these problems and because the estimation from 1968–79 was based upon extrapolation with fixed parameters that:

(a) an underlying predictive model of the dynamics should be developed on the basis of data in Area VI and other Southern Hemisphere fin whale stocks.
(b) evidence from sightings data should be carefully analysed
(c) recruitment rates from age structures should be analysed

before any recommendation about a change in management status could be made.

Other members believed the present result confirmed the reliability of the previous assessment by Chapman (1976) on the population of the fin whales in Area VI. They considered that monitoring of the stock by sightings data (SC/31/Doc 4) also proved it. The stock was estimated to have recovered to 93.5% of the MSYL in 1979/80 according to SC/31/Doc 34. Therefore, these members recommended that the fin whale stock in Area VI should be reclassified as SMS with a catch limit of 156 for the 1979/80 season, based on the present management scheme.

Re-opening of the exploitation will be expected to provide much data and materials to develop the needed information for the population assessment.

Research catches

Some members felt that at this stage a research catch would be premature for all the reasons given above. Holt referred to the criteria for any take of substantial numbers of whales under special permits contained in his minority statement (*Rep. int. Whal. Commn* 20: 42) and expressed his view that such criteria had not yet been satisfied.

Other members stressed that there is urgent need for collection of parameter value information by research catches to resolve the problems associated with the present uncertainties of the analyses.

Annex I

REPORT OF THE SUB-COMMITTEE ON SMALL CETACEANS

1. PARTICIPANTS, AGENDA AND INTRODUCTORY REMARKS

Members (M) of the Standing Sub-Committee or the Scientific Committee of the IWC, invited experts (E), and observers (O) attending the meeting were:

Allen, R. (E), Berney (O), Best (M), Braham (M), Brownell (M), Cameron (E), Christensen (M), Davis (E), Gong (M), Goodall (E), Jonsgård (M), Kapel (M), Kelly (O), Kemper (E), Klinowska (M), Lomax (M), Marcet Ocaña (M), Mitchell (M), Perrin (M, Chairman), Rørvik (M), Rudge (M), Saito (M), Sergeant (E), Suda (M), Wada (M).

All participants did not attend all sessions of the meeting.

The draft agenda was discussed and approved with minor modifications (Appendix 1). Several of the participants had not been involved in previous meetings of the sub-committee and they requested information on the mandate of IWC concerning small cetaceans. The Chairman provided a summary of main small cetacean actions during 1976–78 (Appendix 2).

Rapporteurs for the sub-committee meeting were Sergeant (agenda items 1–4 and 9), Goodall (item 5), Davis (6), R. Allen (7) and Kemper (8).

2. DOCUMENTATION

Documents available to the sub-committee and containing information on small cetaceans were SC/31/Prog Reps 1–12 (not 7); SC/31/SM1–SM23; SC/31/Docs 15, 25 and 51; and the provisional issue LXXXIII of International Whaling Statistics.

3. REVIEW OF MANAGEMENT ACTIONS AND RESEARCH ON NORTHERN BOTTLENOSE WHALE, STRIPED DOLPHIN, DALL'S PORPOISE AND HARBOUR PORPOISE

3.1 Following a comprehensive review of the biology of the fisheries for smaller cetaceans in Montreal, April 1974 (E. D. Mitchell, ed.; *J. Fish. Res. Bd. Can.* Vol. 32 No. 7), the 28th Annual Meeting of the Commission concluded that all cetaceans taken for their own value (i.e. direct takes) be subject to consideration by the Scientific Committee and that the following species in the following areas should be considered for immediate action:

(1) northern bottlenose whale *(Hyperoodon ampullatus)*, North Atlantic;
(2) striped dolphin *(Stenella coeruleoalba)*, North West Pacific;
(3) Dall's porpoise *(Phocoenoides dalli)*, North West Pacific; and
(4) harbour porpoise *(Phocoena phocoena)*, North Atlantic.

At the 27th, 28th and 29th Annual Meetings, the Commission agreed with the Scientific Committee's recommendation that the Secretariat and governments of member nations be urged to initiate or augment research on species involved in direct fisheries. These included recommendations on the above species as outlined in the sub-committee's 1976 report *(Rep. int. Whal. Commn* 27: 481).

3.2 New Information

3.2.1 Northern bottlenose whale, North Atlantic

This species was provisionally listed as a Protection Stock for the entire North Atlantic in 1978 and 1979, pending the accumulation of sufficient information for classification. The sub-committee notes that the bottlenose whale research program recommended in 1977–79 was not carried out this year, as reported by Jonsgård. The Norwegian fishery for bottlenose whale has ceased and no new data were available on stocks. The sub-committee continues to request and recommend that this program be carried out as recommended at the 1977 meeting *(Rep. int. Whal. Commn* 28: 66). The sub-committee also recommends that the provisional classification as a Protected Stock should remain (see Recommendations to the Scientific Committee). Attention was drawn to a recent review

of the biology of the species (Benjaminsen and Christensen, 1979).

3.2.2 Striped dolphin, northwest Pacific

This species is subject to a direct fishery by the drive-in method in Japan. Although extensive biological and population studies had been carried out, several specific research needs were identified in 1976 (Report of Small Cetaceans Sub-Committee, *Rep. int. Whal. Commn* 27: 481). These included catch and effort statistics by species; tagging and census studies to obtain information on school structure, migration, and definition of stocks; and monitoring of life history parameters. Some of these have been accomplished.

While the sub-committee recognises the problems involved in gathering catch and effort data by species in mixed-species fisheries, the sub-committee strongly recommends that a research program to gather these data be expanded as soon as possible (Appendix 6). The sub-committee notes that Japan is implementing such a program.

3.2.3 Dall's porpoise, northwest Pacific

This species is involved in both direct and incidental fisheries. The sub-committee notes the initiation of co-operative research by the USA and Japan (SC/31/Prog Rep 6) and recommends that this research be continued and augmented if possible (see also 5.1.5).

Precise statistics on the directed take in the shore-based fishery in Japan are desired.

Suda reported that the Japanese Fisheries Agency has begun a program of research on the harpoon fishery for Dall's porpoise on the northeastern coast of Honshu. The program will include collection of detailed catch statistics, collection and analysis of biological samples, and studies of population size and status (Appendix 6).

3.2.4 Harbour porpoise, North Atlantic

This species is involved in both direct and incidental fisheries. No reliable estimates of recent takes by the USA and Canada are available. The direct and incidental fisheries along the west coast of Greenland have resulted in annual takes of up to 2,500 porpoises in recent years; approximately 700 animals were taken in the direct fishery in 1978 (SC/31/ProgRep 43. Because the harbour porpoise is a coastal species, the catch must be considered substantial for such a restricted area.

An aboriginal fishery for the harbour porpoise initially pursued by Indians of the Passamaquoddy and Micmac tribes in the Bay of Fundy and Grand Manan Island (summary and references in Mitchell, 1975b: 95, 97) may still exist. The US and Canadian progress reports do not contain statistics for this fishery. D. E. Gaskin and co-workers, University of Guelph in Canada, continue research on harbour porpoise biology, based on samples and observations in the Gulf of Maine, Bay of Fundy and Passamaquoddy Bay.

4. OTHER DIRECTED CATCHES OF SMALL CETACEANS

The sub-committee had available to it new information on research, management and catches of other species taken in directed fisheries, from data in documents submitted to the meeting from participants.

4.1 Japan and Korea coastal fisheries

Suda reported on a new research and management scheme for coastal Japanese waters (Appendix 6). Research is in progress on coastal fisheries for dolphins, and results will be reported later. Aggregate statistics only are available, from the Fisheries Agency (SC/31/ProgRep 6), but Suda stated that the use of varied names for the same species in different prefectures makes tabulation of statistics difficult. The Far Seas Fisheries Research Laboratory is compiling a lexicon of these names.

In the Republic of Korea, a similar problem exists in that coastal catches occur of unknown species and knowledge of local names is lacking.

4.2 Species accounts

4.2.1 Narwhal

The total take of narwhals by Greenland in 1978 was 404, excluding the Thule region. The estimated total was 550 (SC/31/ProgRep 4). Canada (SC/31/ProgRep 3) reported that the Inuit in the Canadian Arctic took 279 narwhals in 1978.

4.2.2 White whale

A take of 979 white whales was reported for Canada (406 in SC/31/ProgRep 3, plus 572—Appendix 3), taken by the Inuit. These figures include takes in Hudson and James Bays. Denmark (SC/31/ProgRep 4) reported a known take of 387 white whales with an overall estimate of 500 to account for lack of information from the Thule area.

4.2.3 Killer whale

In Norway, 54 killer whales were taken under license subsidy by the government (see 5.2).

Canada (SC/31/ProgRep 3) reported a catch of one killer whale.

Ivashin (USSR) reported (through Sergeant) that catches of killer whales by Soviet whaling vessels in the Antarctic were 77 in 1978 and 49 in the early 1979 season. The whale carcases are processed for oil and animal food. Full suites of biological data and specimens are collected from the whales. Catches over the last 10 years (1969–78) have ranged from 2 (1970) to 77 (1978). Adequate assessments of the stocks being fished have not been carried out. (SC/31/Doc 25, Figs. 5 a–b) recorded, without comment, sightings of numbers of large killer whales in Areas IV W and IV E (total >700). These data indicate that killer whales are widespread and abundant in these areas. None the less, the sub-committee believes that this fishery should be pursued only provisionally, pending stock assessment.

4.2.4 Pilot whales

The take of long-finned pilot whales, *Globicephala melaena*, in SW Greenland was 97 in 1978 and 71 in 1977 (SC/31/ProgRep 4).

The United Kingdom (SC/31/ProgRep 11) was unable to give any figures for the St Vincent Islands, but in 1978 three 25 foot boats, each manned with a crew of six, hunted pilot whales with harpoon guns from January to November. Eleven pilot whales were taken in Japan in 1978.

4.2.5 White-beaked dolphins

This species is taken off Labrador for local consumption (SC/31/ProgRep 3).

One dolphin, *Lagenorhynchus* sp., and three other unidentified small cetaceans were caught off SW Greenland (SC/31/ProgRep 4).

4.2.6 Peale's dolphin

Goodall reported that 23 Peale's dolphins, *Lagenorhynchus australis,* were captured for bait for *centolla* traps in southern Argentina in 1978, a take which has since stopped.

In southern Chile (Magallanes), large numbers, mainly this species and *Cephalorhynchus commersonii,* an estimated 2,350 from July 1976 to January 1977, and a similar amount in the 1977–78 season, were harpooned for *centolla* trap bait.

4.2.7 Bottlenose dolphin

This species was probably among the 20 animals taken for local human consumption near the Island of St Helena (SC/31/ProgRep 11).

Marcet Ocaña reported that until 1974 taking of dolphins, mainly *Tursiops,* along with other marine mammals and birds, took place in the Gulf of Mexico for bait for hook and line shark fishing. This is now prohibited and controlled in Mexico.

Some bottlenose dolphins may be captured by driving at Bahia Sanborombon, Argentina but no statistics are available (SC/31/SM 3).

4.2.8 Ocean dolphins

Some ocean dolphins, *Stenella,* are taken along with the pilot whale fishery in St Vincent, and are probably among the 20 animals taken annually in St Helena (SC/31/Prog Rep 11).

4.2.9 Harbour porpoise (See 3.2.4)

In 1976, (*Rep. int. Whal. Commn* 27: 510), Kapel noted that there had been a decline in the take in most recent years of *P. phocoena* in Greenland, from 1,000–15,000 to about 700–800 animals. In the late 1960's and early 1970's, the directed and incidental take may have reached 2,500 animals.

Kapel reported that some incidental capture of *P. phocoena* still occurs in the salmon fishery, but that it has decreased because few foreign vessels are presently carrying out salmon fishing in West Greenland waters. Catch statistics of directed and incidental catch are reported together, so the proportions are not known. The porpoise are used for food.

The sub-committee recommended research, documentation of effort and historical research on the West Greenland harbour porpoise. Kapel commented that this would not be possible at present because of the nature of the records and because of the limited staff and funds available for research in Greenland that would more likely be allocated for research on seals and other whale species, on which the need for studies and collection of data are considered more urgent.

Mitchell believes that on zoogeographic grounds, the West Greenland harbour porpoise is likely an isolated stock, and that the magnitude of removals in the last 10–15 years warranted concern for the status of this stock. The sub-committee then recommended a reassessment of possibilities of research on harbour porpoises in Greenland.

5. PROBLEMS OF INTERACTIONS BETWEEN FISHERIES AND SMALL CETACEANS

The sub-committee reviewed a number of documents and progress reports which dealt with this subject. These were SC/31/SM1, 3, 4, 11, 20 and SC/31/Prog Reps 1, 2, 3, 4, 5, 6, 8, 9, 10, 12. Additional information was provided by sub-committee members and invited experts.

In 1978 (*Rep. int. Whal. Commn* 29: 26–27) the Commission endorsed the recommendations of the Scientific Committee through the Technical Committee to encourage research by member nations into competition between small cetaceans and fishermen (13.4) and that statistics and data on all types of small cetacean fisheries (including direct, incidental and live capture) should be submitted to the IWC as part of the national scientific report (13.6).

The sub-committee reviewed the following new information.

5.1 Incidental takes

5.1.1 North America

Canada. Porpoises are taken in cod traps in Newfoundland, in mackerel nets in the Gulf of St Lawrence, and on the Labrador coast (refs. in Mitchell, 1975b: 95), but the sub-committee has not received any recent statistics on these incidental takes.

5.1.2 South America

Brazil. H. P. Castello (letters of 16.i and 5.ii.1979) has data on incidental killings of dolphins during beach seining operations in Rio Grande which involve 'numerous' franciscanas, *Pontoporia blainvillei.*

Uruguay. Praderi (SC/31/SM 4) reported that many franciscanas, *Pontoporia blainvillei* continue to be caught in the shark gill-net fishery off the oceanic coast of Uruguay, particularly at Punta del Diablo. The number caught in 1978 (254) was the same as in 1977, and slightly higher than in 1976 (244). He feels that because of the increasing emphasis on fishing with larger vessels farther offshore, the mortality of *P. blainvillei* is expected to decline in the future.

Argentina. Goodall (SC/31/SM 3) and Goodall and Cameron (SC/31/SM 1) reported that undetermined numbers of dolphins, mainly Peale's dolphins, *Lagenorhynchus obscurus;* bottlenose dolphins, *Tursiops truncatus,* franciscanas *Pontoporia blainvillei; Stenella* sp.; and possibly Commerson's dolphins, *Cephalorhynchus commersonii,* may be taken during fishing for *anchoita, corvina, caballa, abedejo* and other fish in the provinces of Buenos Aires, Rio Negro and Chubut, but that numbers are probably small. In Tierra del Fuego, Commerson's dolphins and others die in tangle nets used from shore for the capture of *robalo* and *merluza.* Specimens recovered were 23 in 1978 and 21 in 1977, but the number of dolphins killed was much greater; since the fishermen do not utilize them, most are discarded.

Chile. Goodall (SC/31/SM 3) reported that a considerable incidental take of Burmeister's porpoise, *Phocoena spinipinnis,* and *Cephalorhynchus eutropia,* occurs during net fishing for *congrio* and other species off the coast near Valdivia. No information on numbers is available: the dolphins are used for bait, human consumption and possibly fish meal.

Goodall also reported the incidental capture of *C. commersonii* and possibly *Lagenorhynchus australis* in

centolla nets in the area of the Strait of Magellan. No definite statistics are available but an estimated 300 dolphins may be taken per year. This incidental take is declining with the gradual change from nets to traps for southern crab.

Peru. Valdivia reported that at present, there is no directed take of dolphins, but some unloading of incidental catch taken during purse seining for pelagic fish (*anchoveta, sardinas, caballa* and *jurel*) does occur. No statistics are available. Recently, there has been a greater demand for dolphin meat in the markets of small coastal Peruvian ports, which could be an incentive for increased retaining of dolphins.

The Instituto del Mar del Peru (IMARPE) cannot carry out its approved plans of investigation on small cetaceans at present because of limited funds, but possibly studies will begin in the near future.

5.1.3 Africa

Senegal. J. Maigret (letter to IWC, 1979) has advised that investigations have begun on the small cetaceans involved in the yellowfin tuna purse-seine fisheries, which produce the death of 'numerous dolphins'. Observation forms have been distributed and conferences with neighboring countries planned.

According to A. Fonteneau (letter to G. Sakagawa, 12.iv.1979), the fishermen do not use the dolphins on the Ivory Coast and Senegal, and the dolphin catch is probably low.

Seychelles. L. Watson reports that the Seychelles have a small incidental take (about 30 per year) of dolphins, mainly *Stenella.* Under the new Seychelles Marine Mammal Act, all catches in the future will be reported and definite data should be available by the next meeting.

South Africa. In 1978 the reported mortality was less (SC/31/ProgRep 9) than in 1976. One Heaviside's dolphin, *Cephalorhynchus heavisidii,* was trapped in a purse seine net. Forty-four dolphins were trapped in shark nets; the six of these which were examined were bottlenose dolphins, *Tursiops.*

5.1.4 Europe

Norway. E. Christensen reported that harbour porpoises, *Phocoena phocoena,* are caught incidentally in fishing nets, but that the number taken is small.

Denmark. See 3.2.4.

5.1.5 Asia

Japan. The 1979 progress report was indefinite on the number of small cetaceans caught incidentally, since both incidental and deliberate catches were included in Table 2 (SC/31/ProgRep 6). No figure was given for 1978 but 16,074 was reported for 1977 and 18,453 for 1976 for both types of take.

The USA and Japan, under the aegis of the International North Pacific Fisheries Commission, have completed the first year of a three-year study of Dall's porpoises taken in the Japanese salmon gill-net fishery. Data and specimens were collected from 354 Dall's porpoises incidentally captured within the United States' 200 mile fisheries zone off the Aleutian Islands during the summer of 1978. Preparation and analysis of ovaries, testes, stomach contents and teeth is continuing.

Sightings data were also collected aboard Japanese research vessels by US and Japanese scientists and on US vessels of opportunity. Progress reports were submitted by both countries to the Scientific sub-committee of the Ad Hoc Committee on Marine Mammals of the International North Pacific Fisheries Commission, which met in March 1979, in Tokyo.

5.1.6 Eastern Tropical Pacific (Purse-seining for tuna)

The estimated kill of dolphins and small whales in the US tuna fishery declined from 490,000 in 1970 to 27,000 in 1977 and 14,946 in 1978 (SC/31/SM 11). Figures for the first five months of 1979 totalled 10,859. The US kill has gone down in the last two years, with that for 1978 being only half as much as 1977. In 1979 there was less fishing for skipjack, so the kills have been higher. The % of captured animals has not declined, but the % of captured animals killed has declined.

SC/31/SM 20 reported that purse seining for yellowfin tuna has been carried on by Canadian vessels in the eastern tropical Pacific since the 1960s. Two-inch mesh panels were installed to prevent dolphin entanglement in 1974, 1¼in panels in 1977 and 'aprons' during 1978. The operation of vessels tended to be directed more at 'school' rather than 'on porpoise' fishing. Information from logbooks and occasional observers indicated the number of sets 'on porpoise'. Using the rates obtained on similarly operated US vessels, the estimate of dolphin kill for 1976 was 131; in 1977 it was 462 and 106 in 1978. During 1976 an observer program is being carried out in accordance with Inter-American Tuna Commission (IATTC) recommendations. Canada is participating in the IATTC observer program.

At its 33rd meeting in 1976 the IATTC agreed to concern itself with the problem of dolphins killed incidental to purse seining for yellowfin tuna in the eastern Pacific. A research program was founded last year and is now under way. This includes an observer scheme for collecting data on the abundance and incidental mortality of dolphins. In addition, the program is to include population assessment, studies of dolphin biology and gear research.

1979 will be the first year for which there will be estimates of kills for the entire international purse seine fleet, and these will be reported next year.

Other IWC nations known to participate in the purse-seine fishery for yellowfin tuna in the eastern tropical Pacific include Panama, Mexico, New Zealand and Peru. Statistics on kill of dolphins in tuna-seining operations have not been reported by these member nations.

5.2 Direct Conflicts and Competition

In 1978 the sub-committee recommended and the Scientific Committee and the Commission agreed that the Commission foster and support research by member nations into general and specific competitive relationships between small cetacean populations and fish populations, as well as providing data on kills to IWS. (*Rep. int. Whal. Commn* 29). New information was reported to the sub-committee as follows:

5.2.1 Japan

Suda reported that at Iki Island, off the coast of Nagasaki, fishing takes place for yellowtail by day and for squid at night. The islanders scatter bait to gather and feed schools of fish in the area. Dolphins and small whales, mainly *Pseudorca crassidens and Tursiops truncatus,* have moved

into this region and are reported to do extensive damage by eating the bait, the hooked fish and damaging fishing gear. Suda reported that 1,000 tons of anchovy is spread over the area during a period of 200 days per year, as bait and food for the yellowtail. Sometimes the dolphins drive the fish away and other times eat them. At night they eat the squid. Killer whale sounds, speed boats and other methods were tried in 1979 to frighten the dolphins, but nothing has worked. This fishery has gone on for 20 to 30 years, but the build-up of dolphins is fairly recent; Japanese scientists cannot explain the concentrations of dolphins. No study of stomach contents has been carried out to quantitatively assess the supposed consumption of bait, yellowtail and squid by the cetaceans.

Suda also reported that conflicts exist between small whales, probably *Pseudorca*, and the tuna long-line fishery over a wide area in the tropical Pacific. Sometimes two or three years pass without damage, except for sharks, but some years 'sochi', *Pseudorca* and/or other small whales damage 5% of the tuna catch, a loss to the fishermen of about $25–30,000,000. Fishermen can tell if the damage is by sharks or dolphins, as the method of biting is different.

The Japanese fishery associations have asked for research on the problems. Some data can be obtained from log books, and expanded research is planned (Appendix 6).

5.2.2 India

A letter from a reporter for the Times of India (Shailendra Ghorpade to E. Mitchell, 1 July 1978) stated that a bounty was being paid by Maharashtra State to local fishermen for the killing of porpoises. No information was given on the species, reason for the bounty or numbers involved.

5.2.3 Norway

Christensen reported Norway has been taking killer whales inshore since 1976 under licence and with a subsidy from the Norwegian government. The take in a small-type-whaling operation has the purpose of controlling perceived competition by killer whales with herring fishermen for inshore herring stocks. The herring stocks in offshore waters have been much reduced and those populations left are now concentrated near fiords and are vulnerable to killer whale predation.

The sub-committee noted that this fishery constitutes a resumption of a fishery which almost died out in the early 1970s. Inshore catches for the last ten years have been: 1969—189, 1970—232, 1971—18, 1972—7, 1973—1, 1974—6, 1975—2, 1976—0, 1977—7 and 1978—54; ten year average is 52 whales (IWS and Prov. issue LXXXIII).

Christensen is monitoring the catch, collecting teeth and ovaries through a reward system to the whalers. The blubber is rendered to oil, and the meat is used by fox farms. Animals sampled to date have been very fat and females have a high pregnancy rate. No estimates of size of population(s) or status of stock(s) have been made.

5.2.4 Gulf of Guinea

At the November, 1978 meeting of the International Commission for Conservation of Atlantic Tunas (ICCAT), potential conflicts between 'killer whales' and tuna fishing in the Gulf of Guinea were reported. Dumping at sea of undersized yellow-fin tuna has attracted killer whales, which eat these fish and have begun to follow vessels even when not dumping, or surrounding them when stationary. There is fear that the population of killer whales will build up and that they will disperse schools of live fish by attack or tear nets to obtain the fish (Kume, 1978; Kwei and Mensah, 1978). The sub-committee urges Japan to collect data on species, numbers and behavior of cetaceans involved in the fishery and quantitative estimates of tons of tuna discarded and eaten by the whales.

5.2.5 Canada

The increasing problem of cetacean encounters with fishermen's nets in Newfoundland has prompted a research program by government and university scientists (J. Lieu, Memorial Univ.) on the subject (SC/31/ProgRep 3).

5.2.6 Mexico

Marcet Ocaña reported that Mexico has begun a program of research on marine mammal/fishery conflicts. The first work concerns problems with California sealions, *Zalophus californianus*, but cetacean problems will also be researched.

6. EFFECTS OF POLLUTION AND INDUSTRIAL DEVELOPMENT

The sub-committee reviewed the many large industrial developments being undertaken and planned for the North American Arctic and discussed the potential effects of these projects on white whale and narwhal populations. The sub-committee also reviewed industrial and pollution problems in European waters and the special problem of decline in apparent abundance of the harbour porpoise, *Phocoena phocoena*, in the North and Baltic Seas.

6.1 North American Arctic

6.1.1 Hydro-electric Projects

Two major hydro-electric projects are underway on the large rivers draining into Hudson Bay, Canada. The James Bay project is damming several large rivers and diverting several others. The project will have major effects on the coastal marine ecology and may affect the few hundred white whales along the SE coast of Hudson Bay. Of more concern is the Nelson River Project along the SW coast of Hudson Bay. This project involves dams on the Nelson River, which drains over 1,000,000 km^2 of central Canada. In addition, the main flow of the Churchill River will be diverted into the Nelson River. The estuaries of these two rivers comprise two of three main estuaries used by calving white whales in summer. Control of the flow of the Nelson River will reduce spring flooding and delay ice break-up in the estuary, and diversion of the Churchill River will drastically reduce the flow of that river. The suitability of these estuaries for summering white whales could be severely reduced. The effects on the West Hudson Bay population of 5,000–10,000 white whales are unknown and are not being studied.

6.1.2 Coastal Mining Developments

Construction of heavy metal mines near sea coasts could pose a serious threat to local marine food chains. In Greenland, the Black Angel lead-zinc mine which deposits its tailings directly into the sea has resulted in a rapid rise of heavy metals in the water column and marine organisms. The fiord involved is now heavily polluted,

which has resulted in the death of most organisms, and there is some evidence that the situation is spreading to the adjacent fiord (Greenland Fisheries Investigations, Annual Reports 1974–77). Kapel reported that studies of these effects are being continued; sampling includes tissues from ringed seals but not other marine mammals.

The Nanisivik mine (Baffin Island, Canada), also a lead-zinc mine, is depositing its tailings into a lake which overflows into the sea. Background levels of lead, zinc, cadmium, and mercury were high in local organisms, including narwhal, before the mine developed. Kemper reports that some evidence suggests that cadmium biomagnification has occurred in the food chain and levels are very high in narwhal brain tissue. Since resident seals, char and narwhal are used for human food, monitoring programs must precede and parallel such developments. A monitoring program is planned for August 1979.

6.1.3 Oil and Gas Exploration

A large amount of exploratory drilling is underway and planned in offshore regions of the North American Arctic. Drilling in these areas is extremely costly and environmentally hazardous because of severe ice conditions. Drilling in Arctic regions usually occurs during the summer when the 'ice whales' (bowhead, white whale and narwhal) are present in these areas. The principal concern is that an uncontrolled blowout of oil could occur and ice conditions could prevent control of the blowout by drilling a 'relief well' for at least a year. The sub-committee is concerned that there are no reliable data on the ability of cetaceans to detect and avoid a surface oil slick. Similarly, there appears to be no information on the lethal and sub-lethal effects of exposure to oil on cetaceans. Thus, the effects of a major oil blowout in Arctic waters cannot be evaluated.

Exploratory drilling is currently underway in the Canadian and American sectors of the Beaufort Sea using drill-ships in offshore waters and artificial and natural islands in coastal waters. Loss of control has occurred in 3 of 12 wells drilled to date in Canada but the flow in each case was water and/or gas rather than oil. Hearings examining the desirability of increased drilling in waters along the Alaskan Beaufort Sea coast have recently been held and additional drilling in this area could begin as early as 1980. The sub-committee notes that the autumn migration routes of bowheads and white whales in the Beaufort Sea are unknown and that drilling is underway or planned for areas probably used by these whales. The sub-committee also notes that the current summer feeding grounds of the bowhead are presumed to be in Amundsen Gulf based on old (before 1910) whaling records but that no recent surveys have been conducted to verify this. The oil industry plans to drill in this area in the near future and the sub-committee believes that surveys of the numbers and distribution of bowheads on these summering grounds should be conducted.

Drilling was conducted off the west coast of Greenland in 1976 and 1977. However, the exploration was unsuccessful and has been abandoned. Offshore drilling in deep water will begin in Canadian waters in Davis Strait in 1979 and is planned for Lancaster Sound and northwest Baffin Bay. Blowouts from any of these proposed exploration or future production wells could affect major stocks of narwhals and white whales and the remnant Davis Strait stock of bowheads.

Noise, vessel traffic and other activities associated with offshore drilling could cause some disturbance and localized avoidance behaviour by whales but recent studies in the Canadian Beaufort Sea suggest that whales react only when within 1 or 2 km of a stationary source of disturbance (Fraker, 1978). Thus, direct disturbance of whales would only be a serious problem if it occurred in a major concentration area. No such activities are planned nor are they likely to be permitted by either the US or Canadian governments.

6.1.4 Shipping

Current levels of shipping activity in the North American Arctic are comparatively low but they are increasing. Studies of the effects of low levels of large traffic in the Mackenzie River estuary (Canada) indicate that white whales swim rapidly away from moving vessels within about 2 km^2 (Fraker, 1978). The effects of the high levels of traffic that would be associated with future oil production have not been studied. Sergeant (1973) has suggested that there may have been a decline in use of the Churchill River estuary by white whales since a port was established there in the 1930s.

There are several plans for construction of very large ice-breaking tankers to transport oil (if found) and liquid natural gas (LNG) from the Canadian Arctic to southern markets. The most advanced project involves plans for two 150,000 ton (ice Class 10; 150,000 horse power) LNG carriers to travel year round between Melville Island in the western Canadian High Arctic and south-eastern Canada. The ships would be involved in ice-breaking on most voyages and concern has been expressed that white whales and narwhals could follow the tracks through the ice and become trapped when the track freezes behind them. Concern has also been expressed that because the vessels will travel along the west coast of Greenland that they will interfere with the subsistence hunting by more than 4,000 inhabitants of NW. Greenland, and possibly also interfere with the wintering and migrations of narwhals and white whales. The sub-committee does not believe that there is enough information with which to evaluate the effects of this and other projects involving large ice-breaking tankers on populations of white whales and narwhals and it is important that these kinds of problems be investigated before such projects begin.

6.1.5 Marine Pipelines

Pipelines associated with the production and transportation of natural gas are planned for the Canadian Arctic. These projects involve laying of pipelines on the sea-bottom but they are not expected to cause problems for whales. A pipeline rupture that released natural gas into the water column would cause local disturbance but pollution would be low because most gas would bubble to the surface and dissipate into the atmosphere. Rupture of an oil pipeline is potentially more serious but no oil pipelines across marine channels are currently planned.

6.1.6 Research

A large amount of environmental research is being conducted by government and industry in association with the planning of some of the industrial activities discussed above. These studies are generally broad-scale impact assessments but they have provided useful information on white whales and narwhals in the North American Arctic. Some important gaps in knowledge have been outlined above and in other sections of this report. The sub-

committee believes that research has been inadequate to provide appropriate data for management of most white whale and narwhal stocks. This research is vital because these stocks will come under increasing pressure from expanding aboriginal populations (the population of Inuit in Canada will double in 12 years) and from increasing industrial activities.

6.2 Europe

6.2.1 Industrial/pollution problems

European waters, particularly the Baltic, North Sea, English Channel, Irish Sea, Mediterranean and other inland seas suffer from pollution through industrial and agricultural activities and from heavy boat traffic, both commercial and tourist. There are no comprehensive programmes for monitoring the effects on cetaceans and no firm recent evidence on distribution, particularly of small cetaceans. A number of major accidents to oil tankers and to oil exploration installations have resulted in considerable spills in recent years. No efforts have been made to investigate effects on the cetaceans exposed to oil spills in European waters, either of the oil or of the chemicals used in dispersal.

There is an obvious need for systematic studies of the effects of oil and gas exploration on cetaceans in these waters and of the effects on cetaceans of pollution of these coastal waters through industrial and agricultural activity.

6.2.2 Harbour porpoise in European Waters

There are many reports that the harbour porpoise, *Phocoena phocoena*, had declined in abundance in European waters. Mitchell (1975a) concluded that early 'drive fisheries' in the Lille Belt and other fisheries and/or incidental by-catches in nets along the shores of Denmark, Poland and other Baltic Sea countries substantially reduced an initial population of 10–15,000 before 1945. The remaining population, of low abundance, may not have recovered or may have declined farther for a number of reasons. High levels of DDT and PCB in Baltic porpoises and high levels of PCB in porpoises from the Swedish west coast have been found (Olsson—letter to Klinowska, 1978). In seals, such levels of PCB are associated with pathological changes in the uterine tract leading to reproductive failure (Olsson, 1977). If this is true for cetaceans, the PCB pollution may have contributed to the population decline, although this is not universally agreed (Kapel—reporting ICES disc. 1976). It has also been suggested that climatic change may have played a role, particularly changes in ice cover (Lindroth, 1962; Wolk, 1969). Standing information indicates a decline on the Dutch, French and UK coasts (Mitchell, 1975b; Duguy, 1977; *Rep. int. Whal. Commn* 27: 500–01) although the reasons for this are not clear. As noted elsewhere in this report, European waters are particularly affected by industrial activity, mineral exploitation, oil spills and boat traffic. The problems of this species have been repeatedly discussed in the Marine Mammals Committee of ICES and a resolution was agreed by this Council in 1976, urging its members to collect material for analysis of contamination residues from all animals found dead. The Council of Europe has also recently identified the harbour porpoise as endangered by pollution (Smit and Wijngaarden, 1976). There is, however, no major support for efforts to investigate these matters either at national or international level. The sub-committee believes that this matter should be pursued by the Commission.

7. REVIEW OF DEFINITION AND STATUS OF STOCKS OF THE WHITE WHALE, *DELPHINAPTERUS LEUCAS*, AND THE NARWHAL, *MONODON MONOCEROS*

7.1 Increasing importance of fisheries

The investigation and documentation of the status of the stocks of these species is of considerable importance at the moment for the following reasons.

(1) The white whale is considered to be one potential alternative to the Alaskan bowhead whale *(Balaena mysticetus)* which is the object of a subsistence fishery (IWC, 1979).
(2) Some of the stocks have ranges which include the territorial waters of several nations.
(3) Several stocks may be over-exploited.

7.2 White Whale

7.2.1 Distribution, migration and definition of stocks

The sub-committee reviewed information in SC/31/SM 5, 8, 10, 12, 13, 14, 15, 16, 17 and 19. Perrin proposed a conceptual model of the distribution and migrations of white whales, with the features:

(1) Isolated year-round resident populations at low latitudes (examples: St Lawrence Estuary population and Okhotsk Sea population(s)).
(2) Several major wintering grounds near the edge of the pack ice (Fig. 1) (West Greenland, Hudson Strait, the SE. Barents Sea, and the SW. Bering Sea).
(3) Seasonal migrations of varying length to and from the small number of major wintering grounds to a much larger number of major summering grounds, typically in the region of large, relatively warm-water river deltas (examples: White Sea, mouths of Siberian Arctic rivers, Anadyr Gulf, Mackenzie River Delta, Creswell Bay in the Canadian High Arctic, and Cumberland Sound, Baffin Island).
(4) Longitudinal gaps between the ranges of the groups of high-latitude summering populations derived from the major wintering grounds, at approximately the longitudes of Iceland, the New Siberian Islands (approximately 130–150°E longitude) and Victoria Island in the Canadian Arctic (approximately 110°–120°W longitude).

The group agreed to use this model (Fig. 2) as a basis for assessing the likely degree of stock-discreteness of particular populations and that the hypothesis of wintering grounds shared by several geographical summer populations permits of two major alternative conclusions *vis-a-vis* stock discreteness, namely:

(a) wintering group consists of a single inter-breeding stock which disperses in spring, or
(b) animals in summering grounds constitute separate stocks which winter in a common area.

There was no direct evidence for either view, and it was agreed that stock assessment should be carried out considering both alternatives.

The sub-committee recognized that the model is likely an over-simplification and that minor wintering grounds exist, that year-to-year climatic variation affects the tenability of potential winter and summer grounds, and that considerable diversity of scientific opinion exists concerning the migrations and affinities of particular populations (for example, the White Sea population(s)—see SC/31/SM 13, 14 and 17).

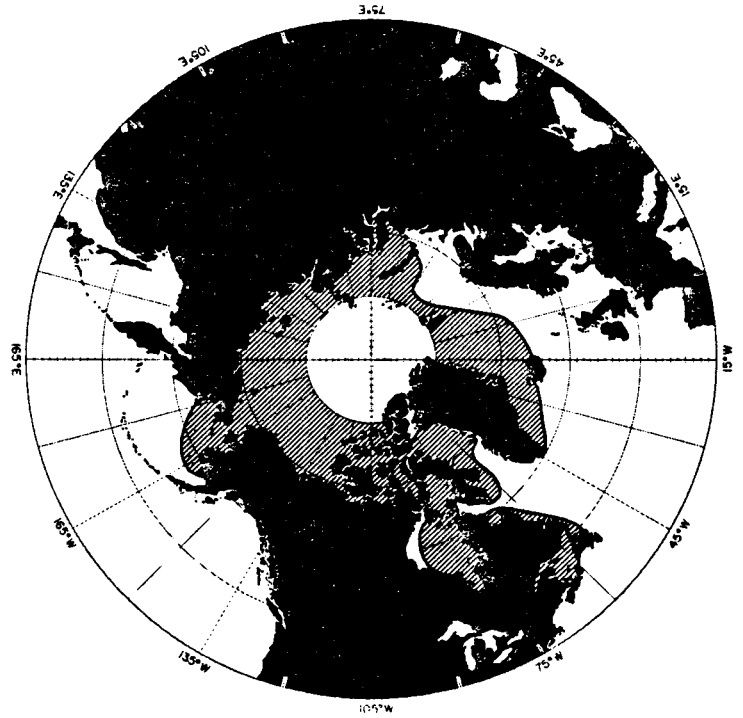

Fig. 1. Approximate limits of winter ice (15 year average).

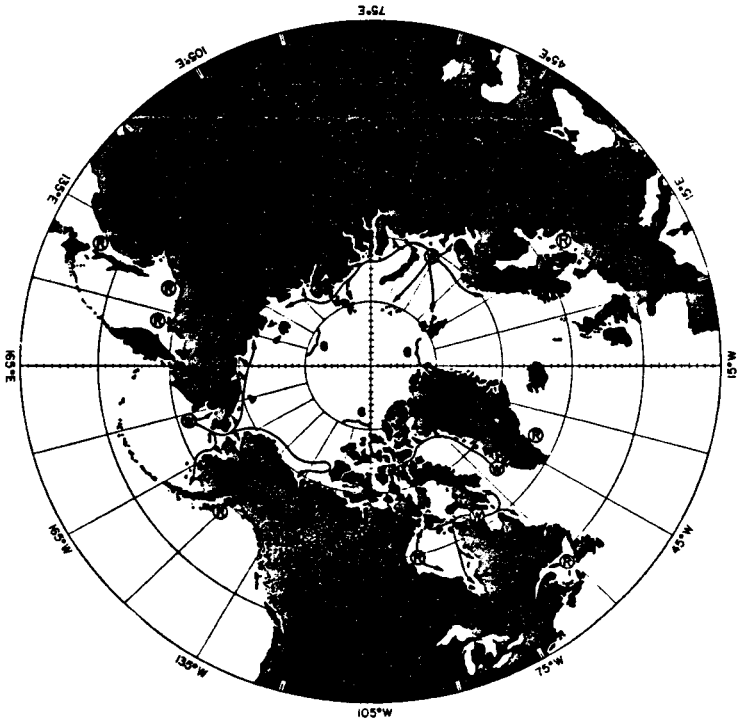

Fig. 2. Conceptual model of distribution and movements of white whales. Arrows indicate spring migrations to main summering grounds.
W — Major wintering ground.
R — Year-round population.
G — Longitudinal gap in distribution.

7.2.2 Age Determination and Vital Rates

SC/31/SM 6, 7, and 15 contained information on age determination and estimation of reproductive rates.

Age determination has been based on counts of dentinal layers, and in the past the balance of opinion has been that there were two dentinal layers per year (Brodie 1967 and Sergeant 1973). However, more recent opinion, based on the same data and the analysis by Ohsumi (1979) tends to favour one layer per year (SC/31/SM 6).

The data in the table below were extracted from SC/31/SM 7 using the alternative assumptions of one or two layers per year.

	One layer/year	Two layers/year
Age of maturity, females	10 years	5 years
Age of maturity, males	16–18 years	8–9 years
Longevity	40–50 years	20–25 years
Gestation	14 months	14 months
Lactation	20–24 months	20–24 months
Frequency of calving	1 in 3 years	1 in 3 years

The data on gestation and lactation are based on direct observation and do not depend on assumptions about the rate of deposition of layers. These were based on samples from the eastern Canadian Arctic, and it was noted that a calving interval of two years had been reported for Alaskan waters (SC/31/SM 15).

Sergeant expressed the view that there is little prospect for success in estimating mortality rates from catch curves derived from teeth because of the difficulty of accurate reading of all teeth. These often exhibit irregular layering and heavy apical wear resulting in the loss of layers. The latter problem might be overcome by selection of teeth. The sub-committee feels that teeth should continue to be collected from all specimens at least in selected fisheries.

7.2.3 Estimates of net reproductive rates

No estimates of natural mortality rates appeared available. Therefore, the sub-committee could only review estimates of gross annual reproductive rates. Data on proportion of young-of-the-year calves in groups of sighted whales were available:

1. Seal River, Hudson Bay 12% (Sergeant, 1973)
2. Seal River, Hudson Bay 11.4% (Sergeant, 1973)
3. Canadian High Arctic 11.7% (SC/31/SM 10)

Davis corrected the Canadian High Arctic estimate to 10% based on fluctuations in the proportions of immature animals present.

Sergeant (1973) calculated a gross annual birth rate of 14.3% from anatomical study of large samples of adult females. This estimate was made primarily from data for females in early pregnancy, and can be assumed to be higher then the true birthrate, as it does not take into account prenatal mortality. Brodie (1971) calculated potential instantaneous rate of increase (r) for Cumberland Sound white whales at 9%.

Based on these estimates and on rates in other small odontocetes, the sub-committee concluded that gross annual production of calves is somewhere around 10%.

The sub-committee next considered the question of whether this species exhibits density-dependent change in rates of production. Sergeant (SC/31/SM 7) compared supposedly heavily and less-heavily exploited populations. He found no change through time in average length of adult whales taken at Churchill over the period 1949–68, which, in combination with a long history of large catches, suggests to him that the West Hudson Bay population has been stable. He found no difference between the populations in mean age at attainment of sexual maturity in males and females, duration of lactation or frequency of calving.

The rest of the members of the sub-committee, however, believe that, in the absence of adequate data on effort, the assumption that the West Hudson Bay population has not experienced a change in density is not supportable. The catch declined over the period 1951–67 (Fig. 3) and the possibility exists that this was caused, at least in part, by decreased density rather than by decreased effort. The issue remains unresolved, and the sub-committee believes that additional analyses of the available data and further research based on larger samples from these and/or other populations are necessary to examine the question of density-dependent change of vital rates in this species.

7.2.4 Estimates of population size

The sub-committee reviewed and tabulated available population estimates for summering populations and, where available, for the major wintering grounds (Table 1). The tabulation is not complete; estimates for some Soviet populations (SC/31/SM 13), in particular are very approximate, and some of them may be missing (discussed below).

7.2.5 Commercial and subsistence takes

Counts and estimates of catch from a wide variety of monitoring sources were reviewed (Table 1). Kapel reported that catches on the Greenland coast are highly variable, with no clear indication of long term increase. Sergeant and Kemper reported that catch-reporting systems in Canada vary with province or territory and are non-existent in some cases. Braham reported that John Burns of the Alaska Department of Fish and Game may have estimates of white whales taken in western Alaska.

Members of the sub-committee expressed uncertainty about the reliability of the catch statistics for Ungava Bay. Roy (1971) reported that 50–60 white whales were taken annually by the Ivujivimmiut (in one village?). Davis reports having seen a processed report (Anon, 1976), which gave an annual harvest figure of 573 white whales for northern Quebec in 1975 (see Appendix 3). Sergeant expressed reservations about this catch figure. If substantiated, this would be the largest catch of white whales in Canadian waters; and if the Hudson Strait—NE Hudson Bay summer population is discrete, then no estimate of population size has ever been made of this stock. The sub-committee also notes that no statistics on this catch have been formally presented to the IWC (*cf* SC/31/ProgRep 3).

7.2.6 Hunting loss rates

The sub-committee notes with some concern that the losses to the hunter of whales killed or mortally wounded is a major factor in the exploitation of both the white whale and the narwhal. No systematic study of white whale loss rates has been carried out and most estimates are anecdotal, subjective and almost certainly imprecise (Appendix 4, 5; Table 1).

Table 1

Estimates of population and Harvests for major summering and wintering populations of white whale

Winter	Summer	Population estimate	Comment	Recent annual catches	% Loss rate[1]	Estimated kill	
						No.	% pop'n
1. Cook Inlet, Alaska	Resident	200–500[a]	Extrapolation of recent aerial survey	~10[a]	Estimated low[b]	>10	>2–5
2. South West Bering Sea				—	—	—	—
	a. Bristol Bay/Kuskokwim	1,000–1,500[c]		—	—	—	—
	b. Yukon/Norton Sound	—		—	67[b]		
	c. Kotzebue Sound	—		—	67[b]		
	d. Alaskan NW Coast	—		—	83[b]		
	e. Mackenzie delta	4,000–5,000[d]	Repeated recent aerial surveys	148 (1972–78)[d,2] (range 123–187)	33[d]	220	4–5
	f. Bering Sea (incl. Anadyr)	2,000–3,000[e]		27 (1976–78)[f] (range 21–32)	—	>27	1
	g. East Siberia/Chukchi Sea	1,000–2,000[e]		None reported[f]	—	—	—
3. Okhotsk Sea	Resident (2 populations)	6,000–10,000[e]		None since 1969[f]	—	—	—
4. Barents Sea		1,500–3,000[e]		824[3] (sum)[f]	—	>824	>28–55
	a. Resident	—		38 (1976)[f]	—		
	b. White Sea	500–1,000[e]		189 (1974–77)[f] (range 71–302)	—	>189	>19–38
	c. Barents/Kara/Laptev Seas (several populations)	1,000–2,000[e]		140 (1974–78)[f] (range 19–170)	—	>140	7–14
5. St Lawrence Estuary	Resident	325[g]	Recent ship survey	0[4]	—	0[4]	—
6. W. Hudson Bay	Resident	5,000–10,000[i]	No recent survey	115 (1978)[h]	33 (25–50)[j]	172	2–3
7. Hudson Strait	—	—		323 (1975)[k,5]	—	—	—
	a. East Hudson Bay	'few hundred'[g]	Partial aerial survey	128 (1975)[k]	33 (25–50)[j]	—	—
	b. Southampton Is.	—	Possible summering area	—	—	—	—
	c. Ungava Bay	'up to 1,000'[l]	Not based on survey	122 (1975)[k]	33 (25–50)[j]	—	—
	d. Frobisher Bay	250–300[m]	Recent aerial survey	5 (1978)[k]	—	7	3
	e. Cumberland Sound	500[m]	Recent aerial survey	85+ (1978)[m]	33 (25–50)[j]	>127	>25
8. West Greenland	—	—		—	—	—	—
	a. Central Arctic	10,250–12,000[n]	Recent aerial survey	11 (1978)[6]	33 (25–50)[j]	>14	>1
	b. Thule/Melville, or	2,000[n]	Deduced	100[k]	<10[p]	110	6
	Total Management Unit	12,250–14,000	Assume a + b one stock	1,064	Various as above	1,270	9–10
				(953[7] + 11[8] + 100[9])		(1,146[7] + 14[8] + 110[9])	

a. SC/31/SM12
b. Appendix 5
c. SC/31/SM15
d. SC/31/SM8
e. SC/31/SM13
f. SC/31/SM17
g. SC/31/SM5
h. *Rep. int. Whal. Commn* 29: 111–14
i. Sergeant, 1973. *J. Fish. Res. Bd Can.* 30: 1,065–90
j. Extrapolated from SC/31/SM8
k. Appendix 3
l. Sergeant & Brodie, 1975
m. SC/SM/16
n. SC/SM/10
p. Appendix 4

1. Loss rate = proportion of total kill that was not landed, e.g. 33% = 1 lost for every 2 landed
2. Probably not complete
3. Including vessel take of 457
4. Possible accidental kill
5. From Hudson Strait, possibly migratory component of an unknown stock
6. Probably underestimated
7. West Greenland (south of Thule) average 1967–74[p]
8. Canadian
9. Thule

The use of rifles rather than harpoons with fixed lines has in small cetacean fisheries necessitated a redefinition of terminology for expressing loss rates. The sub-committee proposes the following terms for future use;

Wounded-but-lost: Animals which are non-lethally wounded and escape.

Killed-but-lost: Animals which are mortally wounded but are not landed.

Kemper reports that loss rates are closely associated with the hunting technology (equipment) used and the situation in which the hunt occurs. Similar methods are used in the pursuit of narwhals and white whales. Fraker (SC/31/SM 18) and Brodie (1971) have documented the loss rates associated with hunts in murky river estuaries. Traditional hunting methods (SC/31/SM 16) using kayak, harpoon with floats and drogue are associated with efficient hunts characterized by low killed-but-lost rates (Durham, in IWC, 1979). The introduction of rifles, first used to kill harpooned animals and more recently employed to shoot at unharpooned quarry has greatly altered this loss rate.

Several authors have attempted to estimate sinking loss (killed-but-lost) (Table 1), but none have attempted to estimate wounded-but-lost rates, which are assumed to be much higher. In contrast to the rifle-first method used in most aboriginal fisheries, other methods are believed to be more efficient, such as the commercial drive method formerly used in Cumberland Sound, the harpoon commercial fishery in West Hudson Bay, the aboriginal and commercial fisheries using estuary-entrapment, and the Thule-West Greenland hunt, where traditional harpoon and float are still used.

Net fisheries are highly efficient (SC/31/SM 16), but are not popular with the aboriginal peoples, who prefer the active hunt and pursuit of game.

While the estimates of loss rate are very tentative, it is necessary to take them into consideration when assessing impacts of exploitation and status of stocks. In some cases they may be very high, making them in these cases the most important element of exploitation (see also narwhal section).

The sub-committee recommends that research on killed-but-lost and wounded-but-lost rates be initiated for each major type of white whale and narwhal hunt so that more confidence can be placed in statistics on removals. Such research might also examine sensible alternative technologies to reduce these losses particularly for those populations where significant removals now occur.

7.2.7 MSY and status of stocks

There are no estimates of MSY. The only estimate of sustainable yield is that of 5% by Sergeant for West Hudson Bay (SC/31/SM 6), but that estimate is based on the assumption that the population has been stable, an assumption that may well not be justified (discussed above). Sergeant reports that he plans to re-examine the data and refine the analysis. The sub-committee believes that at this point there is no secure basis for recommending any specific level of take as sustainable.

The sub-committee notes that the reported or estimated kills expressed as percentage of population size (Table 1) range from very low levels, e.g., less than 1%, to over 50% in the case of the Barents Sea complex (SC/31/SM 13). Some of the estimated exploitation rates exceed the probable level of gross reproductive rate (about 10%).

The sub-committee is especially concerned about the Cumberland Sound summer population, which is exploited at as much as 23% per year, has declined and is expected to continue to decline (SC/31/SM 5 and SC/31/SM 16).

The estimated rate for the Barents Sea complex is almost certainly incorrect, even given the relative shortness of the history of increased exploitation reported in the catch statistics (SC/31/SM 13). Catches of white whales in Soviet waters have declined steadily since 1960 (SC/31/SM 13) for two reasons:

(1) decline in hunting efficiency due to very large year to year variation in catches and

(2) a declining market for white-whale products (SC/31/SM 13). Even given a population decline, the extremely high rates of exploitation implied by the available statistics and population estimates must be incorrect; it is probable that the population estimates are incomplete. The sub-committee notes this situation with some concern and emphasizes the great importance of obtaining full and accurate relevant data (see Recommendations to Scientific Committee).

The West Greenland winter stock may also be exploited at or above probable MSY level. However, Kapel pointed out that the population of white whales occurring in West Greenland apparently has been able to sustain a catch of the magnitude 500–1,000 animals per year since around 1860. Great year-to-year fluctuations and variation in the regional distribution of catches have occurred during this long period. (Kapel and Peterson in IWC, 1979 and Winge 1902, Anon 1944a and b (SC/31/SM 22)).

7.3 Narwhal

7.3.1 Definition of stocks

The sub-committee reviewed the available information on distribution, migration, and stock identity. As stock structure is presently understood, narwhals are divided into three separate stocks. These are the Davis Strait – Baffin Bay stock, the East Greenland – Spitzbergen stock, and a tentatively identified stock in Foxe Basin, Canada. Kapel suggests that there may be a discrete sub-division of the Davis Strait – Baffin Bay stock that summers in the Thule and Melville Bay region. Braham reported on seven sightings of narwhal off Point Barrow, Alaska; five in spring and two in fall; the stock affinity of these is unknown. The Davis Strait – Baffin Bay group winters in the pack ice between Disco Bay and eastern Hudson Strait (SC/31/SM 16). Migration northward in spring is poorly described but is believed to be along the Greenland coast to the Thule and Melville Bay areas and through the central pack ice into Lancaster Sound and various summering areas in the Canadian archipelago. The tentatively identified Foxe Basin group is believed to winter in Hudson Strait, possibly overlapping with the Davis Strait – Baffin Bay stock. This population summers in the Foxe Basin region (Mansfield, et al., 1975).

The East Greenland – Spitzbergen stock extends through the whole extent of the East Greenland pack ice north to northwest Spitzbergen (Reeves, 1979). It has long been known to occur along the East Greenland coast.

7.3.2 Age determination and estimates of vital rates

An adequate technique of age determination does not exist at present, but Kemper reported that research on age determination is underway in Canada. Sergeant (SC/31/SM 6) has the opinion that the life history parameters of

maturation rate and longevity may be similar to those of the white whale. The sub-committee believes that more research is needed to generate estimates of life history parameters for use in stock assessment. No estimates of vital rates were available to the sub-committee.

7.3.3. Estimates of net reproductive rates
No estimates have been made of net reproductive rates. Research on life history and reproductive rates is underway in Canada, including a field program of collection of life history samples (SC/31/ProgRep 3).

7.3.4. Estimates of population size
SC/31/SM 5 and 19 contain information on population size. Table 3 contains estimates from Davis (1978).

7.3.5 Catches
The available information on catches is presented in Table 3. The actual take in the Canadian Arctic may be greater than the reported take (SC/31/SM 9, SM 16 and SC/31/ProgRep 3).

7.3.6. Struck or killed-but-lost rates
Estimates of loss rates (Appendices 4 and 5) are comparable to those for white whales and are of equal concern to the sub-committee. In addition to the animals that are killed-but-lost, a higher proportion (42% of 48 animals) of the narwhals taken at the Pond Inlet ice-edge had old bullet scars (SC/31/SM 9). Kemper reports that research to reduce hunting losses has begun in Canada.

Minority opinion on loss rate, by Sergeant
The estimate of average loss rate for the Canadian Arctic of 52% in Table 3, based on one year's data from one area may be too high, because 1978 was a severe ice year (SC/31/SM 19) and loss rates for ice-edge hunts are higher than for open-water hunts (Table 2, Hay and Sergeant, 1976).

Table 2

Loss rates from narwhal floe edge hunt and coastal (open water) summer hunt, Pond Inlet

Number lost	Total	Percent lost	Where	Observers
11	16	69	Floe edge	Finley *et al.* (Doc 9) 1979
5	21	25	Open water	Finley *et al.* (Doc 9) 1979
7	46	15	Open water	Hay & Sergeant, 1976

More observations are clearly needed, especially on the ice-edge hunt and on the relative numbers of narwhals caught in the different types of hunt in the course of three to five seasons. This should not preclude speedy action to reduce loss rates.

7.3.7 MSY and status of stocks
No estimates exist of sustainable yield, and status relative to initial size could not be estimated for any of the three stocks based on the data available to the sub-committee. The sub-committee urges that the involved governments be requested to initiate the studies necessary to obtain data for assessment and management of the stocks.

8. REVIEW OF SMALL CETACEANS OF THE SOUTH ATLANTIC COAST OF SOUTH AMERICA

The documents reviewed by the sub-committee were SC/31/SM 1, 2, 3, 4, 23 and Prog Rep Argentina.

8.1 Distribution

Mermoz (SC/31/ProgRep Argentina) and Goodall and Polkinghorn (SC/31/SM 2) presented sightings from land observers in Tierra del Fuego and shipboard in the area from the Rio de la Plata to the Falkland Islands (Islas Malvinas), South Georgia and the Antarctic Peninsula. Brownell and Praderi (SC/31/SM 23) presented a historical review and new sighting data for Commerson's dolphin, *Cephalorhynchus commersonii*. Beach surveys (Goodall and Cameron, SC/31/SM 1) were made for observation and collection of stranded cetaceans.

New sightings of *Lagenorhynchus cruciger, L. obscurus* and *Globicephala melaena* were made within the ranges suggested by Brownell (1974, *Antar. Map Folio Ser.* 18: 13 – 19) and former reports (*Rep. int. Whal. Commn* 27: 507–20; L29). The following new data were noted.

Lagenorhynchus australis. Five significant offshore sightings were made of this normally coastal species.

Cephalorhynchus commersonii. The known coastal distribution was amplified by many sightings. Offshore sightings were made in the Drake Passage, NE of Burdwood Bank and south and east of Cape Horn. One sighting at Isla Desolacion, at the western end of the Strait of Magellan, is the most westerly record for the species.

C. eutropia. Thirteen records of this rare species were made in the Fuegian and Patagonian channels, Chile.

Lissodelphis peronii. This species is notable due to its absence; only one tentative sighting was reported.

Orcinus orca. This was a frequently recorded species, particularly near the Antarctic Peninsula and in the Beagle Channel, Tierra del Fuego.

Phocoena spinipinnis. Four sightings in inshore areas were reported, three of them from Tierra del Fuego. These are the first sightings south of the Strait of Magellan.

8.2 Definition of stocks

Knowledge of the small cetaceans of the Atlantic coast of South America is insufficient to determine stocks at present.

8.3 Directed take

Goodall (SC/31/SM 3) summarized information on recent and some historical directed takes. There have been occasional incidents of directed kill because of real or supposed competition with fish or for sport.

About 23 *Lagenorhynchus australis* were harpooned for *centolla* (southern king crab) bait in Tierra del Fuego, Argentina, in July – August 1978, but this has since been stopped.

Dolphins are harvested for *centolla* trap bait in Magallanes, Chile. *C. commersonii* and *L. australis* are utilized, in numbers estimated at 2350, from July – January 1976–77 and possibly a similar number taken in 1978–79. This take is now prohibited by Chilean law but enforcement in the vast inland channels which these species and the fishermen frequent is difficult.

8.4 Incidental take in fisheries

Pontoporia blainvillei is taken in a beach seining fishery in Brazil (Castello, pers comm) and about 250 are taken per

near in shark nets in Uruguay (Praderi, SC/31/SM 4). Specimens for study are collected in both cases.

Incidental takes in fisheries occur along the Argentine coast, but there is no information at present on numbers involved, although it seems fairly low.

Some *C. commersonii* are taken in nets for *centolla* and *robalo* in the Province of Santa Cruz, and by *robalo* nets in Tierra del Fuego (Goodall, SC/31/SM 3).

8.5 Population trends

The sub-committee expressed some concern about impact that recent exploitation may be having on small local populations of *C. commersonii* and *L. australis* in the Strait of Magellan region. Nothing is known about population trends along the Atlantic Coast of South America and more research is definitely needed.

8.6 Research programs

The present sighting program off the coast of southern South America and the Antarctic Peninsula will be continued and improved with assistance from the Argentine Navy and other agencies.

Research is under way at Rio Grande, Brazil; in Uruguay; in Buenos Aires and Peninsula Valdez, Argentina; and in Punta Arenas, Chile. All these programs are greatly hampered by lack of funds.

In Tierra del Fuego, Argentina, a field camp is planned at Bahia San Sebastian on the Atlantic coast due to the large number of strandings which occur there.

Training of local people to observe, collect and report cetacean observations and strandings will greatly improve local knowledge which is poor in all areas except Tierra del Fuego. There is a potential to expand these programs into Chile.

The OAS published a draft proposal of a 'Plan of Action for Marine Mammals', as a result of its meeting of experts in Puerto Madryn, Argentina, 12–16 September 1977. The priorities are research on endangered and poorly known species; specific research on *Phocoena spinipinnis, P. sinus* and *Pontoporia blainvillei;* sperm and Bryde's whales in the SE. Pacific; humpback whales in the E. tropical Pacific; and southern right whales. There is no information as to when this research will begin.

9. LIVE-CAPTURE FISHERIES

Argentina. Goodall (SC/31/SM 3) reported that in 1978 six Commerson's dolphins, *Cephalorhynchus commersonii,* were sent to Germany for display purposes, and four destined for Japan were confiscated by US authorities en route. Four more for Japan are authorized in 1979.

Mexico. Marcet Ocaña reported that during 1977, five to eight live bottlenose dolphins, *Tursiops,* were sent to the UK and in 1978, about 12 were sent to Switzerland and Germany for display and research. Dolphins are completely protected in Mexico.

South Africa. Two dusky dolphins, *Lagenorhynchus obscurus,* were caught in 1978 under permit for public display (SC/31/ProgRep 9). One died in transit, and the other died after 13 months in captivity.

Enactment of the MMPA in the US in 1977 led to live captures of several species in Mexico, but progress is being made in controlling these captures.

10. RECOMMENDATIONS TO THE SCIENTIFIC COMMITTEE

10.1 Concerning white whales and narwhals

(1) The sub-committee recommends that because the Cumberland Sound summering population of white whales has declined to an unknown but likely small fraction of its initial size, and because annual takes in recent years have amounted to as much as 23% (in 1977) of the population, a level almost certainly higher than even gross reproductive rate, the stock be classified as a Protection Stock and a catch limit of zero placed on it. The sub-committee further recommends that current research on the Cumberland Sound stock of white whales be continued and expanded. The research should include regular censuses of the summering population and estimates of gross recruitment. The inter-relationships of Cumberland Sound and Hudson Strait stocks should be examined. Full data on age, sex, size and reproductive status should be obtained from the catch, should there be one.

(2) The sub-committee is concerned about reports of very large catches of white whales in Canada along the Quebec coast of Hudson Strait and the northeast coast of Hudson Bay and the fact that no estimates of the size of the populations involved have ever been made. The sub-committee strongly recommends that Canada be requested to initiate research to determine the identity and size of the population(s) involved in this catch and to determine whether these populations are distinct from those in W. Hudson Bay.

(3) The sub-committee noted that the white whales that winter along the coast of West Greenland migrate to summering areas in the central Canadian High Arctic and in the Melville Bay-Thule areas of Greenland. Although catches in Greenland have been of the level of 400–1,500 animals annually for over 100 years and no population estimate is available for the latter summering groups, the sub-committee believes it highly probable that current levels of removals are higher than MSY for the overall population. The sub-committee recommends that these groups, which winter in west Greenland waters, be provisionally managed as one stock and that Canada and Denmark (Greenland) be urged to initiate a joint research program on this stock. Of particular importance is an accurate census of the numbers of white whales summering in Melville Bay – Thule District and Canadian and Greenland waters of Smith Sound and Kane Basin and analysis of inter-relationships among these and other summer populations. The program should also include more accurate determination of the killed-but-lost rates associated with the various types of hunts in Greenland and Canada.

(4) The sub-committee believes the catch levels for white whales that inhabit the Barents, White, Kara and Laptev Seas are substantially above even annual gross production or that the present population estimates are incomplete. The sub-committee, therefore, recommends that the USSR be requested to provide all available data to the next Scientific Committee Meeting. The analysis of these data should include a study of the components of the Barents Sea wintering group and an assessment of the stock or stocks involved.

(5) The main wintering grounds and composition of the Bering Sea group of white whales are largely unknown, and sizes and inter-relationships of the summering groups

are also poorly known, including those in Soviet waters. Although present removals from these groups may be sustainable, it is probable that harvests will increase as indigenous populations increase or alternative subsistence needs arise. For example, the white whale is one alternative to the bowhead. The sub-committee therefore recommends that national research programs be expanded and that a co-operative research program be instituted by the USA, USSR and Canada. These programs should begin soon and should include documentation of catch statistics, loss rates and characteristics of the hunt and collection of biological samples for determination of vital parameters. The temporal and spatial components of the populations should be determined, the populations censused and the inter-relationships among them identified.

(6) The sub-committee believes that management of the aboriginal/subsistence fisheries for white whales and narwhals should be considered by the Commission in the same manner as in the bowhead fishery in the Bering Sea and Arctic Ocean. White whales of some stocks and narwhals on the one hand and bowhead whales on the other both undergo long migrations, crossing national territorial boundaries. Both are taken by indigenous peoples using light craft and harpoons, with various modifications derived from modern technology. Whaling efforts for the two are interrelated, and scientific analysis of catch data should take this multispecies aspect of aboriginal whaling into consideration. Elements of modern cash economy have arisen in some regions and have modified value and use of carcasses of both bowheads and the smaller whales. The only substantive differences between the fisheries are in size of the whales and size of and organisation of the whaling crews involved, differences not justifying the radically different treatment presently given them. The sub-committee recommends that the Scientific Committee recommends to the Commission that the white whale (*Delphinapterus leucas*) and the narwhal (*Monodon monoceros*) be defined as 'whales' and listed in Paragraph 1 of the Schedule thus:

"white whale" (*Delphinapterus leucas*) means any whale known as white whale, beluga, belukha

"narwhal" (*Monodon monoceros*) means any whale known as narwhal, sea unicorn

so that the appropriate management procedures may be discussed and implemented in the future.

10.2. Other recommendations

(7) The sub-committee recommends that the research programme recommended for the northern bottlenose whale in 1977–78 be carried out and that the stock continue to be classified a Protection Stock with a zero catch.

(8) Noting that no stock assessment is possible with data in hand for the population of killer whales subject to small-type whaling in Norwegian waters, the sub-committee urges that Norway be requested to produce the necessary data on stock assessment at the 1980 meeting of the Scientific Committee. Pending availability of results of such assessment, the sub-committee recommends that Norway be requested to limit its catch in 1980 to not more than 52 whales, the average annual Norwegian coastal take over the 10 year period 1969–78.

(9) The sub-committee noted that the USSR is engaged in whaling for killer whales in the Antarctic. Because stock assessment has not been carried out for the stock(s) being fished, the sub-committee recommends that the USSR be requested to provide for the 1980 meeting of the Scientific Committee the data necessary for such an assessment, including any available data on sightings, sighting effort, sex, length, age, weight, reproductive condition and date and locality of capture of the killer whales taken since commencement of the Antarctic fishery for killer whales. The sub-committee further recommends that, pending the availability of the results of the stock assessment analyses, the USSR be urged to limit its take of Antarctic killer whales during the 1979–80 season to not more than 24 whales, the average annual take over the 10 year period 1969–78.

(10) The sub-committee notes the absence or incompleteness of statistics on the take in many fisheries, and recommends that more complete data be requested from member nations for:

(a) The Canadian white whale harvest, including statistics on fisheries in Quebec, Manitoba and Ontario.
(b) Takes of cetaceans incidental to net fisheries for tuna in the eastern tropical Pacific by Mexico, Panama, New Zealand and Peru as soon as possible.
(c) Takes of harbour porpoises in Passamaquoddy Bay by Canada and the USA and incidental takes in Eastern Canada.
(d) All catches, with reference to the completeness of the statistics, in particular to insure that the following minimum data are collected (as recommended in Scientific Committee Report, *Rep. int. Whal. Commn* 27: 31; and Resolution, Appendix 6, *Rep. int. Whal. Commn* 28: 30):
    (i) Species name, and local vernacular name where available
    (ii) Numbers caught
    (iii) Location of catch
    (iv) Biological data wherever it is possible to collect them
    (v) An appropriate indication of the intensity of catching effort and of the primary species caught, to which the sub-committee would add
    (vi) Day, month and year of capture.

These minimum data are also requested from nations that have recently joined the IWC.

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Appendix 1

AGENDA

1. Participants, agenda, and introductory remarks.
2. Review of documents submitted.
3. Review of management actions and research on northern bottlenose whale, striped dolphin, Dall's porpoise and harbour porpoise.
4. Other directed catches of small cetaceans.
5. Problems of interactions between fisheries and small cetaceans.
   - 5.1 Incidental takes.
   - 5.2 Direct conflicts and competition.
6. Effects of pollution and industrial development.
7. Review of definition and status of stocks of the white whale, *Delphinapterus leucas*, and the narwhal, *Monodon monoceros*.
   - 7.1 Increasing importance of the fisheries.
   - 7.2 White whale.
     - 7.21 Definition of stocks and trans-national boundary migrations.
     - 7.2.2 Age determination and estimates of vital rates.
     - 7.2.3 Estimates of net reproductive rates.
     - 7.2.4 Estimates of population sizes.
     - 7.2.5 Commercial and subsistence takes.
     - 7.2.6 Hunting loss rates.
     - 7.2.7 MSY and status of stocks.
   - 7.3 Narwhal.
     - 7.3.1 Definition of stocks.
     - 7.3.2 Age determination and estimates of vital rates.
     - 7.3.3 Estimates of net reproductive rates.
     - 7.3.4 Estimates of population sizes.
     - 7.3.5 Catches.
     - 7.3.6 Hunting loss rates.
     - 7.3.7 MSY and status of stocks.
8. Review of small cetaceans of the South Atlantic coast of South America.
   - 8.1 Distribution.
   - 8.2 Definition of stocks.
   - 8.3 Directed take.
   - 8.4 Incidental take in fisheries.
   - 8.5 Population trends.
   - 8.6 Research programs.
9. Live-capture fisheries.
10. Recommendations to the Scientific Committee.

Appendix 2

SUMMARY OF ACTIONS ON SMALL CETACEANS IN THE IWC, 1976–78

Year	Level	Mandate for management	Management n. bottlenose whale	Research on 4 spp. (n. bottlenose whale, striped dolphin, Dall's porpoise and harbour porpoise)
1976	Sub-comm.	Pointed out need for coverage of *all* takes, but recommend provisional coverage of directed take	Pointed out need for management action	Recommended
	Sci. Comm.	Referred to Commission	Proposed to discuss in 1977	Accepted
	Commission	Proposed to consider *all* takes in scientific forum and assumed provisional responsibility to manage directed takes (at least, to consider in Sci. Comm.)	Stated that should be considered for immediate action by Scientific Committee	Accepted
1977	Sub-comm.	Acknowledged responsibility to consider directed takes	Referred to full Scientific Committee	Not reported; again recommended
	Sci. Comm.	'Small-type whaling' redefined	Recommended zero catch limit	Strongly urged
	Commission	Accepted new definition of 'small-type whaling' and responsibility to manage, and *Resolved* to urge members to collect statistics on all small cetacean takes	Approved zero catch limit	Noted that Norway plans research
1978	Sub-comm.	Again pointed out need for international coverage of *all* cetacean takes in management	Recommended continued protection	Again recommended
	Sci. Comm.	Agreed	Agreed	Agreed
	Commission	Agreed; is urgent	Approved zero catch limit	Agreed

Appendix 3

LANDED CATCH OF WHITE WHALES IN NORTHERN QUEBEC AND LABRADOR IN 1975[1]

Area	Community	Catch
E. coast of Hudson Bay[2]	Great Whale River	26
	Inukjuaq	97
	Akudlivik	5
S. coast of Hudson strait	Sugluq	122
	Wakeham Bay	162
	Koartak	31
	Port Burwell, N.W.T.	8
Ungava Bay	Payne Bay	43
	Leaf Bay	7
	Fort Chimo	53
	George River	19
	Total	573[3]

1. From: Anonymous 1976. Research to establish present levels of harvesting by native peoples of northern Quebec. James Bay and Northern Quebec Native Harvesting Research Committee. Processed Rep. 230 pp.
2. Excludes community of Povungnituk which did not participate in the study.
3. Except for Port Burwell, the landed catch from these communities have not been reported to the IWC by Canada.

Appendix 4

AVERAGE REPORTED CATCH OF NARWHAL AND WHITE WHALE IN WEST GREENLAND

Including Estimates for Killed-but-lost Rates in Various Hunting Periods and Situations

	West Greenland South of Thule			Thule District		
Period	Average catch[1]	Estimated total removals[2]	Calculated loss rate %	Estimated catch[1]	Estimated loss rate[2] %	Estimated total removals
White Whale						
1967–70	1,023	1,265	19	~100	<10	50–200
1971–74	882	1,027	14	(50–200)		
Narwhal						
1967–70	285	376	24	~200	<5	100–300
1971–74	159	192	17	(100–300)		

[1] Catch data from Kapel, 1977; and Kapel and Petersen in IWC, 1979.

[2] Estimated total loss rates were calculated by apportioning the percent of the landed catch taken in various seasons (and therefore, hunting situations) as follows:

winter–spring hunts:	1 lost per 4 landed.
Savssats (winter):	1 lost per 2 landed.
open water (summer):	1 lost per 10 landed.
Thule summer hunt:	(narwhal) — 1 lost per 20 landed.
	(white whale) — 1 lost per 10 landed.

Catch statistics for NW., CW. and SW. considered separately; Thule hunt as above. Note that the *Savssats* may make up a large proportion of the catch in some years, thereby shifting the killed-but-lost percentage since *Savssats* are assumed to have 50 percent loss rate. *Savssats* occurred more frequently in the 1967–70 period than in 1971–74.

Appendix 5

ESTIMATED LOSS RATES (KILLED-BUT-LOST) IN WHITE WHALE HUNTS IN NORTH AMERICA

Location	Hunting method	Estimated loss ratio	References and notes
Cook Inlet, Alaska	Unknown	Low	Braham
Bristol Bay, Alaska	Unknown	Unknown	
Norton Sd St Lawrence Island Alaska	Boat, rifle and harpoon	<2/1 taken	Braham, via Eskimo whalers, Gambell 1, Alaska
Kotzebue, Alaska	Boat, rifle and harpoon	,,	Braham, via Eskimo whalers, Kotzebue, Alaska
NW coast of Alaska	Ice edge, rifle, boat	<5/1 taken	Braham, pers. obs., SC/31/SM 8
Mackenzie Delta, Canada	Boat, rifle, grapple, silty water	<1/2 taken	SC/31/SM 8
Eastern Canadian Arctic	Boat, rifle (some with harpoon), silty water (some cases)	,,	Extrapolated from SC/31/SM 8

Appendix 6

CATCH STATISTICS SYSTEM AND RESEARCH PLAN ON SMALL CETACEANS IN JAPAN

1. Regular catch statistic system

'Annual report of catch statistics on the fisheries and agriculture' edited by the Department of Statistics, Ministry of Agriculture, Forestry and Fisheries provides 'number of small cetaceans caught' by area (prefecture), but all species are combined. Sizes of catch from 1971 through 1977 are included in Table 2 of the Japan Progress Report.

2. Collection of supplemental information on small cetaceans by Fishery Agency

This will appear at irregular intervals.

The statistics provide information for relevant years on 'number of small cetaceans caught' by (1) prefecture, (2) species and (3) type of fishing gear, with some information about the fisheries concerned. The first work started last year, and the materials are now being examined and compiled.

3. Research plans

(1) The Fisheries Agency plans to develop techniques to prevent damage to fisheries such as the Iki Island fishery (planned for 1978–80 at the Fisheries Technology Laboratory and at Takai University). The plan includes a research project for controlling the behaviour of dolphins by means of broadcast of audible high-frequency sound.

(2) Project is planned for observation of behaviour and collection of biological materials (1980–82, Far Seas Fisheries Lab.). For the project, two areas have been selected in which to concentrate the observation effort:

(1) an area off the east coast of northern Honshu dominated by a cold current;
(2) an area around Iki and Tsushima Islands dominated by a warm current.

Annex J

WHALE MARKING – PROGRESS REPORT 1979

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Information on the progress of whale marking is available in the following Progress Reports:– Australia, Canada, Iceland, Japan, New Zealand, Norway, South Africa, USA, USSR. Recent marking is also referred to in SC/31 Docs 10, 11, 24, 25 and 30; Doc 25 being a Report on the Southern Hemisphere Minke Whale Assessment Cruise 1978/79.

A total of 1,228 large whales was marked in the Southern Hemisphere during the Antarctic season 1978/79 and in 1978 and 1979. This total includes whales marked in the two IDCR Marking Cruises, and comprises 16 blue, 37 fin, 25 sei, 82 Bryde's, 9 humpback, 800 minke, 5 southern right and 254 sperm whales, all marked with Discovery-Type marks (Table 1).

In the North Atlantic 194 whales were marked in 1978 and 1979; 24 fin, 2 humpback, 162 minke and 6 sperm whales. One of the humpbacks and 14 of the minke whales were marked with Visual Streamer Marks.

In the North Pacific 203 whales were marked in 1978 and 1979; 4 blue, 11 fin, 27 sei, 52 Bryde's, 5 humpback, 6 minke, 29 gray and 69 sperm whales. Two of the fin whales and 3 of the humpback whales were marked with radio tags in Alaskan waters. The 29 gray whales were marked with colour coded visual tags.

One killer whale was marked by the USSR in the Antarctic in the 1978/79 season.

Recoveries of Discovery-Type marks so far reported for the 1978 season are from 4 minke whales in the North Atlantic, and from 1 Bryde's whale 1 sperm whale in the North Pacific. In the Southern Hemisphere marks are reported from 5 minke whales marked in the IDCR programme.

Proposed marking programmes

A number of marking programmes were recommended in the sub-committee reports presented to the Scientific Committee. These were reviewed, approved and given priorities by the committee. In Table 2 they are listed in order of priority with the estimated number of marks and marking guns required for each programme, and their estimated costs.

At 1 June there were in stock, or on order, the following quantities of marks:

	In stock	On order
12 Bore Standard	150	1200
12 Bore Increased Charge	225	200
.410 Standard	1300	—

Outstanding payments for marks previously received and those on order can be covered by funds available from the 1978/79 IWC, IDCR and SMRU contributions to whale marking, but no funds are available for the shipment of any of the marks at present in stock or on order. Any additional orders to provide marks and marking guns for programmes which cannot be met from the marks already available, will have to be paid for by the IWC contribution to whale marking for 1979/80 (it was £4,000 in 1978/79) and by additional contributions, reserved for whale marking, made to the Research Fund.