Annex I
Report of the Sub-Committee on Small Cetaceans


1. ELECTION OF CHAIRMAN
Perrin was elected Chairman.

2. APPOINTMENT OF RAPPORTEURS
Reilly acted as rapporteur for the sessions of the sub-committee on pilot whales. Buckland, Collet, Klinowska, Reeves and Smith also served as rapporteurs.

3. ADOPTION OF AGENDA
The Agenda adopted is given in Appendix 1.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS
The sub-committee considered documents SC/39/SM2-25 and the national progress reports. Documents SC/39/O 1, 10, 13, 14 and 26 also contained information on small cetaceans.

5. REVIEW OF LIFE HISTORIES AND STATUS OF POPULATIONS OF PILOT WHALES, GLOBICEPHALA SPP
The genus Globicephala includes two species of small whales found throughout much of the tropical and temperate waters of the world. The sub-committee was pleased to receive the substantial amount of new information on North Atlantic G. melaena1, with additional information available for Southern Hemisphere G. melaena and western Atlantic G. macrorhynchus.

5.1 Long-finned pilot whales, G. melaena, in the North Atlantic
5.1.1 Stock identity and distribution
There are no data available to distinguish pilot whales in the eastern North Atlantic from those in the western North Atlantic. However, this problem has not been systematically addressed. Electrophoretic data from a sample of 628 individuals from nine schools in Faroese waters (SC/39/M13) indicated possible heterogeneity. Statistical analysis implied that the school captured in the northernmost location (Vidvik) of the nine might be different from the rest in this analysis.

The sub-committee concluded that more information on distribution, migration and genetics was needed to resolve issues of stock discreteness. Two studies planned for the coming year in the Faroes will hopefully provide some of this information: DNA-based studies now being conducted at Cambridge University and plans to satellite-tag three pilot whales and physically mark (freeze brand, fin notch and inject with tetracycline) as many others as possible from a single pod, reported by Martin.

5.1.2 Abundance
Information was presented in SC/39/M14 for an offshore area of the North Atlantic resulting from four sighting surveys aimed at studying fin whales, conducted during 1981–4. This document presented preliminary estimates of pilot whale abundance based on 25 sightings. The authors noted that these results applied only to the area surveyed, which is probably only part of the range of the population involved. They also discussed some probable biases and mentioned that these results were probably minimum estimates.

The sub-committee expressed a number of reservations about the abundance estimates presented in SC/39/M14. Because of the small number of sightings and the variability in school size, the standard errors of all the estimates of population size are approximately as large as the estimates themselves, so that 95% confidence intervals include zero in all cases. There were also problems noted with the fitting of a model to the perpendicular distance estimates. Although SC/39/M14 provided a useful investigation of the available data and methods of analysis, these problems dictate that they cannot, without additional data, be used for a population estimate. The sub-committee also noted that G. macrorhynchus has been recorded from the southern part of the survey area.

The sub-committee believed that the school size estimates were of particular interest, since they were made by experienced observers and were notably smaller on average (12–25) than those reported for this area by Duguy and Aloncle (1975) and for schools driven ashore in the Faroes (SC/39/M23). Small schools have also been reported from the Mediterranean (McBrearty et al., 1986). SC/39/M23 presented information from opportunistic sightings and strandings in British and Irish waters. The sub-committee agreed that, while there were some interesting and valuable data in this document, it was difficult to interpret opportunistic data without some

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measure of sighting effort. For example, in this document the increases indicated from both sightings and strandings in recent decades were far too large to reflect population increases and more likely reflect an increase in interest in cetaceans. However, they may reflect shifts in distribution or migration patterns. The seasonal data undoubtedly include effects of varying visibility conditions and other factors unrelated to actual pilot whale abundance.

Sightings of pilot whales made during aerial surveys of minke whales in coastal waters of Iceland were presented in SC/39/O 13. Records of pilot whales along the coast of France were summarised in SC/39/SM21; strandings there have been most frequent during the winter months.

5.1.3 Migration
No new data were presented which provided information on migration. SC/39/O 26 and Jean-Caurant et al. (1987) discuss levels of trace compounds in pilot whales (and other animals) from the Faroes. Appendix 3 discusses potential uses of such data in the study of home ranges and migrations.

5.1.4. Life history
5.1.4.1 Age determination
The sub-committee last year (Rep. int. Whal. Commn 38/123) concluded that the most important need concerning age-related parameters was that for standardisation of techniques used in age determination. Data in SC/39/SM16 indicate that the best technique involves counting of cemental growth layers in decalcified, sectioned and stained teeth. This method was also used by Kasuya and Matsui (1984) in studies of short-finned pilot whales from Japanese waters and by Kasuya et al. (SC/38/SM11) in a re-examination of data for long-finned pilot whales from Newfoundland waters.

The sub-committee believed these methods appeared most promising, but examination of resulting age-distributions left open the question of accuracy of the methods (see Item 5.1.4.2). The lengths at age calculated from these data were very close to those reported for the recent British strandings (Martin et al., 1987).

5.1.4.2 Age distributions
Information on age distributions was provided in SC/39/SM16 and 20. Both indicated age distributions with ‘missing’ portions in the age interval from approximately 5 yrs to 15 or 20 yrs. Possible explanations for this are that reproductive or mortality rates have varied greatly (in which case the anomaly should progress with time), that there is segregation by age (with juvenile schools not available to the fishery) or that there is a systematic bias in the age determination method, (i.e. under-estimation of age in older animals).

5.1.4.3 Sexual maturity
A variety of estimates of age at sexual maturation of females was reported (6-8yrs: SC/39/SM21; 10yrs: SM15; 9yrs: SM16). The differences could be due to the relatively smaller sample size of the French coastal data set, or to slightly different methods used for age determinations. Kasuya et al. (SC/38/SM11) calculated six years as the female age at attainment of maturity for western North Atlantic pilot whales. Spermatogenesis begins at the age of five years but functional maturity is not attained before about 15 years of age (SC/39/SM21). Both SC/39/SM21 and SM15 estimated the length at maturity for males to be about 500cm. There appeared to be no standardisation of criteria for determining male sexual maturity in the reviewed papers.

5.1.4.4 Reproductive rates
SC/39/SM15 provided a number of estimates of reproductive parameters. Ovulation occurred at an average interval of 2.9 yrs. Conceptions and births were diffusely seasonal with a peak in conceptions from April to June and in births from July to October. Gestation is estimated to last 14.5 months (Sergeant, 1962).

Martin proposed in SC/39/SM15 a simple but novel procedure to estimate annual pregnancy rate. Using the estimate of foetal length at approximately 2.5 months at 12.5cm, he simply divided the number of females with foetuses over this length by the total number of mature females to arrive at an estimate of 0.28. Some members believed that the timing of the sample in relation to the peaks of conception and parturition could introduce bias. Others thought the method robust to this problem. No consensus was reached on the validity of this method.

Possible biases notwithstanding, the resulting calving interval estimate of 3.3 yrs is closer to Sergeant’s (1962) estimate of 3.2 yrs for Northwest Atlantic long-finned pilot whales. It is likely that the calving interval for individuals is a whole number of years. A gross reproductive rate of approximately 11% was estimated from the ratio of 46 females who would have given birth in the next 12 months to a total of 392 animals in the target pods. Martin and Desportes (SC/39/SM15) estimated lactation to last 27.3 months; 5 months longer than Sergeant’s (1962) estimate. Twenty percent of the pregnant females were simultaneously lactating and pregnant. It was noted that this would change seasonally; the 20% estimate may not be accurate as an annual estimate.

5.1.5 Exploitation
There were no new analyses available to the sub-committee of the Faroes time series of catches. SC/39/SM2 presented preliminary results of a search for historical records of pilot whale catches in drive fisheries in the British and Irish Islands since the early 18th Century. Peak catches of up to several pods a year occurred in the mid 1800s. The last drive occurred early in this century. Klinowska noted that the statistics are partial and that additional catch records probably reside in the files of regional museums and record repositories. The sub-committee noted the potential value of such data for analysis of long-term patterns in exploitation across the North Atlantic.

SC/39/ProgRep Denmark (Faroe Islands) reported that 1 of 19 bays previously authorised by the Faroes Government for use in the drive fishery has been closed and improvement of two beaches to increase the efficiency of the killing operation has been undertaken.

The fitness of the pilot whale meat for human consumption has implications for continued exploitation in the Faroes. As noted above, results of past studies of contamination by mercury and persistent organochlorines were presented in SC/39/O 26, and Jean-Caurant et al. (1987) summarised preliminary results of ongoing investigations of heavy-metal contamination. Mean levels of cadmium and mercury are relatively high in the
population. The sub-committee recommended that these studies be continued and that a broad survey of organochlorines be initiated.

5.1.6 Status

No new information was available to the sub-committee that would allow assessment of status. The results of the planned cooperative international North Atlantic Survey may provide estimates of abundance that in conjunction with the results of research in progress on life history and composition of the catch will allow an attempt at assessment of status.

5.2

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5.3 Globimphala macrorhynchus

Sightings of the long-finned pilot whale off southern South America were summarised in SC/39/SM4. The summary of cetacean sightings during the IDCR cruises, 1978/79 to 1983/84 (SC/39/O 10) also included sightings of the species in Antarctic waters and in the areas of the South Atlantic, South Pacific and Indian Oceans transected by the survey vessels en route to or from the Antarctic. The sub-committee noted a gap in the distribution of pooled sightings between approximately 45° and 50°S. The apparent hiatus may be an artifact of differential sighting effort or sighting conditions but should be investigated as a possible real gap in distribution. The sub-committee recommended that every opportunity be taken to collect sightings in these latitudes, with records or estimates of sighting effort.

Pilot whales were the eleventh most commonly recorded species (of thirteen) during the Antarctic surveys (SC/39/O 10). Pilot whales were scarce in waters of 0 - 5°C, where other species were common. Average school size was roughly comparable to those recorded for the North Atlantic populations (SC/39/SM20 and 23 and earlier references cited in SC/39/O 10). The sub-committee commended SC/39/O 10 as the results of the first attempt to systematically survey the small cetaceans of the Southern Ocean.

6. REVIEW OF NEW INFORMATION ON OTHER EXPLOITED SMALL CETACEANS

6.1 The dolphin/tuna problem in the Eastern Tropical Pacific

Three papers were presented with information on the status of populations of dolphins which are killed in the multinational tuna purse seine fishery. Two papers presented information on the dolphins killed. SC/39/SM12 presented numbers and species composition for 1986. SC/39/SM1 presented information from biological data and specimens collected from animals sampled from the kill. A third paper (SC/39/SM9) presented information on dolphin abundance over time developed from sightings data collected during the operation of the fishery. The three papers provided substantial new information that may not be consistent with previous assessments of the status of several of the dolphin populations affected by this fishery.

6.1.1 Estimates of mortality

SC/39/SM1 presented a breakdown of the incidental kill of six populations of five species, similar to previous reports (e.g. SC/38/SM1). SC/39/SM12 presented estimates of the kills of dolphins of four populations in 1986. These estimates are substantially higher, especially for some stocks, than reported for recent years (SC/39/SM17; SC/37/SM12; SC/38/SM15; Wahlén, 1987). Total kill estimates were 24,000, 39,400, 56,700 and 129,500 from 1983 to 1986. Several reasons for the increases in 1986 were noted, including (1) increased fishing on dolphin schools, (2) larger catches of tuna per set, (3) higher proportions of night sets, (4) increased fishing on species and stocks with higher rates of incidental mortality (e.g., the common dolphin), and (5) higher proportions of (more vulnerable) juvenile dolphins in the kill of offshore spotted dolphins. Reasons 2-5 suggest that the numbers of dolphins killed per set or per ton of tuna captured, as analysed in SC/37/SM12, was substantially higher in 1986 than in recent years, although specific numbers are not given.

6.1.1.1 Coverage of the international fleet

Sampling intensity in 1986 was 30% of all fishing trips, substantially higher than in previous years. Coverage has increased from 13% in 1984 and 21% in 1985. Sampling was still higher for the US fleet, with 43% of the US versus 26% of the non-US trips being sampled. The coverage of the non-US fleet is, however, an improvement over the coverage in the period 1979-84, when only 5% of the sets on dolphins by US vessels versus 7% from the non-US fleet.

6.1.1.2 Differences between US and non-US kill rates

Possible differences in kill-per-set (KPS) rates for the US versus the non-US fleets were noted in SC/39/SM17 and the existence of such a difference was confirmed in 1984 (SC/37/SM12) for two statistical areas but not for five other areas. Other considerations were noted that made stratification by US versus non-US samples undesirable in that year because of sample-size limitations. However, concern was noted then about the representativeness of the sampling of non-US vessels up to 1984, especially in the two statistical areas where significant differences had been demonstrated between US and non-US KPS rates, and the problem was thought to be serious. There have been recent improvements in sample coversages of the non-US fleet, but the same estimation method (not stratifying by country) was used this year. It may now be possible to remedy this earlier-identified problem, or alternatively to conduct a new statistical test of differences in KPS rates. The continuing increase in the non-US participation in the fishery, in conjunction with differences in sampling fraction by nation, suggests that any differences in KPS

1 Estimate for US plus 1/5 of estimate for non-US 1979-83 from Table 4.
rates would result in biased estimates of the kill. Previously-identified lower KPS rates for US vessels would suggest that the current estimates of total kill could be biased downward.

6.1.1.3 Effects of school size and age structure

It was not noted if dolphin school sizes were larger in 1986, although SC/39/SM4 suggests that school sizes may have increased steadily since 1983 for the northern offshore spotted, eastern spinner, and northern common dolphin populations. School size has been suggested in the past as positively correlated with kill rates. The possible effect of the fishing process on school size was noted in SC/37/SM12; analyses of this possibility was noted to be in preparation, but were not available during the meeting.

The possibility of an increased proportion of sub-adult animals in the kill is not evident in comparing Tables 4 or 5 of SC/39/SM4 with the corresponding tables in SC/37/SM1, although it was noted that the samples in the kill-composition papers may not have been representative of the kill. The basis for the statement about change in age structure of the catches in SC/39/SM12 should be given. The suggestion in the paper that it reflected an increase in the pre-adult fraction of the population suggests that the abundance of adult animals may have decreased, a particular concern given recent kill levels. The other suggestion that this is due to changes in the fishing areas or selectivity was also a concern to the sub-committee, suggesting possibly increasing impact of the fishery on the populations. The suggestion that this increase is due to increased recruitment requires more information than given.

6.1.1.4 Possible revision of earlier estimates

Because of increasing levels of kill reported here, it is important to compare new estimates with those for earlier years. The estimation procedure used has been applied to the data from 1984, 1985 and now 1986. This procedure would need to be applied to the data from before 1984 in order to make statistically valid comparisons (SC/37/SM12). Such estimates were not available to the sub-committee. However, differences in kill rates among countries that were identified in the 1979–84 data, and as were suggested during discussions during the meeting of the 1986 data, suggested to the sub-committee that kill estimates for earlier years that might be made without stratifying by country would be biased downward in proportion to the degree of involvement of countries other than the US and in proportion to the fishing effort sampled.

In summary of the discussions on kill estimates, members noted that the problem of dolphin mortality in the ETP is two-fold. The sub-committee was interested firstly in the size and effects of the kill by species and stock, and secondly in ways in which mortality could be reduced. It noted that the first point was admirably addressed by SC/39/SM12 but that there was little information available on the second. Buckland briefly described technological assistance provided to the international fleet with the aid of UNEP funding. A report which addressed both practical efforts made to reduce mortality and the questions of differential kill rates among areas and fleets would be timely now that a much larger proportion of the non-US fleet was being sampled.

The sub-committee noted the valuable and very important increased participation in the international effort to assess and solve the tuna/dolphin problem and urged that the effort be continued and enlarged.

6.1.2 Trends in abundance

SC/39/SM4 presented new analyses that addressed some of the difficulties identified with earlier similar analyses and included data for more years. The sub-committee found it to be an excellent, very detailed analysis of a complex data set that revealed much about the status of dolphins involved in the fishery. The sub-committee was especially appreciative of the detailed development of the methods used, because that information allowed evaluation of the strengths and weaknesses of the analyses and the data set and provided considerable insight into the populations and the fishery.

Line transect analysis was applied to the sighting data collected by scientific technicians placed aboard tuna vessels. Encounter rates (total numbers of schools sighted per nautical mile searched by the fishermen) in each 1° square were used to stratify the abundance data, with strata defined to achieve homogeneous encounter rates averaged over neighbouring 1° squares to account for possible non-randomness in sampling. Data were divided into the resulting strata, and abundance estimated as the product in each strata of encounter rates, mean school size, and average effective search width using the 'smearing' procedures as in SC/39/SM12. Estimates of population size are presented for eight populations of three species of dolphins from 1975 to 1986. The authors noted a number of difficulties with these data for analysis by line transect techniques and described the methods used to accommodate these difficulties where possible. Several of the difficulties were not completely overcome, and with these in mind the authors suggested that the estimates should not be interpreted as absolute abundance estimates, but rather as indices that show trends in abundance. Under this interpretation the authors suggested that the abundance of northern offshore spotted dolphin, eastern spinner dolphin, and central common dolphins had all declined from 1975 to the early 1980s. The authors also noted that there was a suggestion in the estimates of increases in abundance for northern offshore spotted dolphin and for eastern spinner dolphin in the mid-1980s, although these estimates are difficult to interpret for the northern offshore spotted dolphin because of the apparently biased estimate for 1983. Omitting that point leaves little evidence of an increase. The estimates for the eastern spinner in 1986 is significantly higher than the estimate for 1981–84. The estimated increase is very much greater than could be expected for a dolphin population as a result of natural increase, although a confidence interval for the difference includes levels of increase that are biologically reasonable.

The sub-committee noted several general uncertainties with these analyses that make interpretation of the suggested trends difficult, relating to several factors noted below.

(1) Data collected during the commercial fishing process may be affected by: (a) large and small scale non-random searching patterns; (b) biases in estimates of angle to sighting caused by the searching process; (c) inter-annual changes in degree to which tuna vessels are fishing on dolphins; (d) inter-annual changes in
geographic location of searching effort; (e) the recent increase in use of helicopters for searching.

(2) Rounding errors may exist in estimation of sighting distance and angles.

(3) An unreasonably low estimate of abundance for the northern offshore population of spotted dolphin in 1983, during a major El Niño event, suggest that large changes in environmental processes induce biases in estimates of trends.

(4) The series of estimates for the eastern stock of spinner dolphins developed to accommodate some of the difficulties with assumptions were a great improvement in experience. While the smearing techniques used were thought to adequately address the errors in estimation of angles and distance, these techniques did not adjust for possible biases in estimation of the sighting angle that may result from the fishing process (for example, recording of angle after the vessel has turned toward the school). The effects of these errors would lead to overestimation of abundance.

The manner in which changes in the degree to which vessels are fishing on dolphins and inter-annual changes in geographic location of searching effort affect the estimates of trends in abundance is not clear, but such effects are likely large and unpredictable.

The sub-committee members noted with appreciation the great amount of information available to it on this problem. However, the increasing levels of kill estimated in recent years and the corresponding apparent decrease in abundance during the late 1970s are causes for concern. These suggested declines contradict the previous understanding of the status of these stocks (Smith, 1983), based on absolute abundance estimates from research platforms, estimated dolphin mortality levels from the beginning of the fishery in the early 1960s, and substantially reduced estimated dolphin mortality levels from the late 1970s on and onward. The contradiction may be due to biases in estimates of dolphin kill levels historically or recently (possibly as the international composition of the fishery has changed). Biases in the absolute abundance estimates used in Smith (1983), biases in the estimates of the trends of abundance in SC/39/SM9, or indirect effects of the fishing process on the life history of the dolphins.

The magnitude of the changes in the population size of one of the populations (the northern offshore spotted dolphin) suggested by SC/39/SM9 is large, from an average of 4.2 million in 1975–79 to an average of 2.9 million in 1980–82, a 30% estimated decline. Although the variability of each of the estimates is large, with coefficients of variation decreasing over time from 23% to 14%, Buckland suggested that these estimates provide good evidence of a decline. Taken in conjunction with estimates of approximately 40 to 60% reduction of this population from the early 1960s to mid to late '70s by Smith (1983), these estimates, if correct, suggest that there may be cause for concern about the present status of this population, as well as some other populations such as the eastern spinner.

It is important that additional studies be undertaken to resolve some of these uncertainties. A comprehensive understanding of the status of the stocks can be obtained. In particular, the sub-committee recommended that analytical studies of fishing operations on a detailed basis be carried out, in line with the recommendations of the recent workshop on CPUE (SC/39/Rep2), to allow more detailed evaluation of the trends of abundance indicated in SC/39/SM9. The sub-committee recommended the reporting next year of indices of abundance from ongoing US research-vessel surveys, to provide calibration of the abundance indices derived from data collected during fishing operations.

6.2 Exploitation of small cetaceans in South America

The sub-committee received a preliminary report from Gaskin on the UNEP/IUCN-supported investigation of small cetacean involvements in fisheries in Peru (SC/39/SM10). The work began in 1985 and was completed this year. The field programme has covered ports along the entire coastline of Peru and extended into southern Ecuador and northern Chile. What had been thought to be primarily a problem of incidental kill of Burmeister's porpoise, Phocoena spinipinnis, (UNEP, 1985) has turned out to involve mainly the dusky dolphin, Lagenorhynchus obscurus, which comprised 83% of the carcasses examined. The species composition of the catch may have changed since it was first noted in the late 1960s. The dolphins are taken in offshore gillnets. Some of the take is incidental to a gillnet fishery, but some is also directed take. Some additional directed take is by purse seine and harpoon. The porpoise (12% of the specimens examined), on the other hand, are taken only incidentally, in an inshore gillnet fishery for sharks and rays. Several other species of dolphins and small whales are taken in smaller numbers, chief among them being the common dolphin, Delphinus delphis, and the bottlenose dolphin, Tursiops truncatus. Annual catches of small cetaceans as reported in official Peruvian catch statistics have ranged from about 500 tonnes to about 1,000 tonnes in recent years. The research team found the reported statistics to be consistent with results obtained in its field surveys. The statistics, however, do not include struck—but—lost adjustment. Efforts are underway to partition the weight figures to species and, ultimately, to numbers of animals. The impacts of the takes on the populations are unknown. At present there is no legal protection or management of small cetaceans in Peruvian waters. Gaskin agreed to provide further progress reports to the sub-committee as the analyses of the data are completed.

The sub-committee was provided with an update on exploitation of small cetaceans in Argentina (SC/39/SM3). There was no directed take during the period 1979–86 other than live-capture for exhibition. Species taken incidentally by fisheries are known to have included Cephalorhynchus commersonii, Lagenorhynchus obscurus, and Ziphius cavirostris.
and possibly included *Phocoena dioptrica*. A lack of trained observers has prevented adequate coverage of the various fisheries along the very long coastline of Argentina.

6.3 Killer whale assessment

SC39/SM8 and SC39/SM19 reported the results of continued photographic identification studies of killer whales in Iceland and Norway, respectively. A preliminary report on the work in Iceland has been published (Lytholm, Leatherwood and Sigurjónsson, 1987). In 1986, vessel surveys off eastern and southern Iceland resulted in 37 observations of groups of killer whales, including 23 observations which resulted in the photographic identification of 111 individuals (SC39/SM8). The total of individual killer whales photographically identified in Icelandic waters since 1981 is 143, of which 79 have been provisionally assigned to one of 6 pods. Maximum distance between re-sightings in Iceland was 180km.

In coastal waters at Lofoten, Norway, 18 individual killer whales were photographically identified in 1986, resulting in a total of 26 identified in Norway to date (SC39/SM19). Of particular interest is the photographic re-identification of two killer whales observed off Møre in April 1984 and seen again 700km distant in Lofoten in September 1985.

There have been no photographic matches, to date, between the 143 individual killer whales identified off eastern Iceland and the 26 identified in Norwegian coastal waters. Moreover, preliminary analyses of acoustic recordings from the two areas have found no overlap in call types (SC39/SM16). Further photographic and acoustic sampling in these and other areas of the North Atlantic should provide more conclusive evidence of stock relationships.

The report of a workshop on North Atlantic killer whales in May 1987 was made available for the sub-committee’s information (SC39/SM18). Although this document was not reviewed, the members noted with interest that: (1) the killer whale’s former and recent distribution in the North Atlantic is much wider than was indicated earlier (Rep. int. Whal. Commn 32: 617–18); (2) the gestation period of three killer whales conceived and born in captivity was estimated, on the basis of patterns in hormone levels, as 17 months; and (3) the on-going age-determination work of A. Myrick and co-workers, using a sample of killer whale teeth which includes some labelled with tetracycline, may allow the calibration of layering patterns and improve preparation and reading techniques. The sub-committee was advised of plans to publish the workshop report and some of the presented papers in a book or special issue of a scientific journal. The report contained an estimate of about 190 killer whales in Icelandic coastal waters based on a capture-recapture analysis using photoidentification data.

Two papers on killer whales in Alaskan waters were available to the sub-committee. SC39/SM6 was a summary of progress made from 1976 to 1986 in photographic identification studies in Prince William Sound. SC39/SM6 was a catalogue of photographs of the 218 whales identified and assigned to pods in Southeast Alaska through 1986. SC39/SM4 contained information on killer whale distribution and exploitation in the Indian Ocean. The paper was submitted to the Scientific Meeting on the Indian Ocean Sanctuary.

6.4 Dall’s porpoise assessment

Two major colour morphs of *Phocoenoides dalli* (truei-type and dalli-type) occur in the waters around Japan, and paper SC39/SM11 treated results of nine whale sighting cruises, in order to examine geographic distribution and estimate abundance of the two morphs. The minimum estimate of abundance of the *dalli*-type in the Sea of Japan/Okhotsk Sea area was about 32,000 (CV=0.225). The size of the total *truei*-type population is about 56,000–90,000 individuals.

The sub-committee noted the excellent quality of the analyses and expressed appreciation for the work that had gone into them. Some suggestions were made for further analysis of the sightings data, so that a more robust estimate of abundance might be obtained. In particular, it was suggested that the sighting angle and distance data should be ‘smeared’ before analysis, and that further assessment of which line transect model(s) to use might prove useful. In addition, there was discussion of the relevance of the location of cruise tracks to the mapped distribution of the two colour morphs. The sub-committee recommended that catches of *P. dalli* be sampled to determine the proportion of each colour type in the catches and that biological studies of the catches be carried out. In conjunction with stock size estimates and information on biological parameters, this should enable assessment of the impact of the present catches (10,782 in 1986 – SC39/ProgRep Japan) on the two populations to be carried out.

6.5 Small cetaceans in the Indian Ocean Sanctuary

Two papers which had been submitted to the Indian Ocean Sanctuary meeting in the Seychelles in February 1987 were also made available to the sub-committee. SC39/SM4 reviewed information on the distribution and exploitation of six species in the Indian Ocean: *Orcinus Orca*, *Pseudorca crassidens*, *Globicephala melania*, *G. macrorhynchus*, *Feresa attenuata* and *Peponocephala electra* (mostly juveniles). SC39/SM5 reviewed information on Risso’s dolphin, *Grampus griseus*. It was noted that Risso’s dolphins (mostly juveniles) comprised about 25% of the 858 small cetacean examined that were taken off Sri Lanka during 1981–6 and that a similar proportion of cetacean sightings off Sri Lanka involved this species.

7. OTHER BUSINESS

7.1 Takes of small cetaceans in 1986

Information on takes (directed, incidental and live-capture) available to the meeting is summarised in Appendix 2.

7.2 Progress on requests for catch statistics in 1986

The sub-committee noted the submission of progress reports containing data on small cetacean catches by the following nations that did not submit progress reports last year: Argentina, France and Sweden. These new data submissions were welcomed. Reports for other IWC
member nations known to take small cetaceans remain non-existent or incomplete. The sub-committee notes that submission of catch statistics by calendar year would facilitate consideration and summarization of the data.

7.3 Priority topics for 1988 meeting
It is proposed that next year's meeting of the sub-committee focus on a review of population biology and assessment of the beaked whales, in addition to reviewing progress relative to past recommendations. The sub-committee notes that the several major studies in progress of pilot whale populations in the North Atlantic will be completed and draft papers available by 1989 and proposes that the work be reviewed at the 1989 meeting.

7.4 Workshop on incidental take of cetaceans in gillnet fisheries
In 1985 the Committee recommended that a workshop meeting be held to review new and expanding gillnet fisheries that take cetaceans incidentally (Rep. int. Whal. Commn 36: 37), to investigate how and why entanglement occurs; to estimate mortality and assess its impact on cetaceans, and to consider the possible ways of reducing the mortality of cetaceans, including the large whales, in gillnets. The workshop was tentatively scheduled for Autumn 1986 in Seattle but was not convened, primarily because of funding problems. The workshop is still needed, as pointed out in SC/39/Rep. Perrin reported that the workshop is included in the draft Action Plan of the Cetacean Specialist Group for 1988-1991, and an invitation offering to host the meeting has been extended by the Southwest Fisheries Center in La Jolla, California.

7.5 Publication of documents
A list of documents to be considered for publication was submitted to the Editorial Board.

REFERENCES

Appendix 1
AGENDA

1. Election of Chairman
2. Appointment of rapporteurs
3. Adoption of agenda
4. Review of available documents and reports
5. Review of life histories and status of populations of pilot whales, Globicephala spp
   5.1 North Atlantic populations of Globicephala meloena
      5.1.1 Stock identity and distribution
      5.1.2 Abundance
      5.1.3 Migration
      5.1.4 Life history
      5.1.5 Exploitation
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   5.2 Other populations of G. meloena
   5.3 Populations of G. macrorhynchus
6. Review of new information on other exploited small cetaceans
   6.1 Tuna/dolphin problem in eastern tropical Pacific
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   6.3 Killer whale assessment
   6.4 Dall's porpoise assessment
   6.5 Small cetaceans in the Indian Ocean Sanctuary
7. Other business
   7.1 Takes of small cetaceans in 1986
   7.2 Progress on requests for catch statistics in 1986
   7.3 Priority topics for 1988 meeting
   7.4 Workshop on incidental take of cetaceans in gillnet fisheries
   7.5 Publication of documents
## REPORTED CATCHES OF SMALL CETACEANS IN 1986

<table>
<thead>
<tr>
<th>Species</th>
<th>Argentina</th>
<th>Australia</th>
<th>Canada</th>
<th>Denmark</th>
<th>France</th>
<th>Japan</th>
<th>The Netherlands</th>
<th>Norway</th>
<th>Sweden</th>
<th>USA</th>
<th>UK</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humpback whale, Megaptera novaeangliae</td>
<td>22</td>
<td>40</td>
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<td>Risso’s dolphin, Grampus griseus</td>
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### Key
- D = direct take
- I = incidental capture
- L = live capture
- X = catches known to occur, but no current information available on levels.

### Footnotes
1. SC/39/ProgRep Argentina: Information that catches took place given but precise values not provided for all species and areas. Values in the table are correct for the calendar year 1986. They are not identical to those in the Program Report which covers 1985/86. (SC/39/ProgRep Japan): A few live captures are included in incidental or directed catches.
2. SC/39/ProgRep Sweden: Information that catches took place given but precise values not provided for all species and areas. Values in the table are correct for the calendar year 1986. They are not identical to those in the Program Report which covers 1985/86. (SC/39/ProgRep USA): A few live captures are included in incidental or directed catches.
3. SC/39/ProgRep UK: A few live captures are included in incidental or directed catches.
4. SC/39/ProgRep Canada: Information that catches took place given but precise values not provided for all species and areas. Values in the table are correct for the calendar year 1986. They are not identical to those in the Program Report which covers 1985/86. (SC/39/ProgRep Sweden): Information that catches took place given but precise values not provided for all species and areas. Values in the table are correct for the calendar year 1986. They are not identical to those in the Program Report which covers 1985/86. (SC/39/ProgRep USA): A few live captures are included in incidental or directed catches. (SC/39/ProgRep UK): A few live captures are included in incidental or directed catches.
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Because mammals incorporate pollutants mostly via food, their body load of xenobiotic compounds reflects the chemical characteristics of the environment in which they live and feed. In turn, the chemical load of a given water mass depends on relative and absolute quantities of pollutants discharged in neighboring areas, distance to pollutant sources, food chain complexity, physical environmental parameters such as temperature or water current regimes, and possibly other factors. All these factors produce wide variation of pollutant loads in different water masses, often on a short distance scale.

Logically, animals inhabiting environments with different pollutant profiles are likely to carry distinguishable pollutant burdens, and these burdens may help to ascertain whether two or more sample groups have more or less stable allopatric distributions.

Following this line of thought, pollutant burdens have been used to study migratory patterns or geographical segregation in fishes, birds, and some marine mammals (Krygier and Pearcy, 1977; Dutil et al., 1985; Calambokidis, 1986). This method has poor relation or no relation at all to genetics, so it will not be useful to discriminate populations that are genetically independent but which feed in largely overlapping areas or in areas with very similar pollutant loads. It may be of utility, however, when the research deals with groups of animals occupying different water masses during most of their life cycle. This applies not only to most typical genetically isolated populations, but also to components of homogeneous interbreeding populations which are partially allopatric (for example, sperm whales of different age, sex, or reproductive condition).

However, tissue pollutant concentrations of cetaceans are not simply a direct mirror image of the pollutants present in the water. Many factors unrelated to geographical distribution may affect the pollutant levels of certain individuals, groups of individuals, or even entire population components, making it relatively easy to find artificial differences between groups due more to heterogeneities or inconsistencies in sampling than to a real geographical segregation. These factors should be examined before attempting any comparison and taken into account when sampling or when analyzing results.

In the case of organochlorines, Aguilar (1987) has examined the significance of the most important perturbing factors and discussed the limitations and potential of these compounds for discriminating marine mammal groups with allopatric home ranges. Factors identified were age, sex, nutritional state, reproductive condition, trophic level (which may be heterogeneous within an otherwise homogeneous, population), excretory and metabolic activity, and tissue composition. These factors do not affect all compounds the same, so not only may their absolute tissue concentrations vary but, also, the ratios between compounds may be subject to a definite and often predictable variation. Therefore, the selection of certain compounds or ratios between compounds will be determined by the characteristics of the sample collected and by the characteristics of the groups to be distinguished.

For example, the tD/D/PCB ratio is known to increase with distance from pollution sources (and thus, from the coast), but to decrease with age in females due to differential reproductive transfer to offspring. Therefore, it may be extremely useful in differentiating offshore and inshore populations of the same species (such as bottlenose dolphins or Bryde's whales), provided that the female samples to be compared have similar age compositions. By the same token, some ratios may be misleading under inconsistent sampling regimes or in populations which are suspected to be affected by unmonitored sources of variation.

However, the effect of some factors is still to be ascertained. It is not clear, for example, how important the interactions are between different compounds in enhancing or diminishing the degradative capability of the animals. Most importantly, the use of stranded cetaceans (often diseased and with low fat reserves) to characterize levels of pollutants in marine mammal populations has been repeatedly questioned (Aguilar, 1984), but it is still unclear whether it is reliable or not.

Unfortunately, similar studies are not available for other potentially useful chemical indicators such as heavy metals, trace elements, or radionuclides, all already used in population discrimination of marine organisms other than cetaceans. Research is needed here. Moreover, since the most powerful discrimination capability will undoubtedly come from the comparison of pollutant loads integrating different families of compounds, research is also needed to understand the interactions and the sources of variation of ratios derived from chemicals belonging to different families (for example, combinations of selected heavy metals and organochlorines).

REFERENCES