*Hyperoodon planifrons*) of the Southern Oceans. Bottlenose whales seen in the tropical Pacific may be *Hyperoodon planifrons* or an unnamed species (Klinowska 1991). The biology of the Northern Bottlenose Whale was reviewed by Benjaminsen and Christensen (1979) and Mead (1989). The general status of the species in the North Atlantic was described by Reeves, Mitchell and Whitehead (1993).

Distribution and Stock Identity

Northern Bottlenose Whales are present consistently, throughout the year, in a 20km x 8km "core area," at the entrance of the Gully, a submarine canyon on the edge of the Scotian Shelf (Faucher and Whitehead 1991; Reeves, Mitchell and Whitehead 1993; Figure 1). They are also sighted, more rarely, off the edge of the Scotian Shelf to the east and west of the Gully (Figure 1), and there are very occasional reports from the edge of the U.S. Shelf (Reeves, Mitchell and Whitehead 1993). During the Canadian Patrol Frigate Shock Trials's in November 1994, Northern Bottlenose Whales were observed twice and heard once near the detonation site (42° 05'N 61° 20'W), 110km from the Shelf Break and 200km from the Gully (Parsons 1995; Figure 1).

The Gully is the southernmost area in the western North Atlantic where Northern Bottlenose Whales are found on anything other than on a very occasional basis. The nearest other region where the species may be consistently sighted is off northern Labrador, 1400km to the north.

Analysis of photographic identifications of individual whales suggests that the animals in the Gully at any time are about 57% of a population numbering about 213 animals (Table 1; *see* below). The geographic range of this population is unknown but, based on the pattern of sightings, we suspect that it is principally the slope waters south of Nova Scotia. If the Gully animals are an integral, freely-mixing part of the population off northern Labrador, then the total population numbers only about 213 animals--unlikely given the numbers and geographical spread of recent sightings in northern waters (Reeves, Mitchell and Whitehead 1993).

The population analysis (Table 1) does not rule out occasional migrations of animals between the northern (Labrador-Davis Strait) areas and the Gully. The estimates of mortality+emigration+mark change are about 12% per year, and have wide confidence limits (Table 1). We have no objective means of allocating the 12% between these three possible causes. Much of the 12% could be due to mark change. No other estimates of mortality are available for Northern Bottlenose Whales, although mortality is believed to be about 6% per year in the Sperm Whale (*Physeter macrocephalus*), the species most ecologically similar to the Northern Bottlenose for which data are available (Rice 1989). Thus we can only conclude from the population analysis that emigration rates from the Gully population, and immigration rates into it, are probably less than about 10% per year and may be negligible.

Additional evidence that the Northern Bottlenose Whales in the Gully are largely distinct from those off Labrador comes from an examination of length distributions (Figue 2). The photographically measured animals in the Gully are about 0.7m shorter than those caught off northern Labrador. The same effect is true for the two sexes--the Labrador population is 0.55m larger for all males, 0.94m for females. Some of the difference could be due to differential selection by the whalers and our photographic measurement methods. However, this cannot account for all the difference: about 10% of the Labrador population were greater than 8.5m long, but animals this large were virtually absent from the Gully (Figure 2). It is possible that only young animals visit the Gully. However we

do see distinctive mature males as well as females with calves, and a 6.15m male with 5 growth layers in its teeth which stranded in the Bay of Fundy, and was thus likely from the Gully population, lay below the growth curve for animals caught in Labrador (Mitchell and Kozicki 1975), further evidence that the Gully population are smaller than those from Labrador.

Our observations also indicate that the Bottlenose Whales of the Gully may be on a different breeding schedule to the Labrador population, which mates and gives birth in April (Benjaminsen 1972):

- In the Gully, we have 5 high-quality measurements (probably representing 2 calves) of 3.0 to 3.3m in August, and none between 3.3 to 4.0m. Mead (1989) suggests 3.5m for the mean length at birth of the populations studied in northern waters. Thus, even allowing for smaller animals in the Gully, the 3.0 to 3.3m calves observed in the Gully in August were likely recently born.

- The gestation period of Bottlenose Whales is about 12 months so that mating and calving occur at the same time of year (Benjaminsen and Christensen 1979). In the Gully, the proportion of mixed groups of males and females rises through June-August (proportion of groups with both adult males and females: 10% June; 17% July; 28% August), consistent with an August mating/parturition season.

Protection

National legislation and international conventions protecting Northern Bottlenose Whales from hunting are described by Reeves, Mitchell and Whitehead (1993). Neither now, nor in the near future, is the population in the Gully likely to be subject to whaling.

Several initiatives have been undertaken to protect the Gully population:

- In 1990, the oil company, Lasmo, which was beginning exploitation the Cohasset-Panuke field 110km to the west of the Gully, declared a "tanker exclusion zone" including the Gully, so that shipping associated with the development does not interfere with the whales.

- The Department of Fisheries and Oceans has designated a "Whale Sanctuary" in the Gully for the Northern Bottlenose Whales and, in the Canadian Notices to Mariners Annual Edition (1994), published guidelines for the behaviour of vessels within the sanctuary. Shipping companies have been asked (by letter) to avoid the area, and many have agreed to do so.

- The establishment of a Marine Protected Area in the Gully is being considered by the Canadian Wildlife Service, the Department of Fisheries and Oceans, Parks Canada, World Wildlife Fund Canada and other organizations and individuals (Amirault 1995).

Population Sizes and Trends

High-quality photographic identifications (from 1988 to 1995) of individual Bottlenose Whales with clear long-term markings (nicks on the dorsal fin) have been used to examine the size and structure of the population using the Gully. The analysis uses the maximum-likelihood mark-recapture techniques described by Sandland and Kirkwood (1981) and Whitehead (1990). Estimates were calculated separately for identifications using photographs of the left and right sides of the dorsal fin and surrounding areas, and with calendar years and calendar months as time units.

Several population models were tried. Those which produced the best fit to the data (i.e. no parameters could be removed without significantly worsening the fit of the data to the model) had the following characteristics (Table 1, Figure 3):

- there are, at any time, about 35 photographically identifiable whales with clear long-term marks in the Gully;
- these are a part of a larger population which habitually uses the Gully containing approximately 61 photographically identifiable whales with clear long-term marks;
- animals move into the Gully from the other parts of the population's range (probably the waters of the Scotian Shelf) at a rate of about 0.55/month;
- animals move from the Gully to the other parts of their range at a rate of about 0.45/month;
- animals die, emigrate from the range of the population that habitually uses the Gully (e.g. to northern Labrador), or change their marks at a rate of 0.12/year. This disappearance of animals from our marked population is why the number of identified animals is greater than the population estimate in Table 1.

As about 70% of the population that habitually uses the Gully are identifiable (Faucher and Whitehead 1991), and 41% of these animals have clear long-term marks, about 29% of the population is represented in the population analysis summarized in Table 1. Therefore the results summarized in Table 1 suggest that the animals in the Gully at any time constitute about 57% of a total population numbering approximately 213 animals, with an approximate 95% confidence interval of 172-278. Unfortunately, there are insufficient data to make a meaningful examination of trends in population size with time.

Eighty-seven Northern Bottlenose Whales were taken by whalers working from Blandford, Nova Scotia between 1962-1967 (Reeves, Mitchell and Whitehead 1993). The great majority of these seem to have been killed in, or near, the Gully (Reeves, Mitchell and Whitehead 1993). Assuming that the population size is now somewhere between its levels immediately before and after this whaling, a 29 t0 41% reduction in numbers during the whaling period is indicated.

Habitat

The habitat of the Bottlenose Whales south of Nova Scotia is the waters near the edge of the continental shelf which are greater than 1000m deep, but the overwhelming focus of their distribution is the 20km x 8km core area at the entrance of the Gully. In terms of relief, and penetration into the shelf, the Gully is the most prominent canyon in the western North Atlantic. The whales are never seen in waters less than about 800m deep, even though such depths are within a few km of their core habitat.

Protection of this core habitat is likely to be essential for the survival of the population.

General Biology

The general biology of Northern Bottlenose Whales was described by Benjaminsen and Christensen (1979), Mead (1989) and Reeves, Mitchell and Whitehead (1993).

Limiting Factors

The size of the population that uses the Gully is small, about 210 animals. This is well below the 2000 beneath which IUCN (International Union for the Conservation of Nature) classifies cetacean species as Endangered (Klinowska 1991). However, the Gully Bottlenose Whales, although apparently largely or totally distinct from the populations in more northern waters, are not (as far as we know) a different species. It seems likely that the population is naturally small, limited by available habitat in the area to the low hundreds.

The Gully population is at the extreme southern limit of the species' range in the western North Atlantic. This likely limits the potential for alternative suitable habitat in nearby sea areas.

The proximate threats to these animals from humans are principally:

- collisions with ships. Each year a number of whales are found dead in the waters off Nova Scotia following collisions with shipping (J. Conway, personal communication), although there are no known reports of Bottlenose Whale fatalities.

- acoustic pollution. Whales communicate and sense their environment largely through the acoustic channel. Noise affects the behaviour and movement of whales; it has the potential to interfere with feeding or mating, or cause physiological damage (Richardson et al. 1991; Committee on low-frequency sound and marine mammals 1994).

- fishing gear. Entanglement in fishing gear (that in active use as well as discarded, abandoned or lost gear) is a major threat to many cetacean populations (Cooke 1991). A number of the Bottlenose Whales in the Gully show evidence of encounters with fishing gear (e.g. Fig. 4).

- marine debris. Entanglement in floating debris, such as plastic bags and discarded strapping, is a source of mortality for many marine animals, including cetaceans (Cooke 1991). The Gully has a high level of such pollution (Dufault and Whitehead 1994).

- chemical pollution.

The most obvious sources of these dangers are commercial shipping, fishing activity and petrochemical exploration and exploitation. Explosions and loud underwater sounds made for naval and scientific purposes may also pose a threat (Richardson et al. 1991; Committee on low-frequency sound and marine mammals 1994).

Ships may collide with the whales, are a source of acoustic pollution, and can contribute to marine debris and chemical pollution. The major east-west trans-Atlantic shipping route lies about 30km south of the Gully core area (Figure 1). Commercial ships (excluding fishing vessels) transit the core area of the Bottlenose Whales about once per day (H. Whitehead, unpublished data). This rate may have decreased somewhat since the Department of Fisheries and Oceans' guidelines were published in the Notices to Mariners, and requests for avoidance were sent to shipping companies.

The shallow areas bordering the Gully were heavily dragged for groundfish, while midwater draggers take Redfish (*Sebastes* sp.) from within the core area. Fishing vessels, especially while dragging, are extremely noisy (H. Whitehead, personal observation). They may entangle whales in their active, lost or

discarded gear, and are sources of other marine debris. The crash of groundfish stocks during the last few years has considerably reduced fishing activity in the area of the Gully. Harpooning and long-lining for Swordfish (*Xiphius gladius*) also takes place in the core area but this is less obviously harmful.

Oil and gas have been found in commercially exploitable quantities on the Scotian Shelf bordering the Gully. One find, the "Primrose" field, lies about 5km from the core area of the Bottlenose Whales (Figure 1). The only current exploitation in the area is at the "Cohasset/Panuke" condensate fields (Figure 1). These are 110km from the Gully, and their exploitation probably poses little threat to the bottlenose whales. In the next few years, a consortium of oil companies led by Mobil Oil Canada plans to exploit some of the gas discoveries around Sable Island, the closest of which, the "Venture" field, is about 45km from the core area of the bottlenose whales in the Gully.

Oil and gas exploitation has the potential to harm the Bottlenose Whales directly through the noise of the drilling and other operations, spills and discarded material, but also indirectly because of an increase in shipping traffic. Noises associated with offshore oil and gas production disturbed the behaviour of Bowhead Whales (*Balaena glacialis*) to ranges of about 3-11km (Richardson, Wursig and Greene 1990). It is not known how sensitive the Bottlenose Whale is to acoustic disturbance but the most ecologically similar species for which there are any data, the Sperm Whale, is especially easily disturbed by sound (e.g. Watkins and Schevill 1975; Watkins, Moore and Tyack 1985). Bottlenose Whales have particularly weak social sounds (Winn, Perkins and Winn 1970) which might suggest vulnerability to acoustic disturbance.

The most important limiting factor for the population of Bottlenose Whales in the Gully is likely the pattern and method of development of these oil and gas fields.

Special Significance of the Population

Our research on the Northern Bottlenose Whales in the Gully is unique: it is the only long-term study of any beaked whale population, anywhere in the world--these are the only living ziphiids to be individually identified. There are no known locations at all comparable to the Gully in terms of the potential for studies of beaked whale populations. In the near future, most of what is known about the natural behaviour of living beaked whales is likely to come from the Gully.

The population is not only amenable to research: two film crews have visited the Gully, and have successfully filmed the whales; and local tourist operators are making plans to bring limited numbers of whale watchers to the Gully.

Unusual biological features of the Bottlenose Whale include their maxillary crests, their deep and prolonged dives, the types of sounds produced, and pronounced curiosity towards boats (Mead 1989; Reeves, Mitchell and Whitehead 1993).

Evaluation

The population of Northern Bottlenose Whales in the Gully is small, about 213 animals, at the southern extreme of the species' range, and largely or totally distinct from the larger populations further north. The animals seem to be non-migratory, spending an average of 57% of their time in a 20km x 8km core area, which is bathometrically unique in the western North Atlantic. These characteristics make the population particularly sensitive to human activities. Thus the population should be, at the least, considered vulnerable.

The development and exploitation of the oil and gas fields on the Scotian Shelf is approaching the Gully, threatening the Bottlenose Whales and other inhabitants of the Gully, which include exceptional numbers of some other

cetacean species (Gowans and Whitehead 1995). With exploitation of the Primrose field, the core area of the Bottlenose Whales in the Gully may be abandoned, endangering the population. The current plans for progressive development of the oil and gas fields near the Gully suggest that this population should be designated vulnerable.

Acknowledgements

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Captions for Figures

Figure 1. The Scotian Shelf, showing the Gully, oil and gas discoveries from Wade et al. (1989) (circles, the Cohasset/Panuke and Primrose fields are filled), major shipping route (dashed line), the core area of the Northern Bottlenose Whale population (shaded), and additional sightings and catches of the species (■) from Reeves, Mitchell and Whitehead (1993), the Sea Education Association and our own sightings. The site of the Canadian Patrol Frigate Shock Trial at which Bottlenose Whales were sighted is marked on the inset by a '+'.

Figure 2. Length distributions for the Bottlenose Whales caught off Labrador (n=127) (Christensen 1975), and measured photographically in the Gully using the method of Gordon (1990) (n=451--some animals were measured several times).

Figure 3. Representation of the population organisation of the Bottlenose Whales that use the Gully as suggested by mark-recapture analysis of individual identification photographs (Table 1).

Figure 4. Northern Bottlenose Whale photographed in the Gully showing signs of entanglement in fishing gear.

Table 1. Estimates of population parameters for individually identifiable Bottlenose Whales with distinctive long-term marks in the Gully from high quality photographs using the likelihood methods of Sandland and Kirkwood (1981) and Whitehead (1990). Approximate 95% confidence intervals were estimated from ranges of parameter values with minimum support functions less than 2.0 (Edwards 1972). Population sizes for the individually identifiable animals with clear marks are are uprated to estimates for all animals (**given in bold**) using the proportion of animals with clear, identifiable marks, 29%.

	Estimates Using Photographs From:	
	Left Side	Right Side
Number of identified individuals	66	74
<u>Estimates Using Years As Units</u>		
Total Population Size	60 (**209**)	65 (**226**)
(95% c.i.)	50-79 (**174-275**)	51-94 (**178-328**)
Mortality+Emigration (from total population)+Mark Change Rate	0.10/year	0.15/year
(95% c.i.)	0.00-0.21	0.02-0.26
<u>Estimates Using Months As Units</u>		
Total Population Size	61 (213)	61 (213)
Gully Population Size	32 (111)	37 (129)
Emigration Rate From Gully	0.52/month	0.38/month
Immigration Rate To Gully	0.54/month	0.59/month
Mortality+Emigration (from total population)+Mark Change Rate	0.10/year	0.16/year

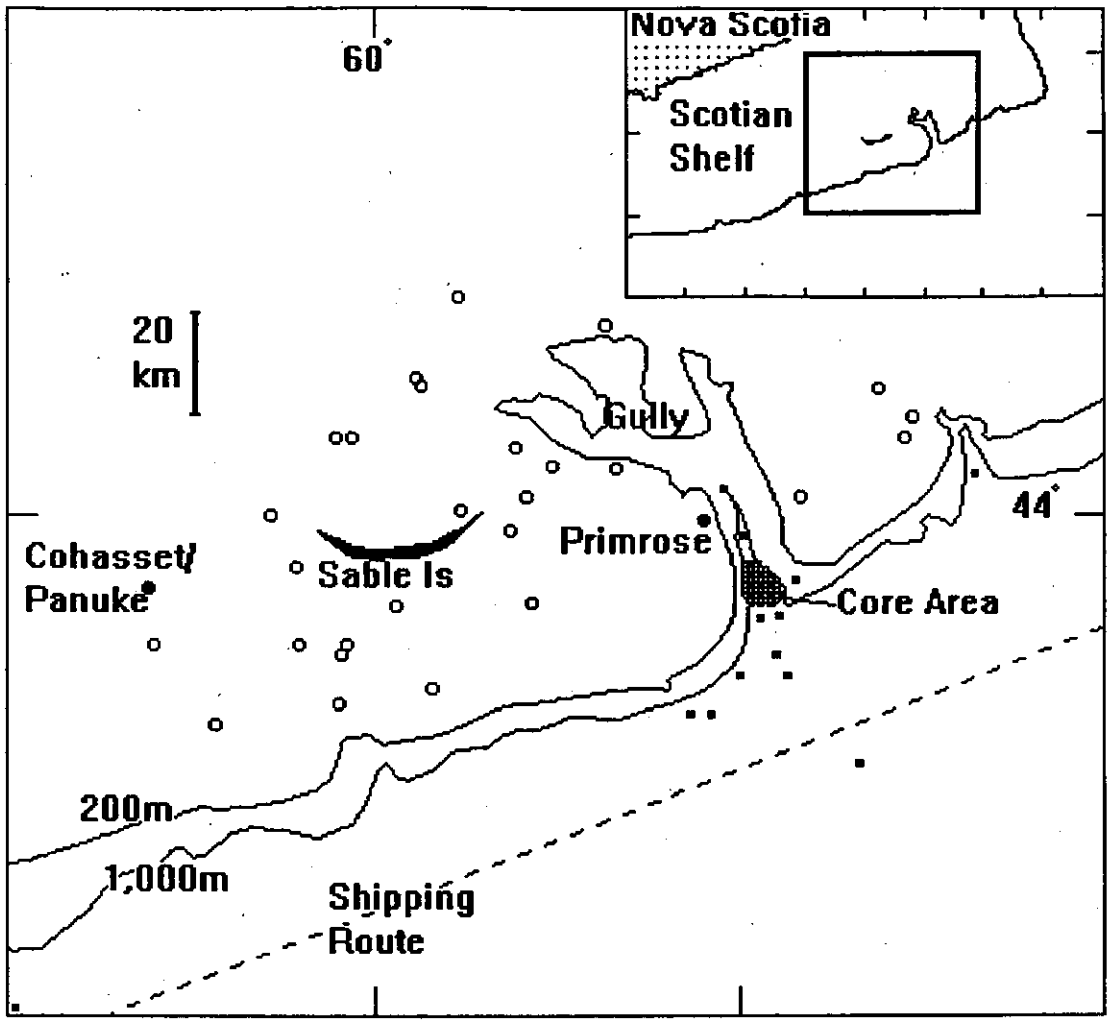
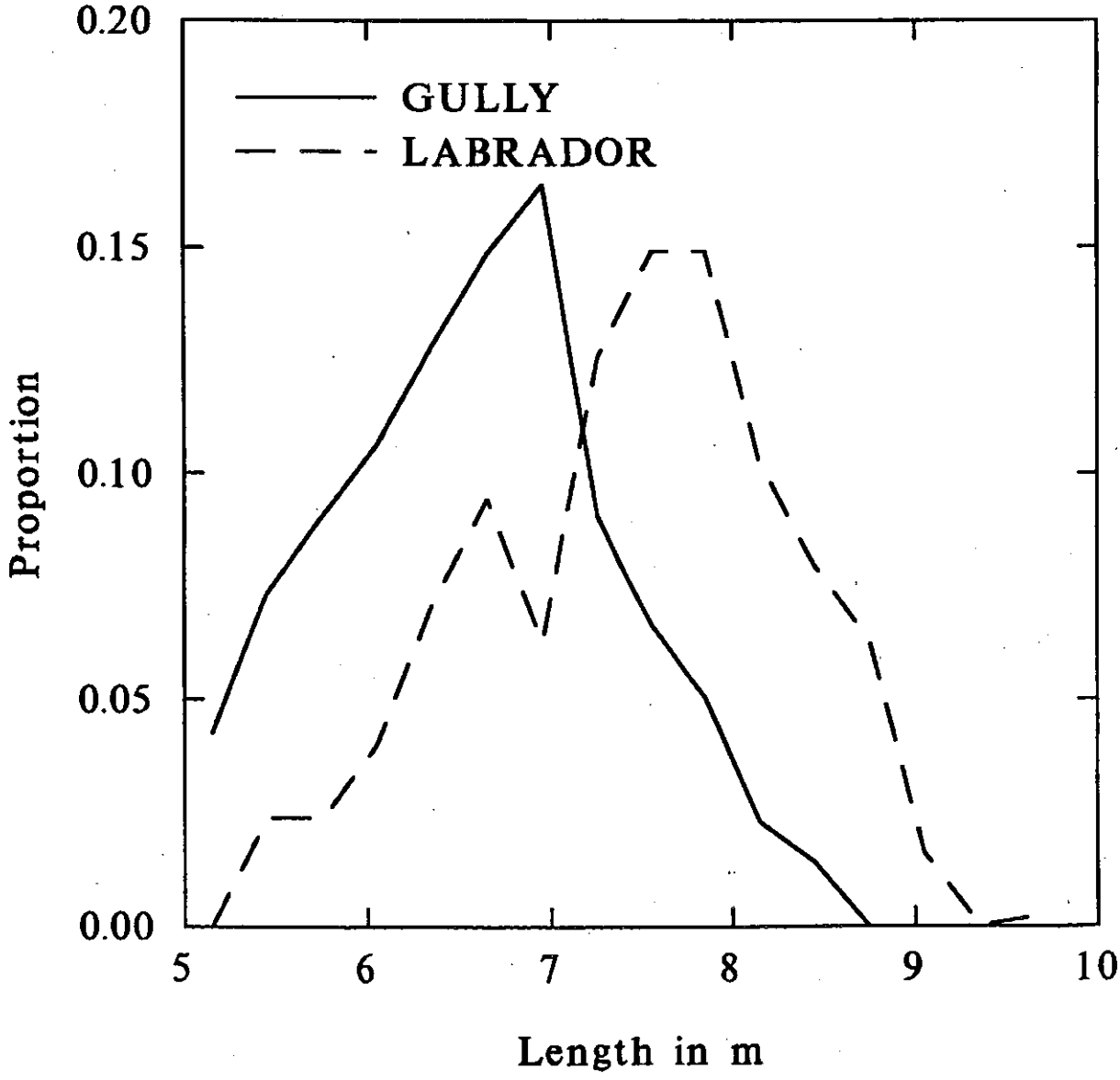


Fig. 1. Whitehead et al.

Fig. 2. Whitehead et al.



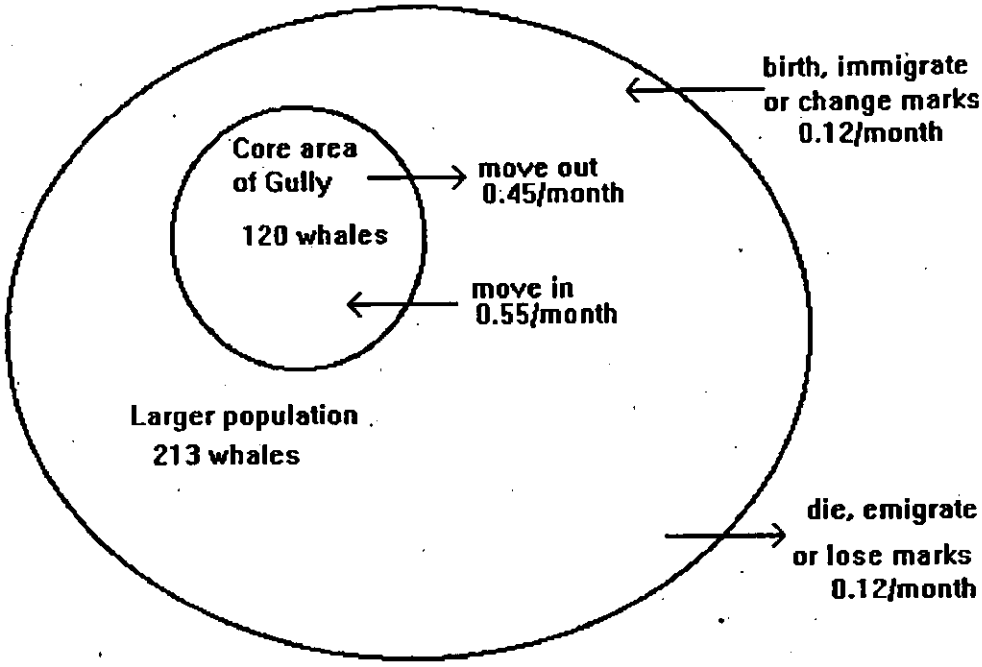


Fig. 3. Whitehead et al.

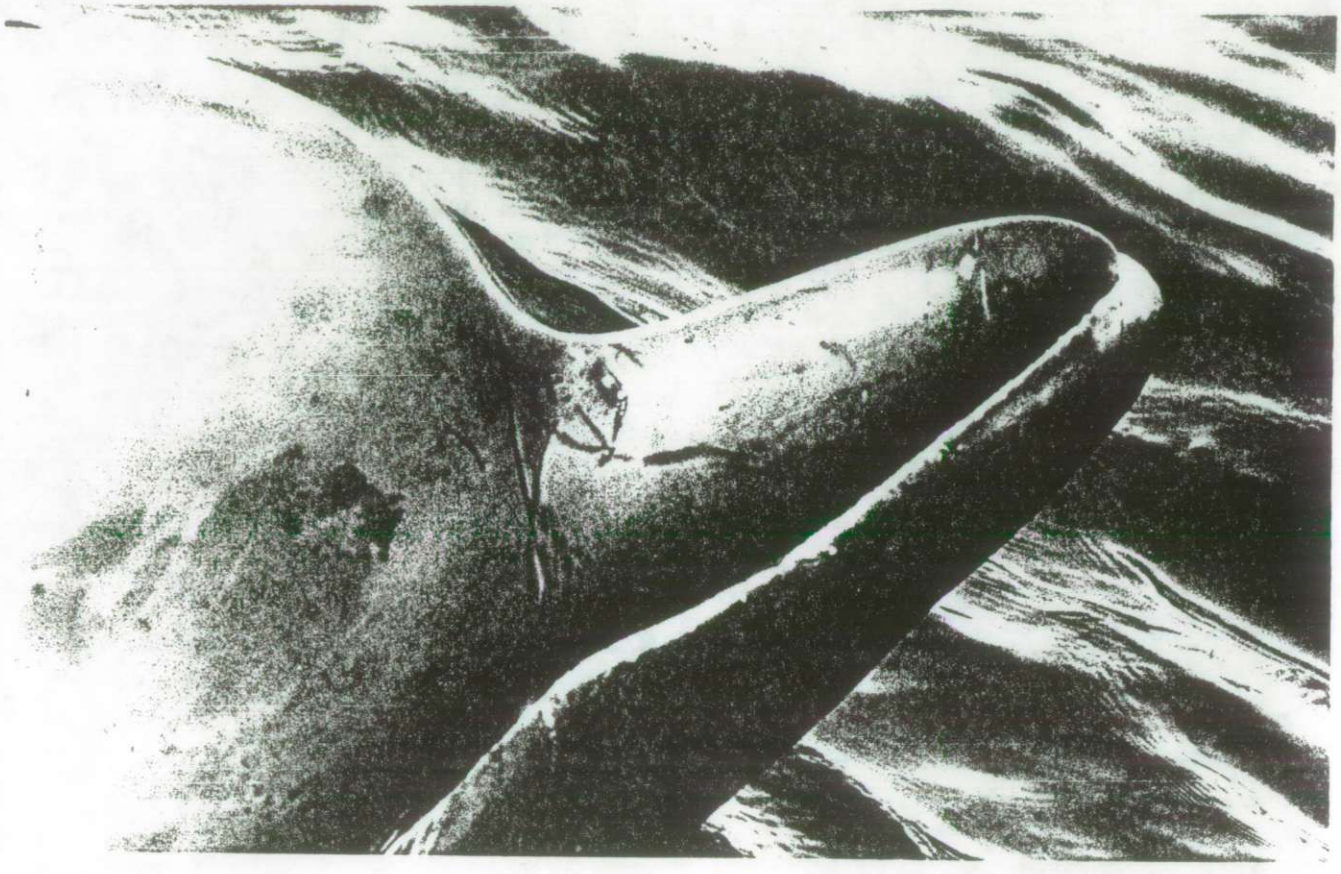


Fig. 4. Whitehead et al.