# Annex H

# Report of the Sub-Committee on Small Cetaceans

## 1. PARTICIPANTS, AGENDA AND INTRODUCTORY REMARKS

The meeting was chaired and the report edited by Perrin. Members (M) of the Scientific Committee of the IWC, invited experts (E), and observers (O) attending were:

Allen, R. (E), Anderson (M), van Beek (M), Berney (O), Best (M), Braham (M), Brodie (M), Brownell (M), Carr (M), Chen (E), Gordon-Clarke (O), Ikeda (M), Ivashin (M), Jordan (O), Klinowska (M), Kapel (M), Kato (M), Mitchell (M), Ohsumi (M), Øritsland (M), Rudge (M), Sharov (M), Spong (O), Terekhin (M) and Yoshinari (M).

Some participants did not attend all sessions of the meeting.

The draft agenda was discussed and approved with minor emendations (Appendix 1).

Klinowska, Braham, Allen, Anderson, Brownell and Øritsland acted as rapporteurs and chaired sub-groups.

## 2. DOCUMENTATION

Documents available to the sub-committee and containing information on small cetaceans were SC/32 ProgReps Australia, Canada, Denmark (Greenland), Japan, Norway, Seychelles, South Africa, UK, USSR and US; SC/32/SM 1–18; SC/32/O 1–3, 5, 9–11, 14 and 16; and issues LXXXIII and LXXIV and the provisional issue LXXXV 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** Beginning in 1976, the sub-committee, the Scientific Committee and the Commission have urged that member nations initiate research on the substantial directed fisheries involving these species (recommendations for research outlined in *Rep. int. Whal. Commn* 27: 481). In one case, that of the bottlenose whale, a management action was recommended and implemented.

### 3.2 New information

*3.2.1 Northern bottlenose whale, North Atlantic*

Twenty-six bottlenose whales were seen in the northwest Atlantic and 32 in the central east Atlantic during a sea mammal sighting programme carried out on Soviet research cruises (SC/32/O 2). No other new data are available.

This species was provisionally listed as a Protection Stock for the entire North Atlantic in 1978, pending the accumulation of sufficient information and a thorough analysis of its status. It is noted that the bottlenose research programme recommended in 1977 in order to obtain independent stock estimates from special sighting cruises and research catches has still not been carried out. The Norwegian fishery for bottlenose whales ceased in 1972, and no new data are available on stocks.

*3.2.2 Striped dolphin, Northwest Pacific*

Directed fisheries for this species continue in Japan. Statistics presented in SC/32/ProgRep Japan show that in 1979 2,193 were taken in drive-in fisheries and 19 incidentally in fishing gear.

Kasuya (1976) estimated total population size in 1974 at 186–202,000, less than 50% of estimated original population of more than 404,000. He estimated MSY at 4,140–6,530 and sustainable yield in 1974 at 4,120–6,140. The take in 1974 was approximately 13,000. Kasuya's estimates were based on assumptions and models that need further examination. No stock assessment has been carried out subsequent to his analyses, although Miyazaki (1977) has developed new estimates of life-history parameters that very probably would change the outcome of such a re-assessment.

Although extensive biological and population studies have been carried out, several specific research needs identified in 1976 still remain (*Rep. int. Whal. Commn* 27: 481). These include collection of detailed effort statistics; tagging and census studies to obtain information on school structure, migration and definition of stocks; and monitoring life history parameters.

While catch statistics (by species and port only) were available this year for the first time, results of other components of the research programme announced last year (Appendix 6 to Annex I, *Rep. int. Whal. Commn* 30: 128) were not yet available to the sub-committee. Ohsumi reported that it has not yet been possible to fully implement the research plan announced last year; efforts to do so continue. The sub-committee re-emphasizes the need for this research.

*3.2.3 Dall's porpoise, North Pacific*

Populations of this species are subject to both direct and incidental take in the North Pacific. A 3-year joint programme of research by the US and Japan is in its third year, and analyses of data and specimens collected from incidental takes by Japanese salmon gillnetters and research vessels will be completed in June, 1981 (SC/32/SM8).

Incidental take in the salmon fisheries (including by research vessels) was 829 in 1978 and the same in 1979 (SC/32/SM9); the 1980 season is underway. Preliminary estimates of abundance in the Bering Sea, west-central North Pacific and Gulf of Alaska (approximately 3 million square miles), using a strip-transect model, range from about 0.8 million to about 1.8 million Ohsumi reported

that Japan also presented an estimate of over 5 million at a recent meeting of the International North Pacific Fisheries Commission (INPFC). If the lowest of these estimates is of the correct order of magnitude and if it be assumed that a single interbreeding population inhabits the area surveyed, it seems likely that the incidental take alone will not have a measurable effect on abundance. The sub-committee, however, recognizes that more than one population may well be involved and believes that considerable research effort should be focused on the questions of possible geographical variation in morphology and of patterns of distribution and migration.

Dall's porpoise are also taken in directed fisheries in Japan. A programme of collection of detailed catch information begun last year (Appendix 6 to Annex I, *Rep. int. Whal. Commn* 30: 128) has yielded statistics for several types of fisheries (SC/32/ProgRep Japan). A total of 6,878 were taken in 1979. Kasuya (1975) estimated that a sustainable yield of 6,000 would require a population of 125–400,000, assuming natural mortality rate (M) of 0.050–0.075 and calving interval of three years. The size and status of the stock(s) are unknown. Data adequate for stock assessments were not available to the sub-committee.

*3.2.4 Harbour porpoise, North Atlantic*

This species is taken in directed fisheries and incidentally in gillnets in small numbers (SC/32/O 5). As was the case at the last meeting of the sub-committee (Annex I, *Rep. int. Whal. Commn* 30: 112) no estimates of take in the aboriginal fisheries in the Bay of Fundy and Grand Manan Island regions (US and Canada) were available to the sub-committee. The directed take in Greenland in 1979 was estimated at 900, (SC/32/ProgRep Denmark) up from 750 in 1978 but about the same as in 1977 (*Rep. int. Whal. Commn* 29: 115). The sub-committee continues to be concerned about the possible effects of this take in a restricted area, from a coastal population of unknown size and status. Some members of the sub-committee felt that the long-sustained catch (over the last 40 years) indicates that the stock has not been adversely affected. All the members of the sub-committee agreed, however, that the data necessary for a stock assessment are not available.

## 4. OTHER DIRECTED FISHERIES ON SMALL CETACEANS

### 4.1 Killer whale

*4.1.1 Antarctica*

In the 1979/80 Antarctic season the Soviet Union took 916 killer whales, which was a substantial increase over previous catches. The Soviet Union's effort in Antarctica is primarily directed at minke whales, and from 1954 to 1979 the average annual Antarctic catch of killer whales was only 28. At the 1979 meeting, the Scientific Committee recommended that the USSR be urged by the Commission to take no more than 24 killer whales from Antarctica in 1979/80. The Commission did not follow the recommendation.

*4.1.1.1 Identity and status of stock (s)*

There is an increasing amount of evidence for a complicated stock structure of killer whales, perhaps even down to the level of some genetic isolation among pods (SC/32/SM9). Two stock structures of Antarctic killer whales were suggested in SC/32/SM12: firstly, a division into six stocks on the basis of winter migrations to the east and west coasts of South America, Africa, and Australia; and secondly, on the basis of length composition of mature females, existence of a small form found most commonly in the Amundsen sea. Also, data on length frequencies are suggestive of a real difference (4.1.1.1.5 below), and Ivashin reported that recent studies of colour patterns have shown population differences in the Southern Hemisphere.

There is insufficient evidence on which to base geographical stock boundaries which would be of long-term use for assessments. The migration model does not give any indication of suitable boundaries in the Antarctic, where most exploitation takes place; and although a boundary of 120°W to 60°W might be inferred from SC/32/SM2 for the proposed smaller form there was no kill in this area in 1979 (SC/32/SM 9), nor are any data for stock assessment available. Thus the sub-committee is obliged to treat the Antarctic killer whales provisionally as if they are a single stock but to take the probable existence of more than one stock into account when proposing management measures.

*4.1.1.2 Abundance*

For Antarctic waters there are sightings data for the 1979/80 season (SC/32/ProgRep USSR) giving a sighting rate of 13.9 killer whales/CDW. This is about one third of the sighting rate observed during the same expedition for minke whales. However, without other information it is difficult to make abundance estimates using this type of data.

During the 1978/79 and 1979/80 IDCR southern minke whale assessment cruises, killer whale sightings data suitable for line-transect analysis were collected and have been analysed (SC/32/SM10). This analysis gives a population estimate in baleen Areas III and IV of 27,500, with a standard error of 6,038. In Appendix I an alternative analysis of the data by Allen is given which gives an estimate of 61,200. This population estimate was made for the areas shown in Fig. 1 and does not include animals known to be north of the surveyed area or those that may be in the pack ice to the south. Furthermore the estimate may be biased downwards, because all whales on the track line of the vessel may not be seen. The sub-committee accepted this estimate, with a 95% confidence interval of 30,600–81,800.

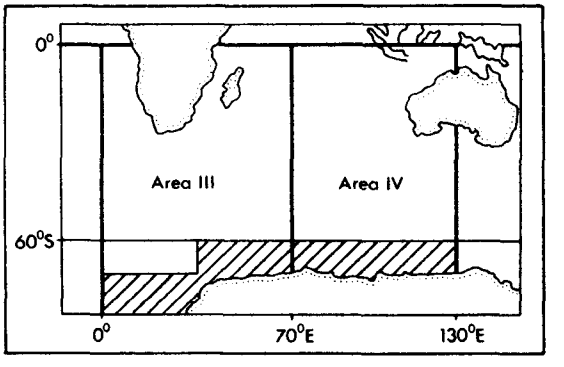


Fig. 1. Area included (shaded) in estimation of abundance of Antarctic killer whales.

*4.1.1.3 Gross reproduction rates*

SC/32/SM9 quotes estimates of reproductive rates of 'adult' (presumably sexually mature) females from the coastal waters of British Columbia of between 11.6–13.3%, and estimates of pregnancy rates of females taken by the Norwegian whaling fleet prior to 1976 of 13.3%. A gestation period of 12–16 months is reported from several authors, which implies a reproductive rate for adult females between 10 and 13%. Assuming that the proportion of reproductively active females in the population is 40% (SC/32/SM9) these data give gross reproductive rates for the population of between 4 and 5%.

Additional data in the form of proportions of females which are pregnant are now available from Antarctic whaling operations. These together with the assumptions of gestation period and the proportion of adult females are used to make additional estimates shown in the table below.

| Source | | Number of adult females | Number of pregnant females | Population gross reproductive rate |
|---|---|---|---|---|
| Antarctic | SC/32/SM12 | 91 | 25 | 8–11% |
| Antarctic 1979–80 | SC/32/ProgRep USSR | 333 | 141 | 13–17% |

These rates are considerably higher than those reported in SC/32/SM9 and, if correct, would require very short reproductive cycles. In SC/32/SM10 there are data showing 51 calves (7–12 ft long) in a total of 785 animals which corresponds to a calf ratio of 6%. It is possible that some of these calves were older than one year, and that they had already been slightly reduced in number of mortality. Nevertheless, the sub-committee agreed that this rate was likely closer to the gross reproductive rate than the rates deduced from the samples of adult females which may not be representative of the population. The sub-committee concluded that the gross reproductive rate is likely to be in the range of 4–7%.

*4.1.1.4 Natural mortality rate*

Unfortunately the killer whales harvested in recent years have not been aged and there is no information from this source about natural mortality.

*4.1.1.5 Catch composition*

The length and sex compositions of the recent killer whale catches in Antarctic are given in Table 1.

These data show that sexes are represented evenly and with the exception of small (less than 14 ft) animals they appear to be spread over all sizes. There is a marked difference between males and females. The distributions can be compared with values quoted in SC/32/SM9: weaning at 14 ft, female sexual maturity at 16 ft, and male maturity at 22 ft. SC/32/SM12 gives a minimum length of maturity for females of 18 ft for animals thought to belong to a small form and states that size of female maturity of other killer whales was at a greater size. A figure of 21 ft was given for maturity of males in Antarctica.

Length frequencies for Antarctic catches by baleen Area are given in IWS (prov. LXXXV). These data also show clear differences among Areas III, IV and V and could either indicate stock differences or be sampling artifacts. Ivashin stated that he will endeavour to find out if the catches could have been selective.

*4.1.1.6 Stock assessment*

Because of the lack of estimates of natural mortality rates and the probable existence of several stocks that cannot at this time be defined, the sub-committee was unable to assess status of the stocks or deduce maximum net reproductive rates.

*4.1.2 Norway*

During 1979, Norway took 221 killer whales in Norwegian coastal waters. At its last meeting the Scientific Committee recommended that Norway limit its 1980 catch to 54 killer whales. The Commission did not follow the recommendation, but Norway did set a national catch limit of 54 for 1980. The number was taken in January this year, after which no more whaling for killer whales was permitted.

*4.1.2.1 Stock identity*

There is no information available about the stock structure of the killer whales in the North Atlantic.

*4.1.2.2 Abundance*

There were no data available to the sub-committee for making estimates of stock size(s).

*4.1.2.3 Gross reproduction rates*

In SC/32/SM14 there are data giving proportions of pregnant females in Norwegian catches. The table below is calculated using only females of 16 ft or larger and the same assumptions about gestation period and proportion of adult females in the stock as were used for the Antarctic killer whales.

| Source | Number of adult females | Number of pregnant females | Population gross reproductive rate |
|---|---|---|---|
| Norway 1978 SC/32/SM14 | 29 | 18 | 19–25% |
| Norway 1979 SC/32/SM14 | 104 | 32 | 9–12% |

The same reservations, mentioned for Antarctic killer whales above, were expressed about these apparently high reproductive rates by the sub-committee, which concluded that a range of 4–7% is more realistic.

*4.1.2.4 Natural mortality*

No estimate of natural mortality is available.

*4.1.2.5 Catch composition*

Table 1 shows length and sex composition for Norwegian catches in 1978 and 1979.

*4.1.2.6 Stock assessment*

No abundance estimate of the killer whales in Norwegian waters is available, and consequently stock assessment is not possible.

*4.1.3 Research needs*

At the 31st meeting the Scientific Committee recommended that the Commission request that Norway and USSR produce information necessary for an assessment of the killer whale stocks being exploited by their whalers.

In response to this request both countries supplied data on catches, including length and sex composition and information on whether or not females were pregnant. In addition the Soviet Union provided sightings data and detailed catch rates. Unfortunately these data can only be used for making estimates of population size when information for several years is available. The information that is still necessary before an adequate stock assessment can be made are estimates of abundance and natural mortality. The recent IDCR minke whale cruises have provided data for population estimates in part of Antarctica, and the sub-committee believes that this type of survey should be conducted for further stock assessment of exploited killer whales. The most direct means of obtaining natural mortality rates would be by ageing animals caught, and, as samples of teeth are taken, the sub-committee believes that reading these teeth is the first step in developing natural mortality estimates.

The stock structure, particularly in Antarctica, where there is some evidence for the existence of several stocks, is also an important issue. The sub-committee believes it is important that the issue of stocks should be addressed by the Soviet Union, and, until it is, all data should be reported by subareas of the Antarctic, such as areas bounded by 10° of longitude.

The Norwegian exploitation of killer whales is partly directed at reducing the predation of killer whales on herring stocks. To date there have been no papers presented to the Scientific Committee either documenting this predation or estimating its effect on the herring stocks. The sub-committee believes that Norwegian scientists should report on this at its next meeting.

It is possible that the Norwegian killer whales have been exploited at a relatively greater level than the Antarctic killer whales, and thus that comparison of reproductive rates may yield some information on the maximum net reproductive rates. The sub-committee believes it is very important to estimate reproductive rates from both areas.

The sub-committee recognises that valuable work on the social structure of killer whale groups is being carried out on the west coast of North America and in Argentina. The sub-committee supports this work and hopes that Canada and the United States will report on it at the next meeting.

The recent ICDR minke whale cruises have provided the first data which could be used to make a partial estimate of killer whale stock sizes in Antarctica. The sub-committee welcomes this type of research and believes that further cruises which collect line-transect data should be encouraged both in the unsurveyed areas of Antarctica and of the northeastern Atlantic.

### 4.2 White whale and narwhal

Investigation of the life history and status of these species is an important management problem, principally for several reasons described in last year's report.

#### *4.2.1 White whale*

##### *4.2.1.1 Distribution, migration, definition of stocks and abundance*

Following the conceptual model proposed by Perrin in 1979 (Fig. 2, *Rep. int. Whal. Commn* 30: 118) the sub-committee further evaluated the question of stock discreteness by reviewing the available information on geographical areas.

(1) *The Bering – Chukchi – Mackenzie stock(s) and the Cook Inlet stock.* A review of papers indicate that white whales in the Bering Sea move north along the west coast

Table 1

Length frequency of killer whales (SC/32/SM14, SC/32/SM12 and SC/32/ProgRep USSR)

| | Norway 1978 | | Norway 1979 | | Antarctic 1961–78 | | Antarctic 1979/80 | |
|---|---|---|---|---|---|---|---|---|
| ft | F | M | F | M | F | M | F | M |
| 8 | | 1 | | 1 | | | | |
| 9 | | | | | | | | |
| 10 | 1 | 1 | | 1 | | | 1 | |
| 11 | | | | | | | | |
| 12 | 1 | | 3 | 1 | | | 1 | |
| 13 | | | | | | | 3 | 1 |
| 14 | | 2 | 3 | 1 | | | 6 | 1 |
| 15 | | 1 | 8 | 1 | | | 9 | 4 |
| 16 | 5 | 2 | 15 | 5 | | | 25 | 6 |
| 17 | 7 | 1 | 28* | 15 | 4 | 2 | 67 | 6 |
| 18 | 8* | 5 | 18 | 18 | 10 | 7 | 45 | 14 |
| 19 | 5 | 4* | 13 | 18* | 11 | 10 | 60 | 39 |
| 20 | 2 | 5 | 14 | 11 | 20 | 21 | 82* | 32 |
| 21 | | 3 | 3 | 6 | 19* | 17 | 86 | 52 |
| 22 | | 4 | 2 | 10 | 26 | 14 | 55 | 69* |
| 23 | 2 | 1 | | 4 | 18 | 27 | 16 | 71 |
| 24 | | | | 1 | 5 | 31* | 2 | 45 |
| 25 | | | | | 3 | 33 | 1 | 39 |
| 26 | | | | | | 24 | | 23 |
| 27 | | | | | | 13 | | 9 |
| 28 | | | | | | 5 | | 14 |
| 29 | | | | | | 1 | | 21 |
| 30 | | | | | | | | 1 |
| | 31 | 30 | 107 | 94 | 118 | 205 | 459 | 447 |

* Indicates median length.

of Alaska and east coast of the USSR from April through early summer (SC/32/SM13 and 18). On the USSR and US sides, summer resident white whales are common but not abundant along the coast. The winter distribution of this population is thought to be in the central and south-central Bering Sea loose pack ice and along the Soviet coast except for those animals remaining in Bristol Bay and resident in Cook Inlet, Alaska. The sub-committee urges that studies be directed at providing information on stock discreteness.

(2) *Far – North white whales of the Barents, Kara, White and Okhotsk Seas.* Two documents provided new information on Soviet white whale populations. From analysis of morphological data on white whales from the Far North, Ognetov (SC/32/SM1) concluded that animals inhabiting the White and Kara Seas are related, suggesting that they are one stock.

The number of white whales in the Sea of Okhotsk apparently suffered a large decline up to 1963, but no specific data or cause were described (SC/32/SM4). From a census conducted in July 1970, this population was estimated at 10,000–18,000 animals, although only 1,300 were actually seen. A survey in August 1979 of the same area resulted in only 160 sightings. Berzin (SC/32/SM4) speculated that the whales were further offshore, resulting in a lower count. Given the behaviour of summering white whales in other areas (i.e. generally coastal), the recent surveys suggest that the population may be further depleted. Population assessment studies are strongly urged.

(3) *The Davis Strait – Baffin Bay stock, Cumberland Sound stock, Gulf of St Lawrence stock and Hudson Bay stock(s).* There is no conclusive evidence to suggest that the Davis Strait and Baffin Bay white whale populations are separated into more than one stock, except perhaps for the West Hudson Bay group(s) (SC/32/O 16). Some mixing with adjacent groups for the Lancaster Sound, West Greenland, Hudson Bay/Strait and Cumberland Sound populations may occur in winter.

New information on white whales off Quebec (Southeast Hudson Bay) indicate that this population is composed of approximately 400 animals (SC/32/SM16). Apparently a major decline occurred historically, as a result of commercial hunting and increasing local human activities. The population in the Poste-de-la-Baleine area may be a local, year-round resident group with no apparent migration taking place except for local movements to selected areas for calving, rearing young and feeding (SC/32/SM16).

*4.2.1.2 Age determination and vital rates*

Additional new information on life history parameters were reviewed in SC/32/SM1, 13 and 16. No apparent correlation was seen between girth and total body length (SC/32/SM16). Females attain 50% of their adult body length by their third year, whereas males do so at approximately 5 years (SC/32/SM1). Although the mean calving month was reported to be July for Alaskan white whales, Braham reported that recent sightings suggest that the calving period was from mid-April through September (SC/32/PS10). The sub-committee restates its request to continue analysis on ageing techniques, specifically using teeth, so as to allow more refined estimates of age-related reproductive parameters.

*4.2.1.3 Estimates of net reproductive rates*

No new estimates of mortality using empirical data were submitted this year, but additional information was provided on birth rates (% calves as a proportion of all other animals observed) and gross recruitment (% pregnancies × % females in the population). Birth rate in the Quebec population (SC/32/SM16) was calculated at 8%, which translates into a gross recruitment of 11–14%. From a review of the literature, Brodie (SC/32/SM17) calculated that net recruitment (rate) should be 7.5%, assuming a 12% birth rate and 4.5% mortality rate. No additional new information was received on density-dependent change in rates of production; this issue remains unresolved.

*4.2.1.4 Commercial and subsistence takes*

The recent catch of white whales for Canada and Denmark are reported in Table 2. Boulva (SC/32/SM5) presents data which may provide some insight into the quality of reported data on whales landed. For the northern Quebec and Hudson Bay area, reported catches were less than the estimated catches by 11–27%, with an increasing trend since 1976. Breton – Provencher (SC/32/SM16) estimates that the rate of exploitation for the Poste-de-la-Baleine area of southwest Hudson Bay is 8–13%, which would exceed maximum sustainable exploitation limit for this population.

The same can be said for the Cumberland Sound population where Brodie (SC/32/SM17) showed that net production nearly equals the quota. A catch quota of 40 animals has been initiated beginning in 1980, which is mutually agreed upon by the Canadian Government and Inuk hunters. Educational pamphlets such as that by Brodie (1972) represent a useful management tool.

The subsistence take for Alaska populations are reported in SC/32/SM13. This represents an average removal (1968–79) of 184 animals from a population which is perhaps in excess of 5,000 (SC/31/SM8 and 13) or 3–4%. In Cumberland Sound 10–13%, using an average of 82 animals per year, were removed between 1972 and 1979 (SC/32/SM17 and 16). Stock separation along the Alaskan coast has not been investigated, something the sub-committee urgently requests be addressed.

Removals from the White and Kara Seas were not reported, but from SC/32/SM1 a minimum of 266 were reported killed. Whether these were part of a subsistence take or for scientific purposes was not specified. Catch statistics from Soviet waters are urgently requested, as well as an evaluation of effort and loss rate, particularly for the Sea of Okhotsk and adjacent coast of the Soviet Union Far East and Chukchi Sea area.

*Hunting loss rate*

Few data were provided on loss rates. In shallow water, loss rates in the Alaskan take were estimated at 20%, but in deeper water about 60% (SC/32/SM13). This means that the annual removal in Alaska, where as much as one third of the take is in deep water, may exceed 300 animals. These data provide better estimates than the undocumented ones presented last year, but this problem is an important issue for small stocks which are being harvested, or for those stocks for which we have no reliable population size estimates. Additional loss rate values were addressed by Sergeant in a minority opinion report at last year's meeting (*Rep. int. Whal. Commn* 30: 122). Brodie recorded a minority view of loss rates in Appendix 3 to this report.

The sub-committee recommends that research be initiated on killed-but-lost and wounded-but-lost rates so that greater confidence can be placed on the significance of annual removals. For example, if a 20–33% loss rate is occurring (which may be too high an estimate—Appendix 3) for the Cumberland Sound population, and all or some of these whales die, then the total take may equal or exceed the estimated net recruitment (SC/32/SM17). Such research should also examine alternative hunting techniques which might reduce losses, particularly for those populations where significant removals are now occurring.

*4.2.1.5 MSY and status of stocks*

Estimates of MSY for white whale stocks are not possible. Breton – Provencher (SC/32/SM16) states that the exploitation rate for the Poste-de-la-Baleine population is estimated at 13%. The actual removal rate was calculated at 9.5% (38 animals removed from a population estimated at 400). This population and the Cumberland Sound population are being exploited near or beyond their net reproductive rate. Research is especially needed on gross recruitment. It is recommended that calf counts be conducted on the Cumberland Sound population.

For all stocks, clearly better data are needed to determine recruitment rates, current exploitation rates and population levels. This is a point of great concern to the sub-committee and one needing urgent attention by all nations taking white whales.

### 4.3 Narwhal

*4.3.1 Definition of stocks*

The sub-committee reviewed the four available documents on distribution and catch from 1974 to 1979 (SC/32/SM11; SC/32/O 16; SC/32/ProgReps Canada and Denmark). From an extensive review of the literature, Mitchell and Reeves (SC/32/O 16) provisionally concluded that one stock of narwhal exists in the Canadian Arctic, West Greenland and Northwest Greenland, as opposed to two as described in *Rep. int. Whal Commn* 30: 121. They pointed out that although it is well known that narwhals in summer concentrate in separate regions of eastern Arctic Canada and north Greenland, their winter distribution is poorly known, and animals from all parts of the summer range may mix in winter in an area of Davis Strait close to the border of the drift ice. Meldgaard and Kapel (SC/32/SM11) reported recent sightings of narwhals in the Melville Bay area and reviewed previous observations from the same area. They concluded that although the catch statistics for Upunavik District clearly demonstrate a northward migration in April–June and a southward migration in September–November, it is not clear whether all these animals migrate to and from the well known summering areas in Thule District (Vibe 1950, cited in SC/32/SM11), or if some of them spend the entire summer in Melville Bay. The sub-committee was not able to agree on the question of whether one or two stocks of narwhal exists along western Greenland and near eastern Canada. This question needs further investigation, and the sub-committee recommends that the involved nations conduct such field studies as are possible to help resolve this problem.

*4.3.1 Life history parameters*

No new information was presented on life history, *per se*. From data reported in SC/32/ProgRep Canada however, a 23% calf-to-adult and juvenile ratio was obtained from 108 narwhals landed out of a total of 115 (4 were lost) trapped in a *savssat*. Greater numbers of females than males were in this group, suggesting that, if the entrapment was not selective, sex segregation in high latitudes may occur at this time of year.

*4.3.3 Catches*

The available information on recent catches is presented in Table 2 and in SC/32/ProgRep Denmark. The actual take may be more than reported (SC/32/SM11; SC/32/ProgRep Canada and SC/32/ProgRep Denmark). A review of the history of narwhal catches prior to 1930 (SC/32/O 16 suggests that the take in Canada has always been large and between 1910 and 1930 may have been as high as 400 animals per year. This is greater than the estimated take for the same period in West Greenland of over 300 per year (SC/32/O 16). Data prior to 1910 are greatly fragmented, but some were summarized by the authors. No additional data were presented on struck and lost rates, but Mitchell and Reeves (SC/32/O 16) used a value of 2 in extrapolating to total takes from the literature between 1910–30.

*4.3.4 MSY and status of stocks*

No estimates of sustainable yield were available; however, evidence presented in SC/32/O 16 suggests that the population has sustained a consistently high take for

Table 2

Available catch data for white whales and narwhals by area in Canada 1974–79
(From SC/32/ProgRep Canada and SC/32/O 16)

| | White whales | | | | | Narwhals | | |
|---|---|---|---|---|---|---|---|---|
| | Arctic | | Hudson Bay | | | | | |
| Year | Eastern | Western | Eastern | Western | Totals | Eastern Arctic | Western Hudson Bay | Totals |
| 1974 | 239 | 165 | 366 | — | 770 | 152 | — | 152 |
| 1975 | 140 | 184 | 529 | 101 | 954 | 264 | 7 | 271 |
| 1976 | 239 | 154 | 489 | 146 | 1,028 | 297 | 8 | 305 |
| 1977 | 286 | 148 | 534 | 191 | 1,159 | 200 | 8 | 208 |
| 1978 | 161 | 127 | 217 | 118 | 623 | 275 | 4 | 279 |
| 1979 | 200 | 144 | 1 | 105 | 450[1] | 289 | 30 | 319 |
| Totals | 1,265 | 922 | 2,136 | 661 | 4,984 | 1,477 | 57 | 1,534 |

[1] 1979 data incomplete.

several centuries. A minimum population size in 1910 was estimated at 11,000 (SC/32/O 16), but no conclusions were reached on the present size of the Canadian Arctic – West Greenland stocks(s). However, Sergeant (SC/31/SM6) reported a population estimate from the recent literature of 20,000 for narwhals in the Lancaster Sound area. Although the population has sustained a long history of commercial and subsistence hunting, the sub-committee reiterates its recommendation of 1979 that additional steps be taken to obtain data on life history, distribution, abundance and other information for assessment and management of the stocks.

### 4.4 Other species

*4.4.1 China*

Chen informed the sub-committee that the *beiji* (white flag dolphin) *Lipotes vexillifer*, has been completely protected since 1975 and that no fishing for that dolphin exists at present. Historical data were reported (SC/32/SM15) detailing how the Chinese have recognized and described *Lipotes vexillifer* for more than two thousand years. Additional information is given on the distribution of *Lipotes*. Most noteworthy is that the dolphin was never common in Lake Dogtinghu (formerly transliterated as 'Tung Ting Lake') and now has entirely disappeared from the lake, due to silting. Its range at present is restricted to the middle and lower reaches of the Changjian (formerly 'Yangtse') River, and the population is much reduced. A review was provided of research on the species since the 1970s. It was also noted that a *Lipotes* Research Group was established at the Institute of Hydrobiology, Wuhan, People's Republic of China nearly two years ago. The research programme includes the following topics: (1) ecology, (2) morphology, anatomy and histology of the respiratory system, and (3) transportation and rearing of animals. One live dolphin was captured on 11 January 1980 by fishermen of Jiayu County, Hubei province and it was successfully transported live back to the Institute of Hydrobiology and is still alive at the time of our meeting. The sub-committee thanked Chen for this important new information and looks forward to hearing about the results of the studies as they progress.

*4.4.2 Japan*

In addition to the directed takes listed in IWS (Prov. LXXXV), local fisheries in Japan took another 13,868 small cetaceans, of 12 species (SC/32/ProgRep Japan and Appendix 4), for a total of 13,899. This includes incidental takes and the Iki Island takes. As noted above (3.2), Ohsumi reported that a planned research programme on small cetaceans described last year (*Rep. int. Whal. Commn* 30: 128) has not yet been launched. The sub-committee is concerned about the lack of research on the identity, size and status of stocks of these species under exploitation.

*4.4.3 Denmark*

In addition to the directed take listed in IWS (Prov. LXXXV) for the Faroes and that summarized above for Greenland, Greenland in 1979 took 960 small cetaceans, of 3 species (SC/32/ProgRep Denmark).

*4.4.4 Indonesia*

An open-boat whale fishery of long standing still exists in Lamalera, Lembata, eastern Indonesia and takes small cetaceans of several species (SC/32/ProgRep Australia and SC/32/O 10.

## 5. PROBLEMS OF INTERACTIONS BETWEEN FISHERIES AND SMALL CETACEANS

In 1978, (*Rep. int. Whal. Commn* 29: 26–7) the Commission endorsed the recommendations of the Scientific Committee that research by member nations should be encouraged into competition between small cetaceans and fishermen 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 progress report. The sub-committee had before it the following progress reports containing material related to this subject: SC/32/Prog Reps Canada, Denmark, Japan, Norway, South Africa, USA and the USSR. The sub-committee also reviewed the following documents containing material relevant to this subject: SC/32/SM6, SC/32/SM8, SC/32/O 5 and Kasuya and Izumizawa, 1980 (draft contract report prepared for US Marine Mammal Commission). Additional information was provided by sub-committee members and invited experts.

### 5.1 Incidental takes

*5.1.1 Canada*

SC/32/ProgRep Canada contained detailed information on cetaceans entrapped in fishing gear during 1979. The reported mortality of small cetaceans is much less than that for humpback, fin and minke whales. Gear involved included salmon nets, traps, gillnets, and seal nets. It is understood that research on measures to reduce entanglement and death of large cetaceans from entanglement is being undertaken by the Canadian government. The sub-committee urges that the research continue and that, if possible, a report be made available to the next meeting.

*5.1.2 US*

SC/32/O 5 contains records of the incidental catches on the US East Coast during the period 1975–79 of 12 small cetaceans taken incidentally in fishing gear. In addition 16,682 dolphins are estimated to have been taken in the US tuna purse-seine fishery in the eastern tropical Pacific (see 5.1.8).

*5.1.3 South America*

Valdivia reported that in 1979, the Institute del Mar del Peru (IMARPE) had been unable to carry out investigations into small cetaceans. He has reported now that no additional information is available on incidental takes of dolphins in Peruvian purse-seining operations.

*5.1.4 West Africa*

G. T. Sakagawa of the Southwest Fisheries Center, La Jolla, California attended the 1st Special Meeting of the International Commission for the Conservation of Atlantic Tunas (ICCAT) in November 1979 as IWC observer. His report was available as IWC/32/11B. In the Standing Committee on Research and Statistics (SCRS) of ICCAT, documentation on whale and dolphin involvement in tuna purse-seine fisheries in the eastern Atlantic was presented. 0–4% of sets were made on dolphin-associated schools and a larger percentage on whale-associated schools. A report by Levenez, Fonteneau and Regalado (SRCS/79/105) compares observations on fleet logs from January 1976 and

June 1979. 30 captains were interviewed and estimated sets on dolphin-associated schools as about 10 per cent per vessel, approximately 3% of sets for those vessels setting on dolphins at all. Log-book analysis substantiates the estimate of 0–4% of all sets for those vessels examined, about 70–80% of tuna seiners fishing in the area. Captains estimate that about 15 dolphins are killed in each set on dolphin-associated tuna.

*5.1.5 South Africa*

SC/32/ProgRep South Africa contains details of 104 entanglements and 100 deaths of dolphins in shark nets of Natal. The kill is the highest recorded since collection of statistics began in 1972. Although dolphins are killed in nets in all months of the year, 69% of the mortality occurred in an eleven-day period during an exceptionally large run of sardine.

Measures taken to minimise the catch of dolphins include furling nets ahead of the sardine run. In half of the cases where dolphins were killed in the 1979 run, nets had not yet been rolled up.

*5.1.6 Japan*

SC/32/ProgRep Japan provides data on both incidental and directed takes of small cetaceans. Directed takes are considered above (3.4.4). Incidental takes occur in fixed net, purse-seine and drift-net fisheries and totalled 1,008, of 10 species.

*5.1.7 China*

SC/32/SM 15 provides detailed information on the beiji, *Lipotes vexillifer*. Examination of 100 individuals killed between 1950 and 1980 indicated that 50 were killed as a result of ingesting hooked fish.

The sub-committee expressed concern that continued high mortality attributable to interaction with line fisheries continues to seriously threaten the remaining population.

*5.1.8 Eastern Tropical Pacific* (purse-seining for tuna)

Incidental takes from US vessels are subject to the provision of the US Marine Mammal Act of 1972, under which permits for incidental takes in the tuna industry have been issued since 1974. In 1976 a mandatory observer programme was initiated. US import regulations require that tuna taken in association with dolphins by vessels of other countries for export to the United States are also taken in accordance with the provisions of the US Marine Mammal Act. Allen (SC/32/SM6) reported on tuna purse seine operations.

In 1976 the Inter-American Tropical Tuna Commission (IATTC) recognised that it had a responsibility to concern itself with the problem of dolphin mortality associated with the purse-seine fishery, and an international observer scheme was in operation for the first time in 1979. Observers placed on board IATTC member and non-member vessels have given reports for seiners from Canada (2), Costa Rica (2), Mexico (1), Nicaragua (1), Panama (4) and the USA (111). Sets on dolphins in the Eastern Tropical Pacific were also made by seiners from Congo, Costa Rica, Ecuador, South Korea, Mexico, Netherlands Antilles, New Zealand, Nicaragua, Panama, Senegal, Spain, the USA and Venezuela. Estimates of mortality have been made for all known sets (SC/32/SM 6). Total estimated mortality of all species in estimated at 23,595. The species involved are spotted dolphin, spinner dolphin, common dolphin, striped dolphin and bottlenose dolphin. These estimates for 1979 are the first that have been presented for the entire Eastern Tropical Pacific yellowfin purse-seine fishery.

The incidental takes by the US are closely regulated, with catch limits set for each known stock of each species based on assessments of status. For some stocks, for example the eastern spinner dolphin, the current catch limit is zero. Provisional quotas for 1980 total 31,150.

The sub-committee noted that reports on tuna-fishery associated incidental takes of small cetaceans had not been submitted by several IWC members (United Kingdom—Bermuda tuna purse-seine activities—and Cayman Islands, Peru and Spain).

**5.2 Direct conflicts and competition**

*5.2.1 Japan*

Catch information was available to the sub-committee in a draft report to the US Marine Mammal Commission (Kasuya and Izumizawa, draft report, 1980) on the drive fishery at Iki Island. Catches for 1979 are in Appendix 4. The figures here are those reported by the Katsumoto Fish Co-op Union.

A research team established by the Japanese Agency of Science and Technology in 1978 was transferred to the Japanese Fisheries Agency in 1979 and has continued its work in 1980. In 1979, 313 of the dolphins killed were examined; in 1980, 445 of the 1,819 killed were examined.

A second proposed research programme was reported by T. Ichihara of Tokai University in an unpublished document presented to the meeting on cetacean behaviour and intelligence and the ethics of killing cetaceans, held in Washington DC in 1980. The proposal includes research on detection of sounds emitted by dolphins, to allow approaching schools to be detected; research on effects of sound on dolphins, to develop means of moving dolphins away from fishing areas; and research on reactions of fishes to sounds used to scare dolphins, to avoid additional interference with fishing.

The sub-committee urges that all efforts be made to quantify the possible competition between these small cetaceans and continued yellowtail and squid fisheries in the area to assess the effects of continued take from the small cetacean populations.

*5.2.2 Australia*

Anderson reported that in September 1979, reports were received that a small number of killer whales were taking hooked fish in a dropline fishery which is developing off the east coast of Tasmania. Fishermen reported losses of 30% of daily catches. Fish were taken from droplines by the whales as the lines were being winched aboard. The interference was having a serious local impact on the fishery, and on some days boats remained in port to avoid what was considered as continued harassment. No action was taken, pending information on methods used for dispersal of cetaceans in other fisheries. Fishing resumed uninterrupted when the possible single pod of whales moved off.

Anderson reported that it is intended to undertake a more detailed examination of the fishery during 1980 and to monitor the behaviour of killer whales in the area should the interaction re-occur. Non-injurious methods of dispersal, including aversive conditioning, may also be assessed and will be fully reported at the next meeting.

*5.2.3 Norway*

A fishery for killer whales in Norwegian coastal waters has been carried out in part as a measure against perceived interference in the herring fishery. Data and further comment on the fishery is contained above in discussion under item 4.1.2.

## 6. EFFECTS OF POLLUTION AND INDUSTRIAL DEVELOPMENT

### 6.1 New information on pollution

*6.1.1 Mercury levels*

SC/32/SM16 reported mercury levels in white whales in the Poste-de-la-Baleine region, New Quebec. Tissue samples from 22 animals were examined.

It appears that between the ages of 0–27 dentinal growth layer groups, mercury concentrates eight times more rapidly in liver than in muscle, rising from 0.4 to about 12 ppm in liver and from 0.14 to 1.5 ppm in muscle. In practical terms, the livers of animals longer than 2.44 m and the meat of animals longer than 2.75 m are not fit for human consumption. Large animals are hunted, but as the hunters eat only the 'Muktuk' (skin) they avoid the risk of ingesting excessive amounts of mercury.

SC/32/O 11 analysed meat samples from a number of species, including short-finned pilot whales and killer whales. The former showed a range of 10.7 to 64.2 ppm, mean 26.2 ppm wet weight. The samples, however, are described as 'semi-dried' and had a moisture content of only 26.7%. the single killer whale sample, described as fresh, had a moisture content of 71% and 15.6 ppm wet weight of mercury.

As the aim of this study was to assess mercury levels in meat samples as consumed by humans, the disparate nature of the samples may perhaps be overlooked. It should be noted, however, that these levels are almost certainly not representative of those in fresh caught material and that the possibility that the samples had been contaminated before purchase was not explored. The quoted Japanese standard of 0.4 ppm refers to fish, but is similar to the Canadian standard mentioned in the previous paragraph. Further discussion of this paper may be found in the Scientific Committee Report, item 13.1.

*6.1.2 Organochlorine pollutants*

A study by O'Shea, *et al.*, (in press) of organochlorine pollutants in small cetaceans from the Pacific and South Atlantic Oceans was noted. The abstract was available to the sub-committee and an early draft had been seen by some members. Sixty-nine individuals representing 10 species were sampled. Collections were made from 1968 to 1976 in the eastern tropical Pacific and along the coasts of California, Hawaii, Japan and Uruguay. Total DDT and PCB residues in blubber of most of the 19 individuals of the five southern California species sampled exceeded concentrations which are associated with reproductive impairment in pinnipeds, although the nature of such associations is not well defined. Only one individual, a rough-toothed dolphin from Maui, Hawaii was not contaminated. Details of the reproductive condition of the animals were not included in the paper but are available from the authors.

Brodie pointed out the importance of recording the sex of animals in studies of pollutants. He stated that in grey seals, for example, both sexes accumulate DDT at the same rate until sexual maturity. After this, the males continue to accumulate DDT, but in females, pregnancy and lactation seem to act as a sink.

In view of the lack of information on the exact relationship between high concentrations of organochlorides and reproductive impairment, particularly in marine mammals, future studies should endeavour to include anatomical and histological studies of reproductive tissue.

*6.1.3 Other information*

Kapel, reporting on a joint session of the ICES Marine Mammal Committee and Environmental Quality Committee, said that while there was much evidence on the levels of pollutants in the tissues of marine mammals, there was little information about the physiological effects of these contaminants.

He further reported that some studies have been completed and others are underway. The local populations of fish and marine mammals are known to be contaminated with metal and pesticides. Cadmium, for example has been found in large quantities in ringed seals. It is possible that this metal is more severely damaging than mercury. The situation is further complicated by possible interactions between different types of residues, particularly mercury and selenium. The next joint meeting will be held in the first week of October 1980.

The Inland Sea in Japan has a pollution problem, but Kasuya and Kureha (1979) recently reported that sightings in the area reveal a considerable stock of finless porpoise. While information on previous population levels is not available, nevertheless this does show that even in a highly polluted area it is possible to find a considerable stock of small cetaceans.

The sub-committee notes and emphasizes that the majority of studies only dealt with the amounts of pollutants and not with their effects. Some members felt that the sub-committee should not be concerned about pollution, as there is no evidence that the accumulation of pollutants have affected the physiology or stock status of cetaceans. Other members thought that as other animals were known to be damaged, it is important to continue to investigate the problem, although such studies are difficult, not least because captive animals are known in some instances to react differently than wild animals to these substances. It is also important that studies include anatomical and histological investigations so that possible confounding effects of infections, etc., may be made clear.

Studies of PCB and other pollutants' effects in small cetaceans and dugongs are being carried out by N. Miyazaki at the National Science Museum, Tokyo. Arima and Nagakura (1979) have published a study of mercury and selenium in odontocetes.

The review by Risebrough (1979) on pollutants in marine mammals was noted, as was the information that in the United Kingdom the Royal Commission on Environment Pollution is investigating the effects of oil pollution on marine biota, including marine mammals. Braham reported that studies of effects of oil on cetaceans are presently being conducted by US Scientists; they will be reported on at next year's meeting.

### 6.2 New information on industrial development

*6.2.1 China*

SC/32/SM15 noted that among the factors causing the decline of the *Lipotes vexillifer* population are destruction

of the habitats due to harnessing the river and increasing navigation. Chen further remarked that individuals apparently killed by propellors showed wounds only on the head. These were extensive, with the skull opened or partly cut away. No body wounds were seen.

*6.2.2 Baffin Bay and Davis Strait*

SC/32/ProgRep Denmark states that the possible effects of a Canadian project for transportation of liquified natural gas (LNG) along the West Greenland coast on stocks of marine mammals in Baffin Bay and Davis Strait and their exploitation by local people have been reviewed. Kapel reported that the matter is still under review. The project, which has not yet been approved, would begin in 1986 at the earliest. Gas has been found in northern Canada and the problem is to transport it to consumers to the south. The proposed 'Arctic Pilot project' includes construction of two very large transport ships (340 m in length and 200,000 horsepower) which would be able to sail on a year-round basis. 60 passages a year (about one every six days) are planned. The suggested route would pass very close to the Greenland coast, and the plan has caused much concern in Greenland. This is mainly on two grounds: one, that this activity may interfere directly with hunting; and two, that it may also affect the stocks of marine mammals and birds breeding or migrating through the area. Of special concern is that the noise from such ships is of an order of magnitude not previously known in this area. Kapel reported that a Danish specialist has calculated that cavitation noise from the ships will dominate ambient noise and have a masking effect on marine-mammal echo-location for more than 100 km on each side of the passage. Cetaceans are known to use sound for echo-location and/or for communication, and it is not known to what extent this new noise will affect the animals.

A working group has been set up with scientists and representatives from the Greenland and Canadian governments and representatives of the Canadian Crown Corporation concerned. Two or three meetings have taken place to identify the problems and to determine what research is needed. A priority is to design a route which will do least damage to marine life.

In further discussion of the High Arctic, it was pointed out (SC/32/O 16), and the sub-committee agreed, that in view of (1) the extensive development underway or planned in the Canadian Arctic; (2) the dependence of the narwhal on a deep-basin High Arctic habitat; (3) the likelihood that Canadian narwhals may all belong to a single stock and the only one 'sufficiently large and concentrated to ensure species survival', a larger research effort than currently exists should be carried out to investigate scientifically the possible and probable impacts on the narwhal habitat and population of proposed developments in the Davis Strait, Baffin Bay and Lancaster Sound regions.

## 7. OTHER BUSINESS

**7.1 Review of CITES report**

The Scientific Committee requested that members of the sub-committee review the small-cetacean portions of a draft of an expanded and revised version of 'Proposals Concerning the Cetacea'. The members of the sub-committee agreed that time would not allow review of the document during the meeting. Several members agreed to review the draft and forward comments to Klinowska.

*7.2 Meeting on cetacean reproduction*

The sub-committee recognises the continuing need for a special meeting (with a laboratory-based workshop component) on cetacean reproduction as it relates to stock assessment and management, emphasizing reproduction in female odontocetes. An invitation and offer of partial funding have been received by the Commission from the Southwest Fisheries Center. The tentative date would be the first week in December, 1981. The sub-committee members find the place and time suitable and recommend that the invitation be accepted.

## 8. RECOMMENDATIONS TO THE SCIENTIFIC COMMITTEE

**8.1 Northern bottlenose whale**

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.

**8.2 Killer whale**

The sub-committee recognises that the IWC has a mandate to classify killer whale stocks (the killer whale is listed in the IWC Schedule, Section I, paragraph 1), and to set catch limits for them. Thus, the sub-committee is recommending appropriate stock classifications as well as research that it believes is necessary.

(1) Noting that until 1979/80 the catches of killer whales have been a small fraction of the estimated stock size for a part of the waters near Antarctica, the sub-committee recommends that the stock(s) be classified as an Initial Mangement Stock. Because it has not been able to perform an adequate stock assessment for this area, the sub-committee is unable to recommend a catch limit on scientific grounds.

(2) Noting a lack of information about reproductive rates, natural mortality rates, stock structure, and the effects of various harvesting regimes on social structure, the sub-committee recommends that the USSR be asked to continue its research with the aim of providing adequate data for stock assessments. The sub-committee also recommends that the USSR be made aware of the requirement for collecting full catch and biological statistics for *each* killer whale taken by catcher vessels (Schedule VI.24).

(3) Noting that the Norwegian exploitation of killer whales in the North Atlantic has a long history of catches, the sub-committee recommends that this stock be provisionally classified as a Sustained Management Stock, with a catch limit of 54 pending an assessment of the population. The provisional classification would require review at next year's meeting.

(4) Noting that no estimates of population size are available for the killer whales in Norwegian coastal waters, the sub-committee recommends that Norway be asked to conduct research to provide this and other information necessary for an adequate stock assessment.

(5) Noting that the management criteria used by the Commission do not address situations where the interest of another marine resource has an impact on whale management, such as may be the case for the Norwegian exploitation of killer whales, the sub-committee recommends that the Commission be requested to instruct the Scientific Committee on suitable management critera for such situations.

(6) Recognising that there is much field research in progress on killer whales, in North America, South America, the USSR and elsewhere, and that much of the existing relevant expertise has not been available to the sub-committee in its efforts to assess killer whale stocks, the sub-committee recommends that a three- or four-day workshop on stock identity and population structure of killer whales be convened before the next meeting of the Scientific Committee.

**8.3 White whales and narwhals**

Recommendations on white whales and narwhals made last year to the Commission by the Scientific Committee were not acted upon, pending a legal review of the status of IWC *vis a vis* cetaceans not presently listed in the Schedule. The sub-committee therefore reiterates the substance of recommendations, taking into account new information available at this meeting.

(1) 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 is 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. The only substantive differences between the fisheries are in size of the whales and the size and organisation of the whaling crews involved, differences not justifying the radically different treatment presently given them. The sub-committee recommends to the Committee 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.

(2) The sub-committee recognises that for the first time a catch limit (40) has been set by the Canadian government for the Cumberland Sound stock of white whales, but because the population has declined to approximately 10–15% of its initial size, the sub-committee still must recommend on biological grounds that 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 continue to be examined. Full data on age, sex, size and reproductive status should be obtained from the catch, should there be one.

(3) The sub-committee noted that the white whales that winter along the southern coast of West Greenland and at the edge of the pack ice migrate to summering areas in the central Canadian High Arctic and in the Melville Bay – Thule areas on Greenland. Although catches in Greenland have been 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 possible that current levels of removals are too high for the overall population. The sub-committee recommends that these groups, which winter in south-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(s). 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 adjacent summer populations. The program should also include more accurate determintion 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 new information made available at this meeting did not include abundance estimates. The sub-committee, therefore, recommends that the USSR be urged to commission 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 instituted by the USA, USSR and Canada. These programs should begin soon and should include documentation of loss rates, 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 relationships among them identified.

**8.4 Competition with fisheries**

The sub-committee considers that while cases of perceived competition for common resources between fisheries interests and cetacean populations are reported from many areas, there is as yet no case in which quantitative verification is available. The sub-committee therefore again recommends that member nations be urged to foster and support expanded research on perceived competitive interactions between marine mammals and fishermen. The sub-committee strongly urges that such perceived competition be assessed in direct quantitative terms.

**8.5 Pollution**

The sub-committee is particularly concerned about the lack of knowledge concerning the short- and long-term effects of pollution on cetaceans and recommends that member nations be especially urged to investigate the physiological effects of pollutants on growth, reproduction and mortality.

**8.6 Terminology**

(1) The sub-committee recommends that the Bureau of International Whaling Statistics be requested in

compiling IWS to follow the list of common and scientific names accepted by IWC as a convention (*Rep. int. Whal. Commn* 27: 25 and Appendix 1). The list has not been followed in past issues of IWS. For example in Vol. LXXXIII of IWS the following corrections are needed:

(a) Common porpoise reported caught in the USA in Table Z[2] are actually common dolphins, *Delphinus delphis*.
(b) Northern bottlenose whales, *Hyperoodon ampullatus*, reported caught by the USSR in Table Z[4] are southern bottlenose whales, *H. Planifrons*.
(c) Long-finned pilot whales, *Globicephala melaena*, reported caught by Japan and the British West Indies in Table Z[5] are short-finned pilot whales, *G. macrorhynchus*.
(d) Common porpoises reported caught by the USA in Table Z[10] are common dolphins, *Delphinus delphis*.

(2) The sub-committee recommends that the common name *beiji* be substituted for *white flag dolphin* (an erroneous translation of the Chinese name) for *Lipotes vexillifer* in the IWC List of Small Cetaceans recognised (*Rep. int. Whal. Commn* 27: 483).

### 8.7 Statistics

As discussed above, statistics supplied by member nations for directed and incidental takes of small cetaceans are in very many cases incomplete or inadequately detailed. The sub-committee again recommends that member nations again be requested to collect and submit full statistics, as detailed in last year's recommendation (*Rep. int. Whal. Commn* 30: 124).

### 8.8 Tuna-seining in the eastern tropical Pacific

The sub-committee recommends that member nations purse-seining for tuna associated with dolphins in the eastern tropical Pacific, or planning to do so, be urged to participate in the international observer programme operated by the Inter-American Tropical Tuna Commission. These nations at present include the United Kingdom (Cayman Islands and Bermuda), Peru and Spain.

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## Appendix 1

### AGENDA

1. Participants, agenda and introductory remarks.
2. Review of documents.
3. Review of management actions and research on northern bottlenose whale, striped dolphin, Dall's porpoise and harbour porpoise.
4. Other directed fisheries on small cetaceans.
   4.1 Killer whale.
   4.2 White whale and narwhal.
   4.3 Narwhal.
   4.4 Other species.
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. Other business.
8. Recommendations to the Scientific Committee.

## Appendix 2

### ABUNDANCE ESTIMATES FOR KILLER WHALES IN ANTARCTIC AREAS III AND IV

R. Allen

Best (SC/32/SM10) estimated the abundance of killer whales using line transect methods with a negative exponential distribution of sighting distances. Although a chi-squared test did not reveal differences between the observed and fitted distributions, there is a clear discrepancy in the first interval. In fact the chi-squared test does not have very much power in distinguishing between observed and fitted curves, particularly when only a small number of degrees of freedom are available. Furthermore, for line transect estimation it is critical that the fitted distribution of sighting distances fits the observed distribution well at the origin.

To attempt to overcome this a truncated negative binomial distribution (Best and Butterworth, 1980, *Rep. int. Whal. Commn* 30: 257–83) with a cut off point at 0.5 miles was fitted to the data given in SC/32/SM10. In the original analysis the parameter for the negative exponential distribution was estimated from the data as a whole, and then the lengths of track line, areas, and number of observations were stratified into 9 areas. This was done in an attempt to remove the effects of non-homogeneous densities through the area. However, the effect of estimating the parameter of the distribution from the pooled data and population estimates from stratified data is unknown, and this analysis is done for the combined data. Although line-transect theory assumes the population density is homogeneous for unbiased estimates from an area within a non-homogeneous one, it is sufficient that track lines be random with respect to areas of high and low density.

Appendix Table 1

Frequency distribution of right and sighting distances for killer whales with fits to the negative exponential distribution truncated at 0.5 miles and to the untruncated negative exponential distribution (SC/32/SM 10)

| Distance interval n miles | Observed frequency | Truncated negative exponential | Negative exponential |
|---|---|---|---|
| 0–0.1 | 14 | 13 | 9 |
| 01–0.2 | 8 | 9 | 8 |
| 02–0.3 | 6 | 6 | 7 |
| 03–0.4 | 4 | 3 | 6 |
| 04–0.5 | 2 | 3 | 5 |
| | 34 | 34 | 29 |

Appendix Fig. 1 shows the sampling effort (length of track line/area) plotted against relative density (numbers sighted/length of track line) for the eight strata with observations. This graph shows that although there is a considerable amount of scatter, there was in fact relatively more sampling in high density areas than in low-density areas, and thus an estimate made without stratification is likely to be an over-estimate of the true population.

With a cut off point of 0.5 months, the data extracted from SC/32/SM10 (excluding the stratum with no observations) were:

n = 34 numbers of schools seen.
A = 960,484 area surveyed.
L = 14,239 length of track line.

Then the estimate of $\lambda$ using

$$\lambda = \frac{n-1}{\Sigma y}\left(1 - \frac{0.5\lambda e^{-\lambda/2}}{1-e^{-\lambda/2}}\right)$$

was 3.94, and the estimate of N, the total number of schools in the area, using

$$\hat{N} = \frac{nA}{2L}\,\frac{\lambda}{1-e^{-\lambda/2}}$$

was 5,250. Appendix Table 1 shows the fequency distributions of right angle distances for the observations and fits to the truncated and untruncated distributions.

The average school size given in SC/32/SM10 was 11.66, and thus the estimate of population size is 61,200. This is a little more than double the estimate given in SC/32/SM 10 and the difference is more or less equally due to the difference between using a truncated and non-truncated model and to the difference between the partial stratification and pooled methods. It is clear from Fig. 1 of this Appendix that pooling will lead to some over-estimation of numbers but it is also likely that the partial stratification introduces a bias. The use of the truncated model will produce a better estimate of the density than the untruncated one, providing the relatively large observation in the zero-to-0.09 n miles category is not an artefact caused by whales actively moving towards the boat.

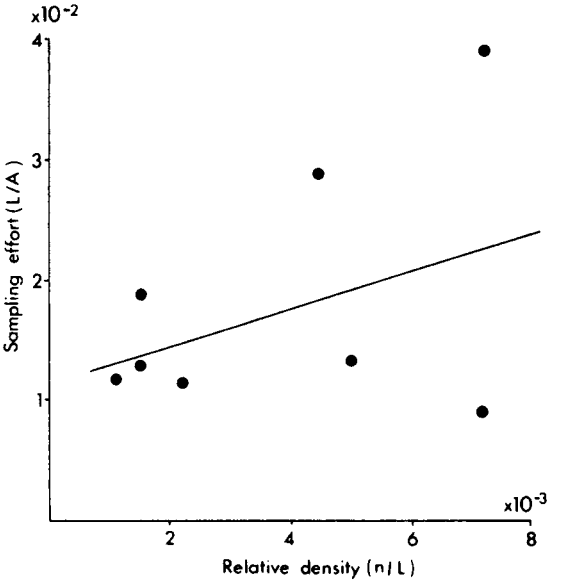


Fig. 1. Regression of sampling effort on relative density (see text).

The coefficient of variation estimated using the negative exponential distribution was 0.25. The coefficient of variation for the truncated model used here is difficult to calculate and consequently the coefficient of variation for the ordinary model is used for a rough guide to the statistical variation in the estimates. Because a part of the variance is the result of random variation in n which is common to both estimates this is likely to be an over-estimate. If it is assumed that the estimates are symmetrically distributed an approximate 95% confidence interval would (30,600, 91,800).

## Appendix 3

## HUNTING LOSS RATE FOR WHITE WHALES IN CANADA

P. Brodie

A single percentage-loss rate cannot be applied for all hunting activities across the Canadian Arctic. Loss rates are not only site specific but hunter specific.

The skills of the hunter and the type of rifle used are further complicated by the salinity and turbidity of the water. For example, the Mackenzie delta hunting area is of low salinity and high silt load. Whales are easily lost due to lower buoyancy and once lost cannot be seen through the muddy water. In addition, wounded animals would have increased wound infection due to the lower salinity.

Heavier-calibre rifles used in the Mackenzie delta tend to cause greater wounds (observed by Brodie in 1972) than in the Canadian Eastern Arctic.

The Cumberland Sound hunting is generally with lighter, high velocity rifles (for seal hunting) which tend to cause more superficial wounds. The higher salinity not only reduces the sinking but provides better healing conditions for escaping wounded animals.

Effective strategies are used by hunters, such as driving animals into shallow water before killing them or harpooning before the killing shot.

## Appendix 4

## CATCH OF SMALL CETACEANS IN 1979 BY SPECIES AND COUNTRIES

(D = Direct, I = Incidental, and L = Live capture)
(1 Provisonal, 2 1979/80 Antarctic Season, 3 Estimated total, and 4 Non-USA Kill in Eastern Tropical Pacific)

| | | | | Denmark | | | | South | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Japan | Canada | Greenland | Faroes | Norway | USSR | Africa | USA | Non-USA[4] | Total |
| Baird's beaked whale | (D) | 28 | — | — | — | — | — | — | — | | 28 |
| Northern bottlenose whale | (I) | | 1 | — | — | — | — | — | — | | 1 |
| Narwhal | (D) | | 319 | 350[3] | — | — | — | — | — | | 669 |
| | (I) | | 1 | | | | | | | | 1 |
| White whale | (D) | | 449[1] | 700[3] | — | — | — | — | — | | 1,149 |
| | (I) | | 2 | — | — | — | — | — | — | | 2 |
| Indo-Pacific hump-backed dolphin | (I) | | — | — | — | — | — | 1 | — | | 1 |
| Melon-headed whale | (D) | 140 | — | — | — | — | — | — | — | | 140 |
| False killer whale | (D) | 339 | — | — | — | — | — | — | — | | 339 |
| Killer whale | (D) | 5 | — | — | — | 221 | 916[2] | — | — | | 1,142 |
| Long-finned | (D) | — | — | 50 | 1,725 | — | — | — | — | | 1,775 |
| pilot whale | (I) | — | 5 | — | — | — | — | — | — | | 5 |
| Short-finned | (D) | 93 | — | — | — | — | — | — | — | | 93 |
| pilot whale | (I) | 11 | — | — | — | — | — | — | — | | 11 |
| Atlantic white- | (D) | — | — | 8 | — | — | — | — | — | | 8 |
| sided dolphin | (I) | — | — | — | — | — | — | — | 1 | | 1 |
| Dusky dolphin | (I) | — | — | — | — | — | — | 1 | — | | 1 |
| Pacific white- | (D) | 360 | — | — | — | — | — | — | — | | 360 |
| sided dolphin | (I) | 64 | — | — | — | — | — | — | — | | 64 |
| Bottlenose | (D) | 615 | — | — | — | — | — | — | — | | 615 |
| dolphin | (I) | 51 | — | — | — | — | — | 8 | 9[3] | | 68 |
| | (L) | | | | | | | 4 | | | 4 |
| Risso's dolphin | (D) | 934 | — | — | — | — | — | — | — | | 934 |
| | (I) | 1 | — | — | — | — | — | — | — | | 1 |
| Spotted dolphin | (D) | 427 | — | — | — | — | — | — | — | | 427 |
| | (I) | — | — | — | — | — | — | — | 8,317[3] | 3,401 | 11,718 |
| Spinner dolphin | (I) | — | — | — | — | — | — | — | 3,085[3] | 408 | 3,493 |
| Striped dolphin | (D) | 2,193 | — | — | — | — | — | — | — | — | 2,193 |
| | (I) | 22 | — | — | — | — | — | 10 | 321[3] | 281 | 634 |
| Common dolphin | (D) | 50 | — | — | — | — | — | — | — | | 50 |
| | (I) | 39 | — | — | — | — | — | 23 | 4,950[3] | 2,421 | 7,433[3] |
| Harbour porpoise | (D) | — | — | 900[3] | — | — | — | — | — | | 900 |
| | (I) | 3 | — | — | — | — | — | — | 7 | | 10 |
| Dall's porpoise | (D) | 6,872 | — | — | — | — | — | — | — | | 6,872 |
| | (I) | 828 | — | — | — | — | — | — | — | | 828 |
| Finless porpoise | (I) | 1 | — | — | — | — | — | — | — | | 1 |
| Other | (D) | 49 | — | 2 | — | — | — | — | — | | 51 |
| | (I) | 1 | 1 | — | — | — | — | 62 | — | | 64 |
| Total | | 13,126 | 778 | 2,010 | 1,725 | 221 | 916 | 109 | 16,690 | 6,511 | 42,086 |