Report of the Scientific Committee

The Committee met from 9–22 June 1992 at The Central Hotel, Glasgow, Scotland, under the Chairmanship of P. Hammond. A list of participants is given in Annex A.

1. CHAIRMAN'S WELCOME AND OPENING REMARKS

The Chairman welcomed participants to the meeting. The Committee paused in silence in memory of Dr Ikeda, Director of the Institute of Cetacean Research, Japan, and a member of the Committee for many years.

2. ADOPTION OF AGENDA

The adopted Agenda is given in Annex B. Statements concerning the Agenda are given in Annex O.

3. ARRANGEMENTS FOR MEETING

3.1 Appointment of Rapporteurs

Donovan was appointed Rapporteur, with various members of the Committee assisting as appropriate. Chairmen of sub-committees appointed rapporteurs for their meetings.

3.2 Meeting procedures and time schedule

The Committee agreed to a work schedule similar to that in previous years. This took into account comments, suggestions and procedures agreed to at earlier meetings (*Rep. int. Whal. Commn* 33:36; 38:59).

3.3 Establishment of sub-committees

The Chairman stressed that the main business at this year's meeting was to be the development and implementation of the Revised Management Procedure (Items 6 and 7 of the Agenda). The reports of the three sub-committees established (management procedures; Southern Hemisphere baleen whales; and North Atlantic baleen whales) are given as Annexes D-F, respectively. The standing sub-committee on small cetaceans also met and its priority items were narwhals, white whales and Japanese drive fisheries. Its report is given as Annex G. A number of working groups was established to examine specific subjects, including: implementation trials; population assessment models; maximum sustainable yield rates (MSYRs); aboriginal subsistence whaling; IWC/IDCR Southern Hemisphere minke whale assessment cruise; and research proposals. Their reports are given as Annexes or incorporated under relevant Items.

3.4 Computing arrangements

Allison outlined the computing facilities available to the meeting. In addition to the link with the University of Cambridge computing system, 10 personal computers were in use by the Secretariat computing facility and four were available for use by Committee members.

4. REVIEW OF AVAILABLE DATA, DOCUMENTS AND REPORTS

4.1 Documents submitted

A list of documents submitted is given as Annex C.

4.2 National progress reports on research

The revised guidelines for national progress reports are given in *Rep. int. Whal. Commn* 39:130. The progress reports received this year are listed in Annex C. The Committee reaffirmed its view of the importance of progress reports and again **recommends** that the Commission urges member nations to provide them following the approved guidelines. In view of discussions under Items 9.1.2 and 16.4.5, the Committee reiterated that countries should include in their progress reports: (i) sightings data, including incidental sightings data (a summary of results and/or an indication of where these can be found); (ii) statistics and data for small cetaceans (as agreed by the Commission in 1976; *Rep. int. Whal. Commn* 27:31).

4.3 Data collection, storage and manipulation

4.3.1 Catches and other statistical material from the previous season(s)

The Secretariat had received the data from the 1991/92 Japanese research permit cruise, and the 1991/92 Southern Hemisphere minke whale IDCR cruise. The 1990/91 cruise data have been validated by the Secretariat. During the meeting, data from the Norwegian 1990 sightings cruise and distance experiment were received, together with documentation for the 1989 parallel ship experiment.

4.3.2 Progress on data coding projects

Allison reported that good progress had been made on the data coding projects. SC/44/O 32 lists the catch data already coded for the Southern Hemisphere. Data from the 1930s and early 1940s are currently being encoded. Post-1945 marking data from the International Marking Scheme in the Southern Hemisphere have been encoded and are being validated.

4.3.3 Progress on computing projects

Allison reported that the management related work specified in *Rep. int. Whal. Commn* 42:72 and IWC/44/4A (Report of the Special Meeting of the Scientific Committee

on the Revised Management Procedure, published in this volume) had been successfully completed. Although two revised versions of the HITTER/FITTER programs and associated documentation had been received, these had not yet been validated. Haw had carried out analyses of pre-1990/91 Southern Hemisphere minke whale cruise data as described in SC/44/SHB3.

4.4 Whale marking

Kato reported that a Discovery mark had been recovered from a minke whale during the 1991/92 Japanese research programme (SC/44/ProgRep Japan).

The following national progress reports contained information on natural markings: Australia; Denmark; Germany; Iceland; Japan; New Zealand; Norway; Peru; Sweden; UK and USA.

5. CO-OPERATION WITH OTHER ORGANISATIONS

5.1 ICES

The report of the IWC observer at the 79th Statutory meeting of ICES held in La Rochelle from 26 September-4 October was available as IWC/44/10A. The observer attended the meetings of the Marine Mammals Committee. Topics of interest to the IWC Scientific Committee included the Reports of the ICES study group meetings on seals and small cetaceans in Northern European Seas; post-mortem procedures for stranded animals; marine mammals and the ICES multispecies/ multi-disciplinary approach; environmental quality; and fisheries and marine mammals in the Baltic. The Committee also noted that the report of the study group on pilot whales will soon become available. The meeting thanked Bjørge for attending the ICES meeting.

Under Item 10.3, the Committee had discussed a proposal for a workshop to address issues of multispecies interaction, feeding ecology and marine ecosystems with special reference to whales in the North Atlantic. It was agreed that interested scientists in the Committee should consult informally with scientists from ICES on this matter with a view to presenting revised proposals next year.

5.2 CCAMLR

The report of the IWC observer at the 1991 meetings of CCAMLR was available as IWC/44/10B.

The Committee noted that the CCAMLR Scientific Committee had agreed at its 1991 meeting that because the original reasons for its interest in the proposed CCAMLR/ IWC Workshop on the Feeding Ecology of Southern Baleen Whales no longer apply, it would be inappropriate for CCAMLR to continue as a co-sponsor of current IWC initiatives for this Workshop.

The Committee had been asked to respond to a request for information contained in a letter from the Convenor of the Working Group for the CCAMLR Ecosystem Monitoring Programme. The request was for advice on sources of available data for investigating the krill requirements of baleen whales in three particular study regions: the Antarctic Peninsula; South Georgia and Prydz Bay. Data sought included population size, distribution, breeding information, body weight, diet and food energy content.

The Committee recognised that a comprehensive response would involve the successful completion of many of the studies being undertaken or proposed at this time. For species other than minke whales (and perhaps also humpback whales) it was agreed (Annex E) that abundance estimates for areas other than the whole circumpolar area can not currently be obtained for the Antarctic. For minke whales, it should be possible to provide information in due course for the Antarctic Peninsula and Prydz Bay regions, i.e. those within the IDCR sightings cruise area of operation.

The Committee recognised that information from the Japanese scientific take of minke whales is currently being analysed. This will provide a major source of information for many of the subject areas described in the CCAMLR request. It may therefore be feasible for information on minke whales to be available within a time scale of 1–2 years, possibly for review at the interactive workshop proposed by CCAMLR. The Committee noted that it might be appropriate to propose that this workshop be a joint CCAMLR/IWC venture.

The Committee agreed that CCAMLR's attention should also be drawn to IDCR and other relevant data held by the Committee and specific member countries. Such data for regions of special interest to CCAMLR might be useful in its proposed investigations.

5.3 CITES

The report of the IWC observer at the 1992 meeting of CITES was available as IWC/44/10C. Although cetaceans were not directly discussed at the meeting, it was noted that CITES was reviewing and revising its criteria for inclusion of species in its appendices. The Committee agreed that aspects of this, particularly with respect to minimum effective population size, were of interest in the context of developing a revised Aboriginal Whaling management procedure. It was agreed that the Secretariat should inform the CITES Secretariat of the Committee's interest in obtaining relevant documentation.

5.4 NAC

The report of the IWC observer at the Fourth Meeting of the North Atlantic Committee for co-operation on research on marine mammals, held in Greenland on 9 April 1992, was available as IWC/44/10D. An Agreement on Cooperation in Research, Conservation and Management of Marine Mammals in the North Atlantic was signed by the Faroe Islands, Greenland, Iceland and Norway. It established the North Atlantic Marine Mammal Commission (NAMMCO), which intends to establish working relations with appropriate organisations including the IWC. The Committee thanked Larsen for attending the meeting.

5.5 CMS

Hykle introduced SC/44/O 21 which provided information on the Convention for the Conservation of Migratory Species of Wild Animals. Matters relating to small cetaceans were discussed by that sub-committee (Annex G).

5.6 UNEP

Holt reported on matters concerning the Planning and Co-ordinating Committee (PCC) of the Marine Mammal Action Plan. He noted that the IWC had not signed the Memorandum of Understanding but hoped that the IWC would cooperate as fully as possible with the PCC. The Scientific Advisory Council (SAC) of the PCC has met and considered the issue of marine mammal strandings and contaminants. A task force of specialists has been established to directly obtain samples from suspected mass mortality. The SAC was currently addressing the scientific

basis for the culling of marine mammals to protect fish stocks. A workshop to examine and develop suitable models and determine data requirements to investigate this problem will take place in the coming year.

6. COMPREHENSIVE ASSESSMENT – REVISED MANAGEMENT PROCEDURE FOR COMMERCIAL WHALING (also see Annex D)

6.1 Further development of Revised Management Procedure (RMP)

At the 1992 Special Meeting in Copenhagen, the Committee had developed a draft specification for the RMP (IWC/44/4A, Annex D). In that draft, there were a number of items that remained to be finalised. As recommended by the Special Meeting, the management procedures steering group presented a revised draft for consideration at this meeting.

6.1.1 Scope and presentation

In discussing the scope of the draft specification, the Committee agreed that it was designed solely for application to baleen whales. It also noted that most simulation trials used in the development of multi-stock management rules have been based on potential management of baleen whale species that undertake migrations between breeding grounds in lower latitudes and feeding grounds in higher latitudes, with previous whaling operations primarily only in higher latitudes. While recognising that not all baleen whales on which whaling operations might in the future be contemplated would necessarily follow this pattern (e.g. Bryde's, humpback and right whales), the Committee agreed that the framework outlined in the draft specification was designed to be suitable for calculation of catch limits for all baleen whale species.

It was also noted that, while the title of the draft specification developed at the 1992 Special Meeting refers to a revised management procedure, in reality the draft specification is primarily restricted to procedures for the calculation of catch limits. A change in name of the draft specification to reflect these points was agreed.

When discussing the appropriate mode of presentation of the draft specification, the Committee noted that it was difficult to be fully prescriptive in definitions that are to apply to all baleen whales. In addition, in a number of places, there are provisions for alternative actions to be taken, based on a review of relevant biological information and possibly on the results of case-specific simulation trials. The Committee therefore agreed that the text of the draft specification should be annotated at those places where the need for interpretations arose, or where further consideration possibly involving extra simulation trials may be necessary before implementation. These annotations should be of an explanatory nature, including examples where possible, and indications of the types of criteria to be applied when choosing between alternative actions.

It was pointed out that it is often difficult to determine the basis on which decisions of the kind required when implementing the procedure for a particular species and region have been made by the Committee in the past, because of inadequate or widely dispersed documentation. The Committee **recommends** that particular care be taken to provide full documentation of all implementations of the RMP to a species and region. In particular, criteria used or developed for choosing the precise form of implementation should be recorded, normally in the appropriate annotations to the specification.

6.1.2 Possible need for additional simulation trials

The Committee discussed the potential need for further single or multi-stock simulation trials to be carried out prior to finalising the draft specification and undertaking the task of implementation for particular stocks and regions. With respect to completion of the draft specification, it agreed that further single stock trials examining the effects of different inter-survey intervals were needed in relation to the proposed phaseout rule. Specification and results of these are discussed under Item 6.1.3.

It also agreed that additional single stock trials were needed to examine further the robustness of the procedure to potential degradation of the environment in the future. Previous robustness trials had considered cases where either the carrying capacity, K, or stock productivity (measured by the MSY rate, MSYR) varied with time, but not when both varied together. It was suggested that if the environment was to deteriorate in the future, it is likely that this would be reflected in a simultaneous decline in both carrying capacity and stock productivity. Accordingly, trials were set up in which both K and MSYR decline linearly to half their initial values over the 100 year management period.

The results of these trials are discussed under Item 4.1.2 of Annex D, and in Appendix 4 to that Annex. The Committee agreed that the RMP demonstrated robust performance in the circumstances modelled. Given these results, the Committee agreed that the extensive trials carried out prior to and during this meeting were now sufficient, and that no more trials would be needed for it to complete its development of the draft specification.

With respect to implementation for particular species and regions, however, the Committee recognised that the rules for calculating catch limits contained in the draft specification, especially those involving possible use of catch-capping and/or catch-cascading, required detailed consideration on a case-by-case basis. Almost inevitably, this would require reviewing the results of implementation simulation trials specifically tailored for that species and region. These trials should encompass, as far as possible, the full range of plausible hypotheses consistent with the biological data available for that species and region. In addition, they should incorporate the known catch histories for the species and region, and available estimates of absolute abundance with associated variance related statistics.

The Committee therefore **recommends** that suitable case-specific simulation trials be carried out prior to the initial implementation for each species and region. Such trials for Southern Hemisphere and North Atlantic minke whales are discussed under Item 7.

6.1.3 Specification of rules for setting catch limits

The Committee then proceeded to review the draft specification. The completed draft is given in Annex H. Explanations of text, including examples and criteria to be used when choosing between alternative actions, are contained in the annotations that are also given in Annex H.

In one aspect relating to the phaseout and associated rules (Items 2.3 and 2.4), Annex H is incomplete. In the

draft specification adopted at the 1992 Special Meeting (IWC/44/4A), it was tentatively envisaged that phasing out of catches would not begin until ten years had elapsed after the year pertaining to the last acceptable (i.e. that met the requirements of Item 2.2 of the draft specification) estimate of absolute abundance. However, it was noted that this required further consideration.

The tentative identification of a period of ten years was based on the results of robustness trials which showed little deterioration in performance with an inter-survey interval of ten years over those with an interval of five years. The Committee agreed that it wished to see results of further, more exhaustive, simulation trials of the effect of increasing the inter-survey interval from five to ten years before attempting to reach conclusions. These trials, which involved *inter alia* looking at combinations of factors previously only examined individually in single stock robustness trials, are described in Item 4.1.2 of Annex D.

In none of the single factor trials carried out was there any notable increase in risk to the stock as the survey interval was increased up to ten years. Similar conclusions were reached in trials involving combinations of these factors. The only notable risk-related effect was found for a combination of episodic events and a positive bias in the abundance estimates. For this combination, the scaled lowest population size statistic was somewhat lower when the inter-survey interval was increased to ten years (see Item 4.1.2, Annex D). However, while the trials showed little effect on risk to the stock if the survey interval is increased, total catches were reduced by up to 20% when the MSYR was relatively high.

These trials served only to confirm that the primary effect on single stock trials of an inter-survey interval of ten years was a reduction in catch, rather than an increase in risk. At least over this range of survey intervals, the RMP compensates for the reduced information in the survey data by reducing catches. The ability of the procedure to do this is related to the restricted amount of information provided by time series of absolute abundance estimates collected at inter-survey intervals within this range. The additional information provided by surveys with the assumed levels of variability conducted at five-year intervals is, in fact, not that much greater than that provided by ten yearly surveys. The reduction in catches also results from the fact that the procedure was tuned during development to meet agreed performance criteria, of which maintenance of acceptably low levels of risk is given highest priority. Schweder pointed out that relative weighting given to data in the statistical estimation procedures embodied in the catch limit algorithm (see Item 3, Annex H) may also be a contributing factor.

Despite these findings, some members expressed concerns about the prospect of ten years elapsing before phaseout of catches commenced, citing other issues that could not be addressed in simulation trials alone. In view of this, the selection of an appropriate period to elapse before phaseouts were invoked was referred to the Commission for advice. This is discussed further under Item 6.2.1.

6.1.4 Future changes to the RMP

The Committee agreed that a revised management procedure recommended by the Committee and adopted by the Commission should be able to be amended and improved in the future, in the light of advances in knowledge and methodology. Indeed, it recognised that protocols for future revision should in principle be an integral part of a full specification of the RMP. However, amendment of the procedure is not something that should be undertaken without careful consideration.

The Committee has undertaken a very lengthy and comprehensive process to develop the procedure described in Annex H. It was believed essential that any proposed future changes should be subject to a similarly comprehensive review before they could be approved by the Committee for recommendation to the Commission. For substantive changes, this would involve repeating many of the computer trials previously undertaken to ensure that the performance of any proposed amended procedure was in fact better than the current procedure. In consequence, evaluation of proposed amendments or improvements should be undertaken only after careful consideration in light of the Commission's priorities.

The Committee briefly discussed possible ways in which evaluation of such proposals might most efficiently be carried out. The following suggestions were made.

(i) It is essential that adequate notice be given to the Commission and Scientific Committee of any proposal for amendment of the RMP, either in its general specification or case-specific implementation.

(ii) Given the time it would take for the Committee to evaluate such proposals, it would be necessary that suitable evidence be presented to indicate that the proposed amendment would indeed represent an improvement. In this context, an amended procedure that allowed higher catches or lower catch limit variability would only be considered an improvement by the Committee if it could be shown that it performed at least as well on risk-related statistics. This evidence should take the form of appropriate, fully specified and programmed simulation trials (including at least the robustness trials used to evaluate the currently proposed RMP), the results of which would need to be available to the Committee before the proposal could be considered. These should have been carried out by the proposer.

(iii) Further simulation trials and/or modification of trials already carried out should be specified by the Committee, along with criteria for the evaluation of the results. Advice to the Commission could then be given at its next annual meeting, subject to completion of the work specified.

The Committee agreed that these suggestions seemed reasonable, but noted that there had been insufficient time available to allow thorough deliberation. It **recommends** that this issue be considered further.

6.1.5 Documentation and availability of programs

Calculation of catch limits according to the draft specification is accomplished using a computer program held and verified by the Secretariat. In addition, the large set of simulation trials used by the Committee in developing the RMP was carried out using a computer program developed by the Secretariat. The Committee discussed whether additional documentation to that already existing in the Secretariat was necessary for either of these programs, and the extent to which these programs should be publicly available. The extent of existing documentation for the two programs was reviewed by the sub-committee on management procedures (see Item 4.3, Annex D).

For the program implementing the calculation of catch limits, Allison reported that the existing documentation had been sufficient for her to validate the program. However, neither a fully comprehensive algebraic and

computational description of the program nor a user's guide has been written. Program documentation and a form of user's guide exists for the control program for carrying out the simulation trials, but both may need further development if the program is to be used by inexperienced users.

The Committee agreed that full documentation of the program implementing the calculation of catch limits was essential, and that further documentation of the control program was also highly desirable. It recognised, however, that this would be a lengthy task. While Allison was best able to undertake most of this work, it would also require input from other members of the Committee.

The Committee also suggested that now the stage of conducting detailed case-specific implementation trials has been reached, the opportunity might be taken to revise the control program, incorporating as flexible a structure as possible to minimise the need for programming changes in future implementation trials. However, this should be treated as a separate task from documentation of the version currently used.

Implications of the above for priorities and staffing of the computing section of the Secretariat are considered under Items 17 and 18.

The Committee agreed that the programs and associated documentation must be available to accredited scientists, as defined in the Rules of Procedure of the Committee. Many Committee members believed that, as a matter of principle, the programs should be accorded as wide an availability as possible. However, at the moment several issues relating to ownership of the programs and copyright remain unresolved (see Item 4.3, Annex D). Until these are resolved, the Committee **recommends** that access to these programs be restricted to accredited scientists.

6.2 Advice to the Commission

6.2.1 Draft specification and annotations

The Committee **recommends** that the Commission adopts the draft specification for the 'calculation of catch limits in a Revised Management Procedure for baleen whales' contained in Annex H, and that the Commission endorses the appended annotations.

Phaseout rule

As noted under Item 6.1, the Committee had been unable to determine a suitable period that should elapse before phaseout of catches should occur, in the absence of suitable estimates of absolute abundance. The matter is referred to the Commission for advice. The following points highlight the issues involved.

The Committee agreed that inclusion of a ten year period in the phaseout rule might be interpreted to mean that surveys only need to be carried out every ten years, rather than more frequently as the Committee had envisaged. Most robustness and multi-stock trials considered by the Committee had assumed an inter-survey interval of five years. It was agreed that, were it possible to separate the issue of appropriate inter-survey intervals from that of the time limit before phaseout of catches began, this latter time limit may be less critical. However, so far the Committee has been unable to devise a way to do this.

Despite the findings of the simulation trials with a ten year inter-survey period described in Item 6.1.3 above, a number of members reiterated their concerns about not invoking phaseouts until the most recent abundance estimates were ten years old. They pointed to other factors that would favour a lower inter-survey interval than ten years that would not and could not be examined in simulation trials alone. These included the desirability of continuity and maintenance of skills by those conducting surveys, and the increased likelihood that unexpected events may be detected, directly or indirectly, by more frequent surveys. Some of these points were raised in SC/44/O 25.

It was pointed out that there was a wide variety of possible types of survey. In relatively small regions, it was feasible to survey the entire area in a single year, or at least most areas occupied by whales during the time of the survey. However, in the Southern Hemisphere, for example, coverage of the entire area south of 60°S in a single year is infeasible using the current methods and the current levels of effort and resources. Instead, it has been the practice to survey segments of the region annually. In past IDCR surveys, the full area is covered every six years. Another case cited covered situations in which only parts of areas for which catch limits are to be set are surveyed annually, with full coverage only being achieved after some years. In this instance, the year to which the estimate of abundance for the whole area is taken to refer, may be important.

Most members felt that allowances needed to be made for cases in which pre-planned surveys carried out at appropriate intervals could occasionally not be completed due to unexpected events, such as bad weather or breakdowns. They also noted that the requirement in the phaseout rule was for completion of assessments by the Scientific Committee within the time period, rather than just completion of surveys. It would not be appropriate for phaseouts to be invoked because of extended delays in completion of an assessment by the Committee. They therefore favoured a longer, rather than shorter, phaseout period within the range five to ten years.

Given these differing factors, the Committee was unable to reach a conclusion on what would be an appropriate period between five and ten years to allow before invoking a phaseout of catches. Accordingly, it **refers** this matter to the Commission.

6.2.2 Other matters relating to draft specification

Additional points inappropriate for inclusion in the annotations to Annex H were made during discussions that the Committee believed should be **drawn to the attention** of the Commission. These are reported below.

Historical catch data prior to initial implementation of the RMP

The draft specification requires that all known removals from each area should be included in the historical catch data used in an assessment. The intent was that this should include both direct catches (including lost whales) from whaling operations, and known indirect catches, such as those resulting from entanglement in fishing gear. While accepting this requirement, several members queried the implications of the word 'known', particularly in relation to the extent to which information on such indirect catches may be actively sought, either from members or non-members of the Commission.

Another query raised was whether it was appropriate to include estimates of indirect catches in the catch history, rather than just known ones. Some members expressed the opinion that it was important that this be done. Others, while not disagreeing, stated that this was a difficult issue that needs further research.

In relation to both these points, attention was drawn to the robustness demonstrated in single stock trials in which the historical catch record was underestimated by up to 50% (*Rep. int. Whal. Commn* 42:272).

The Committee noted that the effects of possible errors in the recording of catches after implementation of the RMP have not been addressed in simulation trials.

Block quotas

Catch limits set in accordance with Item 2.3 of Annex H remain in force for a period of five years unless superseded by a subsequent assessment. These five catch limits are equal, unless subject to the application of the phaseout rule. The setting of fixed annual catch limits to operate over a five year period has similarities to the block quota schemes that the Commission has sometimes used for setting catch limits. The main difference is that the formulation in Annex H does not allow any carryover of catches between seasons whereas this had been allowed in previous block quotas, subject to a fixed total catch over the period of the application of the block quota.

The Committee recognised the operational advantages of these previous forms of block quotas. However, it also noted that unless the extent of carryover between seasons was small, this could constitute a substantial change to the procedure that may require additional simulation trials to be evaluated, possibly involving modelling of the strategies of whaling operations.

The Committee therefore **recommends** that the attention of the Commission be drawn to the possibility that had been raised about incorporation of a block quota in the RMP. It further **recommends** that, subject to the Commission's approval and specification of the form of the proposed block quota, it should consider this possibility further.

Catches taken in excess of catch limits

The question was raised of what account should be taken of any cases within the five year currency of an assessment in which the seasonal catch limit in a Small Area was exceeded. With respect to future catch limits during the currency of the assessment, one suggestion was that these might be adjusted downwards so that the total of the catch limits was not exceeded over the five years.

Adjustments for unbalanced sex ratios

The Committee adopted the procedure for setting separate catch limits for female whales given in Annex H, rather than an alternative formulation in which total combined sex catch limits were adjusted in the light of estimated sex ratios in the historic catches (which had been the method used previously for Southern Hemisphere minke whales). This choice was made primarily because of anticipated difficulties in predicting future sex ratios.

Some members suggested that the approach adopted by the Committee might not be sufficiently flexible from an operational point of view, and that therefore this should be drawn to the attention of the Commission.

6.2.3 Advice on incorporation of the RMP into the Schedule

The Committee has developed a draft specification for calculation of catch limits in a revised management procedure, along with a set of annotations (Annex H). It has recommended that the draft specification itself be formally adopted by the Commission, and that the annotations be endorsed by the Commission (see Item 6.2.1). In seeking endorsement of the annotations, rather than formal adoption by the Commission, the Committee had in mind the more dynamic nature of the annotations. These contain, for example, criteria used by the Committee to select amongst the several options for calculating catch limits. The Committee wished to avoid a situation in which, during an implementation, it wished to vary or add to relevant criteria but might not be able to do so without prior approval from the Commission. Naturally, subsequent endorsement by the Commission would be sought for any resulting amendments to the annotations.

The Committee was unable to advise further on how the draft specification should be handled in terms of a Schedule amendment necessary for the Commission to adopt the RMP. It noted, however, that development of Annex H has been a long and difficult task, involving a wide range of scientific and technical issues. The Committee therefore **recommends** that the Commission exercises great caution before considering any changes to Annex H when developing possible Schedule amendments. It noted that the Chairman of the Committee and the Chairman of the sub-committee on management procedures will be present during the Commission meetings and will be available for consultation in this regard.

6.2.4 Minimum standards for data

This topic had been discussed at the 1992 Special Meeting (IWC/44/4A), in response to the request for advice from the Commission. The Committee noted that there remained matters relating to minimum standards for data and revision of Section VI (Information Required) of the Schedule requiring further consideration. These are discussed below.

Data required for implementation of the RMP

(a) CATCH DATA

Paragraph 24 of the Schedule currently deals with catch data. The Committee reiterated the recommendation in IWC/44/4A that this should be amended to require the position of whale capture to the nearest degree and minute of latitude and longitude. Other information detailed in paragraph 24 should continue to be collected.

(b) ABUNDANCE ESTIMATES

The Committee agreed that plans for survey design and proposed methods of analysis of the resulting data for the purposes of calculating estimates of absolute abundance should be reviewed by the Committee in advance of their being carried out, but that prior approval by the Committee should not be a requirement. An advantage of prior review is that this would facilitate subsequent endorsement of the estimates by the Committee. Additionally, it was considered desirable that those intending to conduct a survey should inform the Commission. This would allow the work of the Committee to be better planned, and ensure that the results of surveys are reported, regardless of the outcome.

The Committee **recommends** that a set of guidelines for conducting surveys and analysing the results should be developed. Ideally, this should include standardised methods of survey design, field procedures and data collection. Similarly, a set of approved methods of analysis should be developed for use by the Committee. Programs for conducting such analyses should be validated by and held at the Secretariat and should be available to accredited scientists. As new methodologies are developed, tested and approved these would then be added to the set of available options.

The questions of data availability and validation were considered. The Committee **recommends** that data for any sightings survey to be used to calculate abundance estimates for the purposes of applying the RMP should be documented and provided to the Secretariat in computer-readable data files before a specified time in advance of the Committee meeting in which the data are to be used. All such data should be archived by the Secretariat in an appropriate database such that abundance estimates can be calculated for any specified Small Areas. Data should be in a fully disaggregated form so that estimates can be recalculated correctly if the boundaries of Management Areas are altered. Once lodged with the Secretariat, these data should be available to accredited scientists as defined in the Committee's Rules of Procedure.

A detailed specification for the required data should be developed by a sub-committee consisting of members involved in conducting sighting surveys and in analysing survey data to produce abundance estimates. The data that would be required fall into two basic categories: firstly, data necessary for standard analyses (e.g. sightings effort data and sightings records) and secondly, ancillary data (as appropriate according to the analyses to be carried out, e.g. dive-time records). A more detailed example specification of such data is given in Appendix 1 of Annex H.

If the Secretariat is to archive all data in a common database, and validate and hold standard programs, there are implications for the Secretariat computing section staffing and costs. These are considered under Items 17 and 18.

(c) MINIMUM STANDARDS FOR SURVEY DESIGN, DATA AND ESTIMATES

Two possible minimum standards were considered by the Committee. These were that there should be a maximum CV of (say) 40% for estimates of absolute abundance for the Medium Areas defined for a species and region, or that a minimum distance steamed on primary shipboard survey effort per unit area of a Medium Area should be specified. In the latter case, this minimum would be calculated for each species and Medium Area, based on the relationship between survey effort and variance for previous surveys in that Medium Area. The Committee agreed that both of these approaches should be investigated further, particularly the latter approach.

The Committee noted that the robustness trials of the effect of uncertainties in estimates of absolute abundance implicitly defined minimum standards for data. If, however, conditions changed such that, for example, the estimates resulting from survey analyses had CVs very different from those tested in the trials, the question of whether or not the new estimates were acceptable could be addressed by further trials.

The Committee noted that, in relation to the estimates of absolute abundance for northeastern Atlantic minke whales described in SC/44/NAB12, both the new methodology described therein and the resulting estimates had been considered in detail in Annex F and subsequently used in implementation trials (see Item 7.2.3).

Data not directly required for implementation of the RMP

The Committee has repeatedly recognised that data currently not used directly by the RMP can play an important role in providing an independent check on the status of populations managed under the RMP. In addition, other important types of biological data are used indirectly, the most obvious example being data clarifying the identity of stocks in different regions.

Various requirements for biological samples are already specified in Paragraph 29 of the Schedule (e.g. earplugs, ovaries). At the 1992 Special Meeting (IWC/44/4A) and in SC/44/O 25, suggestions were made for other biological samples to be provided (e.g. tissue samples for genetic work). The Committee considered that it would be most helpful to replace Paragraph 29 with an 'enabling clause' which stated that in response to advice or requests from the Committee, the Commission could require certain samples/data to be collected from whaling operations. The advantage of such an approach is that any requirements could then be made via a Commission resolution rather than needing a Schedule amendment. A possible form of wording might be:

> 29. Contracting Governments shall arrange for the collection and analysis of such biological samples, tissue samples, specimens and data as the Commission may from time to time decide on the advice of the Scientific Committee. The results of the analyses of these collections shall be reported to the Commission.

The types of samples that were considered likely to be of importance were, for example, those related to reproductive capacity, condition of the animal (e.g. blubber thickness) and various tissue samples to facilitate work on stock identity, growth or contaminant burdens. It was noted that data from such samples could form the basis for a periodic review of evidence for changes in carrying capacity.

Other data referred to in the Schedule, Section VI

Section VI of the Schedule deals with 'Information Required'. The Committee agreed that, although effort data are not presently required for the RMP, it is highly desirable that such data continue to be collected on a routine basis. It was also suggested that the provision for collection of product data should be retained. Such data have proved useful in the past for detecting changes in the condition of whales.

While offering the above advice, the Committee noted that in the time available, it had been unable to complete a full review of Section VI. Lack of comment on the remaining aspects should not be taken to imply that the Committee endorses discontinuing collection of those types of data.

Additional discussion on minimum data standards

As noted above, the Committee has not completed development of guidelines and minimum standards for absolute abundance data and corresponding estimates. There was considerable debate over the possible implications of this, both in terms of potential delays in the Commission adopting a revised management procedure, and the consequent status of estimates of absolute abundance developed at this meeting for minke whales in the North Atlantic and Southern Hemisphere.

Some members stated their view that, as reflected in part in SC/44/O 25, from the point of view of the Commission, a complete revised management procedure for incorporation in the Schedule would include more than a specification of the method for calculating catch limits. They believed that the Commission would also wish to have in place specifications of standards for data and practical means for verification that these are met. While

some of these matters lay outside the terms of reference of the Scientific Committee, particularly the last of these, there were aspects for which scientific input may be needed.

These members believed it important that the Commission receive this additional advice from the Committee as soon as possible, and reiterated the recommendation in Annex D that completion of a set of minimum standards for data and the review of Section VI of the Schedule be accorded high priority.

Other members stated their view that many of the issues referred to were technical rather than scientific, and were more properly discussed by the Commission. While acknowledging that there remained some work to be done on data standards and Schedule Section VI, the fact that this had not been completed was no reason for any delay in adoption by the Commission of the RMP developed by the Committee and implementation for the two regions considered by the Committee at this meeting.

In relation to possible implementation, they noted that the multi-stock robustness trials developed over the years by the Committee were based largely on the types of abundance data available for North Atlantic and Southern Hemisphere minke whales. Furthermore, estimates of abundance for these regions have been discussed and agreed by the Committee. Thus, in their view these data were suitable for use in implementation regardless of whether or not minimum standards have been determined.

Yet other members stated that, while not passing judgment on the specific issue of implementation on particular species and regions, as a matter of principle it was possible to proceed to implementation even if some aspects of data standards remained unfinished.

6.2.5 Further advice on the Commission's 1991 Resolution

In its 1991 resolution, the Commission sought advice from the Scientific Committee on the probability of whaling being inadvertently allowed under the proposed RMP when stock levels are significantly below the protection level of 54%. The Committee investigated this matter at its 1992 Special Meeting and provided quantitative advice in respect of application of the RMP to single known biological stocks (IWC/44/4A, Item 4).

For cases where the RMP is applied to regions containing multiple stocks, there is information relevant to the question in the results of multi-stock trials discussed at the 1992 Special Meeting (IWC/44/4A) and Workshop (IWC/44/4B). However, it is unclear how to interpret these results in terms of quantitative advice on probabilities, because in these cases the boundaries and sizes of the stocks themselves are uncertain. The Committee is unable to provide advice further to that contained in the Report of the Special Meeting (IWC/44/4A).

Appreciation

The Committee expressed its deep appreciation to Kirkwood for his guidance, wisdom and dedication, well beyond the call of duty, over the years of development of the Revised Management Procedure. Without his leadership the Committee would neither have been in a position to recommend that the Commission adopt the Draft Specification given in Annex H, nor have almost completed its work on the initial implementation of the RMP for North Atlantic and Southern Hemisphere minke whales.

7. COMPREHENSIVE ASSESSMENT – IMPLEMENTATION OF THE REVISED MANAGEMENT PROCEDURE

Before starting the process of attempting to implement the RMP for Southern Hemisphere and North Atlantic minke whales, the Committee discussed how far it should attempt to go along this route, and what forms of advice should be given to the Commission. The Chairman reiterated his desire that sufficient work should be completed that would allow the Commission to implement the procedure for these species and regions at its forthcoming meeting, should it wish to do so.

Allison informed the Committee that once it had completed and reviewed implementation simulation trials for the two regions and reached conclusions on the input catch data, the absolute abundance estimates and related variance statistics and the precise methods to be used for calculating catch limits, she would be able to produce these very quickly.

There was considerable debate on whether or not calculated catch limits that would apply in the first years following implementation (which are routinely calculated during implementation simulation trials) should be given in the report of the Committee. Although some members believed that Commissioners may want such information in order to reach conclusions in relation to adoption and implementation of the RMP, the Committee agreed that it would be inappropriate to include it in the report. The Secretariat was instructed not to include these catch limits in the printouts from the various implementation simulation trials.

The Committee was aware that there has been widespread speculation as to the possible size of initial catch limits on implementation of the RMP. It authorised the Chairman to state that initial catch limits have not been calculated by the Committee, and that any such numbers that may be cited are entirely speculative.

The Committee agreed that, should the Commission wish to set catch limits according to the RMP during its forthcoming meeting, these should be calculated by the Secretariat, checked by the Chairman, and then transmitted by him to the Commission.

During discussions of Annex I, the question of whether initial catch limits should be included in the Report was raised again. The Chairman ruled that the Committee would abide by its earlier decision. A minority statement is given in Annex O.

7.1 Southern Hemisphere minke whales (see Annex E)

7.1.1 Stock identity

'Small' Areas

The Committee agreed that for Small Areas, as defined in the Draft Specification for the Calculation of Catch Limits in a Revised Management Procedure for Baleen Whales (Annex H), 10° sectors represented the best present option although this might require revision as more information is obtained.

The decision was based on the results of management trials, assuming that biological stocks each had a core area (equivalent to 'home area' or 'preferred feeding area' as used previously, *Rep. int. Whal. Commn* 41:109) of either 60° or 120° longitude and total ranges of up to 120° or 180° when overlaps are included. That was itself based on the most recent view of the Committee in 1990 (*Rep. int. Whal. Commn* 41:125) that there were five stocks. Of the sizes of Small Areas investigated (10° or 60°), only those trials with

areas of size 10° longitude gave satisfactory results under all the stock identity hypotheses. Small Areas have to be appreciably smaller than biological stock areas because catches are often concentrated at Management Area boundaries.

None of the four papers presented to the meeting contradicted the previous view of the Committee based on feeding concentrations, mark recoveries and knowledge of likely breeding grounds, suggesting a typical span of 60° for biological stocks (*Rep. int. Whal. Commn* 41:113–15).

It was agreed that an appropriate starting point for defining the 10° sectors is the Greenwich meridian (0°). It was also agreed that 60°S is a satisfactory northern boundary except in Areas II and V, where there are more northerly areas with IDCR sightings effort.

'Medium' Areas

Medium Areas are defined in Annex H. On the basis of genetic evidence provided in SC/44/O 26 and SC/44/SHB9, and marking results analysed in SC/44/SHB6, it was agreed that a typical range for stocks, including overlaps, could be represented by 80° of longitude or more, with an overlap of up to 40° with each neighbouring stock. The Committee noted that these conclusions were reached on the basis of almost no data from Areas I and VI.

The Committee reviewed three options for the choice of Medium Area boundaries (Annex E, Appendix 2). Option (i) was for nine Medium Areas each spanning 80° of longitude with a 40° overlap with each of its neighbours; option (ii) was for six Areas each spanning 90° with 30° overlap; option (iii) was for six Areas each spanning 120° with 60° overlap. There was no support for option (iii), which involved Areas larger than the suspected typical range of stocks. Option (i) included an Area straddling the Antarctic Peninsula, which most members considered unlikely.

On balance the Committee preferred option (ii). It was closest to the previous assumptions adopted in 1990, with the addition of an extra area in the South Pacific; it was not inconsistent with the spread of at least 54° longitude indicated by the recovery of two marked whales off Brazil, nor with the genetic conclusions of SC/44/SHB9. It did treat some Small Areas differentially, some being contained in only one, but most in two, Medium Areas; although there was little basis for singling out those particular Small Areas for different treatment, the inconsistency was not believed to be serious.

Arising out of its discussions on Medium Areas, the Committee **recommends** that biopsy sampling be carried out on breeding grounds, to allow further investigation of the discreteness of Southern Hemisphere minke whale stocks. It was also suggested that in addition to the DNA analyses, isozyme analyses should be undertaken to provide more information on stock separation.

7.1.2 Estimates of abundance

7.1.2.1 *Methodology*

IDCR LINE TRANSECTS

Some options for generating abundance estimates by 10° sector were provided in SC/44/SHB3, including assuming constant effective search width and mean school size across 30° sectors, and sighting rates estimated by 10° sector.

The Committee reviewed these options and agreed to the methodology outlined in Annex E (Appendix 3).

Several methodological issues were raised for future consideration. They could not be addressed in advance of obtaining estimates for use at this meeting, but are reviewed in Annex E (Appendix 4).

Arising from those considerations, the Committee **recommends** that:

(i) outstanding coding required for data from IDCR surveys, Japanese scouting vessels, the Japanese research programme, early Japanese non-IDCR surveys, and IDCR cruise transects across lower latitudes, should be completed expeditiously;

(ii) given the obvious advantages that would occur from the development of a database holding such data not only for Southern Hemisphere minke whales but for other stocks and regions, consideration should be given to the development of a database to allow flexible extraction and utilisation of all such data (additional considerations, including appointment of a database manager, are included in Annex E while detailed specifications for such an appointment, including funding and personnel, are considered under Item 17);

(iii) development of a general linear model framework to permit evaluation of alternative models of spatial and temporal distribution be encouraged before the next meeting – a working group convened by Reilly was established to accomplish this.

The Committee agreed to assume, as previously, that in the IDCR surveys, $g(0)=1$ for minke whales.

Given that decisions at this meeting were partly determined on the basis of what was practical, and because some issues require further examination, it was noted that any abundance estimates agreed at this meeting may require subsequent revision.

SCOUTING BOAT AND OTHER DATA

As in some areas there are 'gaps' in IDCR survey effort south of 60°S, the northern boundary of many 10° sectors is in effect south of 60°S. There is strong variation between surveys in the size of such gaps, especially because two vessels were available in some surveys but three in others. RMP trials had been undertaken under the scenarios of different proportions of the stock in the surveyed area in different survey years. For the present meeting it was agreed that estimation should proceed on the basis of zero abundance in the gaps. The IDCR effort had been extended to more northerly latitudes, using scouting boat data, in earlier analyses (SC/42/SHMi18 and SC/43/Mi34). It is desirable that the Committee should be in a position to adopt an agreed methodology for allowing estimation of abundance for such gaps (see Annex E, Appendix 4) at the next meeting if possible. The Working Group convened by Reilly (see (iii) above) will draft a proposal for circulation to the steering group on management procedures before the next meeting.

Additional abundance estimates are available from dedicated Japanese sightings surveys associated with research under special permit and earlier sightings cruises that had not been part of the IDCR programme. These data should be treated in the same way as the scouting boat data; relevant documented surveys are listed in Annex E (Appendix 4, Table 1).

7.1.2.2 *Estimates*

The Committee agreed to adopt abundance estimates obtained during the meeting, given the methodological options already agreed. They are reported in Annex E

(Appendix 5). Some minor errors noted in earlier estimates for Areas II and VI are documented in Annex E (Appendix 6).

7.1.3 Implications of implementation of the RMP

Two documents relating to multi-stock simulation trials for Southern Hemisphere minke whales were available to the Committee. These were SC/44/O 33, which presented results of trials specified at the 1992 Special Meeting (IWC/44/4A) to examine use of catch-cascading, and SC/44/O 34, which contained a number of suggestions for possible improvements to multi-stock trials that the authors believed were more appropriate for addressing this question.

The Committee agreed, in line with its recommendation under Item 6.1.2, that detailed case-specific implementation simulation trials should be carried out in order to determine the extent to which catch-cascading and/or catch-capping would be appropriate when implementing the RMP for Southern Hemisphere minke whales. The task of specifying suitable trials to address this was assigned to an *ad-hoc* Working Group on Implementation Trials set up by the sub-committee on management procedures. Trials developed by that Working Group were to be carried out by the Secretariat. In developing the trials, the Working Group considered results and specifications in SC/44/O 33 and O 34, and incorporated advice on definitions of Management Areas, possible ranges of stocks in the region, and the estimates of absolute abundance and related variance statistics agreed by the sub-committee on Southern Hemisphere baleen whales (Annex E). The report of the Working Group is discussed under Item 7.3.

7.2 North Atlantic minke whales

7.2.1 Stock identity

Two documents presented new information on stock structure. SC/44/NAB3 reported results of comparison of mtDNA sequences of minke whales from Norway and Iceland. The pattern of sequence variation did not accord with geographic origin. These results provide no new information on stock identity.

SC/44/NAB15 reported that allelic frequencies for 29 enzyme systems indicated that whales from Norway and West Greenland came from different populations, as did whales from Iceland and Norway. Taken with results of an earlier paper (SC/42/NHMi24), which had indicated that whales from West Greenland and Iceland were genetically distinct from each other, these results strengthened the existing hypothesis of three breeding stocks.

It was agreed to continue using the Small Areas as defined for previous North Atlantic minke trials (Fig. 1, *Rep. int. Whal. Commn* 42:246–51). Some possible deficiencies in these boundaries were discussed. It was agreed that performance of the RMP would not be sensitive to minor boundary changes, for which time did not allow detailed consideration at this meeting. It was further agreed that a mechanism should be developed for review and revision of Small Area boundaries, the results of which could be important for planning future surveys.

At the 1992 Special Meeting (IWC/44/4A), a correspondence group was set up to document and review the biological information used to define the stock structure hypotheses and values used in the 'mixing matrices', which represent measured or hypothetical exchange rates between Small Areas. The report of that correspondence group (Annex F, Appendix 3) described the various categories of biological information in narrative form, documented the history of the simulation trials used to test the existing hypotheses, and provided references. During the meeting, it was agreed that the numbers used in the mixing matrices should be replaced with a series of qualitative assessments of the advisability of combining Small Areas. Table 1 summarises the advice provided to the sub-committee on management procedures concerning the possibility of interchange of minke whales between Small Areas of the North Atlantic.

7.2.2 Estimates of abundance

Estimation of g(0)

SC/44/NAB17 reported the results of simulation studies of g(0) estimation using duplicate surfacings and survey data. Various models for g(0) were tested against different underlying 'true' distributions, and a new 'Composite Model' proposed. The author concluded that estimates can

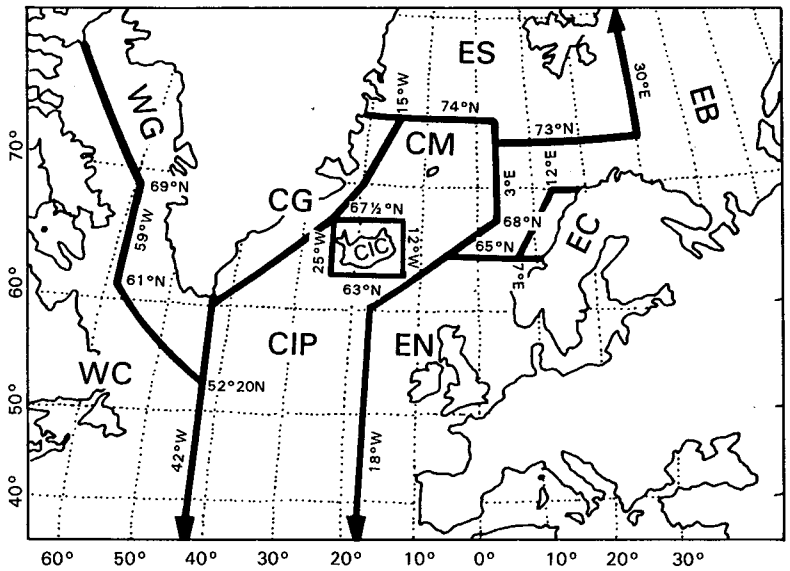

Fig. 1. Small Areas for North Atlantic minke whales.

Table 1

Agreed advice to the sub-committee on management procedures on possibility of interchange between minke whales between small management areas, (see Fig. 1). 'Yes' - strong evidence of exchange; areas can be combined for cascading without sensitivity trials. 'No' - strong evidence of no exchange; areas should not be combined. 'Maybe' - some evidence consistent with exchange, but not conclusive; sensitivity trials should be carried out before deciding whether to cascade. Annex F, Appendix 3 summarises the evidence used for these determinations.

Area Pair	Exchange	Area Pair	Exchange
WG - CG	Maybe	CIC - ES/EB/EC	No
WG - CIP	Maybe	CM - ES	Maybe
WG - CIC	No	CM - EB	Maybe
WG - ES/EB/EC	No	EB - ES	Yes
WG - adjacent	Maybe	EB - EC	Yes
CIP - CIC	Maybe	EB - EN	Maybe
CIC - CM	Maybe	EB/ES - EN	Maybe
CIC - EB	No	EC - EN	Maybe
CIC - CG	Maybe	EC - EB/ES	Yes

be biased if whales react to the vessel, or if the true g(0) model is a combination of objective and subjective functions and the fitted model does not have this structure. The Committee recognised that this paper represented a substantial contribution towards understanding and testing statistical behaviour of methods of estimating the surfacing detection probability function (usually called the hazard probability of sighting) for estimating g(0).

Estimates of abundance for minke whales in the northeastern North Atlantic were reported in SC/44/NAB12, from results of sighting surveys and experiments conducted by Norway between 1988 and 1989. g(0) was estimated by fitting a spatial model for the hazard probability of sighting to the survey data combined with independent observer data, using a recently developed method, maximum simulated likelihood (Schweder and Host, 1992, *Rep. int. Whal. Commn* 42:575–82). The model fitted the observed data well, and gave an estimated g(0) of 0.360. The authors considered that any biases in the estimate of g(0) were likely to be positive, which would result in negative bias in the abundance estimate of 86,736 (CV=0.1655; 95% CI 61,000–117,000).

There was extensive discussion of the results from SC/44/NAB12 and the implications of the simulation results from SC/44/NAB17 for the estimation of g(0) used in making the abundance estimate. It was questioned whether the maximum simulated likelihood method had been tested using simulation techniques to see if it actually did provide maximum likelihood estimates. In response, some additional simulation trials were conducted and presented. While limited in extent due to the short time available, these results supported the conclusion that the method was finding maximum likelihood estimates for the parameters of the hazard rate probability model.

Concerns were also expressed that the simulation results in SC/44/NAB17 indicated that, in some cases, if the underlying true hazard rate probability model was different from the model used to estimate g(0) in SC/44/NAB12, that g(0) could be substantially biased. It was suggested that estimates of g(0) using the Composite Model (SC/44/NAB17) be calculated and compared with the estimates of g(0) in SC/44/NAB12. This was not possible because not all of the data used in SC/44/NAB12 were immediately available, and it was not feasible to do the calculations in Norway because substantial modifications would have to be made to the existing software there.

Considerable debate followed on whether the inability of the Committee to perform the alternative estimation of g(0), which was a consequence of some of the data not being available, compromised the process by which it reviewed results and reached conclusions. The majority of members believed that it did not. They noted that the simulation results of SC/44/NAB17 could be, and had been, used to provide a sufficient basis for evaluating the necessity of performing the suggested calculations before a decision could be made about the acceptability of the g(0) estimate from SC/44/NAB12. The majority of the Committee considered that alternative calculations would, at most, suggest that the g(0) estimate was positively biased, which would result in a negatively biased abundance estimate. Moreover, it was emphasised that the process employed by the Committee to evaluate and review the estimation of g(0) in this case had been very extensive and thorough. Thus, with only a few members dissenting, the Committee agreed that the process used to review results over the past three years had been highly effective at arriving at a solution to the difficult problem of making an estimate for g(0). A minority believed that the unavailability of the data precluded a full evaluation of the estimation of g(0).

After these extensive discussions, and considering previous discussions, the Committee agreed that the estimates of g(0), and abundance and their variances presented in SC/44/NAB12 were the best currently available for the 1988 and 1989 shipboard surveys of the northeastern North Atlantic, and accepted them as such.

The matter of data availability was considered to be of substantial importance, notwithstanding differences of opinion about the immediate effects discussed above. This is discussed under Item 6.2.3.

Best estimates for Small Areas for implementation of the RMP

NORWEGIAN SURVEY DATA

Concerns were expressed about the manner in which the abundance estimates by survey block in SC/44/NAB12 had been prorated to the agreed Small Areas. The scheme which had been used, based on amount of area encompassed by the Small Areas as a proportion of the survey blocks, could result in biased estimates if whale distribution is non-random within the blocks. A preferred method is to prorate based on the frequency of sightings recorded. An *ad hoc* comparison of the two methods made during the meeting indicated that, in this case, there was little difference in the results. The Committee therefore decided to accept the Small Area abundance estimates and accompanying variance statistics.

ICELANDIC 1987 SURVEY DATA

An estimate of abundance and variance for the overall area covered by these data had been previously reviewed and accepted by the Committee (*Rep. int. Whal. Commn* 41:66) but no estimates for the Small Areas had been presented. Estimates were calculated using *ad hoc* methods for both proration methods investigated for the Norwegian survey data to allow an evaluation of the best approach. Calculations made at the meeting indicated that results for the two proration schemes in some cases differed substantially; preference was expressed for the sighting frequency-based results. Given the robustness shown by the RMP to biases in absolute abundance estimates (IWC/44/4B), the Committee agreed that these

estimates were suitable for use in the implementation simulation trials.

The Small Area estimates accepted for use in the implementation simulation trials are given in Table 2.

7.2.3 Implications of implementation of the RMP

The Committee had agreed at the 1992 Special Meeting that unless there was a need for revision of the mixing matrices used in previous trials, sufficient trials had been carried out to allow implementation of the revised management procedure by combining Small Areas and invoking catch-cascading. As noted under 7.2.1, no need to revise mixing matrices had been identified intersessionally by the correspondence group set up by the 1992 Special Meeting or the Steering Group on Management Procedures, so no additional trials had been carried out prior to this meeting. Although no such need had been identified before the meeting, and the results of other trials had reached similar findings (SC/44/NAB8), the Committee agreed that additional implementation simulation trials should be conducted for the following reasons:

(i) the sub-committee on North Atlantic baleen whales had developed the basis for a revised mixing matrix at this meeting (Annex F and Item 7.2.1);
(ii) it would be appropriate to use the actual estimates of absolute abundance and associated variance related statistics calculated by that sub-committee in implementation simulation trials, rather than those used in previous North Atlantic multi-stock trials;
(iii) improved methods of modelling CVs of future surveys in the trials developed during discussions of Southern Hemisphere minke whale implementation simulation trials should also be incorporated in North Atlantic trials.

The Working Group on Implementation Trials was therefore instructed to proceed with specifying and carrying out suitable trials. The Committee noted that the Working Group had experienced some difficulties in incorporating the advice in respect of mixing between Small Areas given by the sub-committee on North Atlantic baleen whales into simulation trials. These were discussed by the sub-committee on management procedures (see Section 5.3.4 of Annex D). The Committee endorsed the solution developed.

The report of the Working Group is given in Annex I and discussed under Item 7.3.

7.3 Results from implementation simulation trials

The Committee received the report of the Working Group on Implementation Trials (Annex I) in the final hours of the meeting. It was not possible for the Committee to review in any detail the extensive results presented. The Committee agreed that the only conclusion that could be reached in the time available was that the results presented confirmed the agreement made at the 1992 Special Meeting (IWC/44/4A) that implementation of the RMP was possible on a Small Area basis for both North Atlantic and Southern Hemisphere minke whales.

The Committee agreed that further consideration of the results presented in Annex I is required before it can determine whether or not catch-cascading is appropriate for the implementation of the RMP for North Atlantic or Southern Hemisphere minke whales, and if so which Small Areas should be combined for this purpose.

The Committee noted that two trials originally specified by the Working Group had not been completed in the time available during this meeting. These addressed (i) whether, for Southern Hemisphere minke whales, catch-capping was appropriate in Antarctic Area II to take

Table 2

Abundance estimates, N (with CVs) for the North Atlantic minke whale stocks by Small Area (as in Fig. 1).

A. Northeast North Atlantic (SC/44/NAB12)

N(CV)	N(CV)	N(CV)	N(CV)
EB 43,786 (0.166)	ES 17,126 (0.204)	EC 3,612 (0.249)	EN 22,213 (0.361)
		Total (E) 86,736 (0.1655)	

B. Central North Atlantic from the NASS surveys (see Annex F, Appendix 9)

(i) By Small Area

	CG	CIP	CIC	CM
Aerial (Iceland '87)			8,645 (0.202)	
Norway '87				4,461 (0.273)
Iceland '89		7,145 (0.280)		
Iceland '87, Block 2		324 (0.250)		
Iceland '87, Block 3	693 (0.275)	780 (0.275)		
Iceland '87, Block 4	862 (0.375)	0 (0.000)		
Iceland '87, Block 6		182 (0.329)	182 (0.329)	
Iceland '87, Block 8			947 (0.329)	1,136 (0.329)
Iceland '87, Block 9				1,793 (0.375)
Total	1,555 (0.260)	8,431 (0.245)	9,774 (0.182)	7,390 (0.198)

(ii) Combinations of Small Areas

Areas	N(CV)	Areas	N(CV)	Areas	N(CV)
CG+CIP	9,986(0.217)	CIP+CM	15,821(0.167)	CG+CIC+CM	18,719(0.128)
CG+CIC	11,329(0.162)	CIC+CM	17,164(0.136)	CIP+CIC+CM	25,595(0.123)
CG+CM	8,945(0.176)	CG+CIP+CIC	19,760(0.144)	CG+CIP+CIC+CM	27,150(0.120)
CIP+CIC	18,205(0.152)	CG+CIP+CM	17,376(0.153)		

account of substantial previous catches off Brazil north of the Small Areas currently defined, and (ii) the effect for North Atlantic minke whales, of an inter-survey of ten years (see Annex I for specification of these trials). The Committee agreed that it was not necessary to specify any further implementation simulation trials for either North Atlantic or Southern Hemisphere minke whales.

The Committee agreed that when these trials had been completed, it would be in a position to develop recommendations to the Commission for the most appropriate options to use when implementing the RMP for North Atlantic or Southern Hemisphere minke whales.

7.4 Requirements for future implementation for other species or regions

The Committee reviewed the process of the development and conducting of implementation simulation trials it had undertaken for North Atlantic and Southern Hemisphere minke whales, with a view to identifying those areas where difficulties had arisen, and to providing advice for possible future implementations for other species or regions.

The Committee noted that there had been some problems in communication between the sub-committee on management procedures and the sub-committees on Southern Hemisphere and North Atlantic baleen whales. While these had been satisfactorily resolved, it agreed that communications would have been enhanced if a comprehensive set of specific questions had been given to the relevant sub-committees at the start of their meeting. It **recommends** that this be done for future implementations.

The Committee noted that, despite working very long hours, the results of implementation simulation trials for Southern Hemisphere and North Atlantic minke whales were only available just before the end of the Scientific Committee meeting, and well after the time allocated to the sub-committee on management procedures had expired.

In the light of its experience this year, the Committee **recommends** that should further implementations be attempted, more time must be allocated to this work. If the implementation is for a species and region for which previous trials did not apply directly, the work should be carried out over two meetings. This would involve the implementation simulation trials being specified at one meeting, on the advice of relevant sub–committees. These trials would be carried out during the intersessional period by the Secretariat, and the results discussed at the next meeting. If the implementation is to be carried out for a species and region more closely matching those already considered, it may be possible to complete this exercise in a single meeting. Implementation to more than one species-region combination should not normally be attempted at one meeting.

The Committee discussed under what circumstances it should undertake an implementation of the RMP for a particular species and region. This is an important issue, given the length of time it takes to complete an implementation and the consequent implications for scheduling the Committee's work. After some discussion, the Committee agreed that it should only undertake an implementation of the RMP to a species and region on instruction from the Commission. It noted that in this context, there was a need for adequate notice to be given, for specification of the species and region, and specification of the type and location of whaling operation contemplated.

8. COMPREHENSIVE ASSESSMENT – STOCKS PREVIOUSLY ASSESSED

8.1 North Atlantic fin whales

8.1.1 Stock identity

SC/44/NAB16 presented preliminary results of studies on genetic variation in fin whales sampled in three areas: off the Canadian east coast; off west and southwest Iceland; and off north Norway. The study reported important methodological results, revealing that it was possible to use skin and blubber samples for isozyme analyses. Only the samples from Canada deviated significantly from expected Hardy-Weinberg frequencies, indicating within-location heterogeneity. This could be due to small sample sizes, the fact that some samples were taken in different years, or the possible existence of more than one population off Canada. Allele frequency analyses indicated significant differences in gene pools between samples from Icelandic and Norwegian waters, Icelandic and Canadian waters, and Canadian and Norwegian waters.

The Committee noted that although the results are preliminary, they are in accordance with results of a recent study of the sequence composition of the mitochondrial D-loop (SC/F91/F32). It **recommends** that these studies be continued and expanded to include larger sample sizes from more areas, and that the alternative explanations for heterogeneity be investigated.

8.1.2 Estimates of abundance and trends in abundance

Results from the 1989 Spanish survey

The Committee had before it new fin whale abundance estimates for the survey blocks covered by the Spanish vessel in NASS-89 (Buckland *et al.*, 1992, *Rep. int. Whal. Commn* 42:457–60). Several stratification factors (sea state, survey block and school size) were examined and a preferred analysis selected. Encounter rate and mean school size were stratified by sea state and survey block, but stratification by school size was found to be unnecessary. Abundance in the Spanish survey blocks was estimated at 17,335 whales (95% CI 10,400–28,900). The previous estimate from 1987 for a smaller area which had been used at the 1991 Special Meeting (*Rep. int. Whal. Commn* 42:595–644) was 4,617 (CV=0.0981; 95% CI 3,800-5,600).

The Committee accepted the new revised estimate as the best available for this area.

At the 1991 Special Meeting, no assessment of the British Isles-Spain-Portugal management stock as presently defined in the Schedule had been carried out. If that stock is assessed and if the assessment of the 'Iberian' sub-area is repeated, this new estimate should be taken into account.

Trends in catch and effort for the East Greenland-Iceland management area

SC/44/NAB1 reported preliminary results of an analysis of Icelandic fin whaling operations with respect to the consequences of geographical and other changes in these from 1959 to 1989. The author believed that the preliminary results suggested that further studies of these data are needed, and that any subsequent analyses of CPUE or biological parameters should consider stratification by locality of catch, bottom topography, and by time period (separating commercial from scientific catch operations).

Other views were also expressed (Item 5.2.2, Annex F). The Committee did not have time for an in-depth discussion of these analyses, but encouraged that the work be continued.

Information from other studies

SC/44/NAB14 reported results of analyses of fin whale blow rates collected at two localities off West Greenland. Rates differed by location, group size and time of day. This should be considered in future studies using cue counting estimates of abundance. The Committee expressed appreciation that these studies had been carried out in response to its recommendation in 1991 (*Rep. int. Whal. Commn* 42:605). It **recommends** that these studies be continued and that other techniques, including VHF radio tracking, be employed to avoid the problem of possible missed surfacings using visual methods.

8.1.3 Future implementation of the Revised Management Procedure

At the 1991 Special Meeting (*Rep. int. Whal. Commn* 42:595–644), a Working Group was established to discuss information required for management trials. The revised report of that Working Group was not reviewed by the Committee. It was forwarded as a working paper to the sub-committee on management procedures but was not discussed.

The Committee noted that prior to this meeting it had been working on the assumption that implementation for North Atlantic fin whales would follow the Comprehensive Assessment. This Item had been placed on the agenda for this reason. However, following discussions under Item 7.4, the Committee now believes that work towards implementation should only be initiated on instruction from the Commission.

8.2 North Pacific minke whales

8.2.1 Future implementation of the Revised Management Procedure

A Comprehensive Assessment of North Pacific minke whales had been undertaken at last year's meeting (*Rep. int. Whal. Commn* 42:64–68; 156–77) and this Item had been placed on the agenda on the understanding that implementation of the RMP would follow. However, following discussions under Item 7.4, the Committee now believes that work towards implementation should only be initiated on instruction from the Commission.

8.3 Northeastern Atlantic minke whales

At last year's meeting, the Norwegian Commissioner had requested advice on the classification of the Northeastern stock of minke whales under Schedule paragraph 10. The Committee did not address this question directly (*Rep. int. Whal. Commn* 42:69). This year the question was again placed on the Committee's Agenda.

The Committee noted that it is currently finalising its advice on a Revised Management Procedure. It is anticipated that this will provide a replacement for the management rules currently in the IWC Schedule. The Draft Specification of the RMP (Annex H) does not envisage any requirement for the Classification of stocks. Application of the RMP to a species and area does not require that the depletion of a stock relative to historical levels be explicitly determined.

Prior to substantive discussion of this Item, Wallløe reported that after consultation with his Commissioner, he was authorised to state that a direct response was not required and that the question could be considered to be withdrawn. He stated that the comments above were sufficient and that the matter would not be raised again by the Norwegian Commissioner in the Commission meeting.

A minority statement, referring to an analysis which was neither discussed nor reviewed by the Committee, is given in Annex O.

9. COMPREHENSIVE ASSESSMENT – STOCKS STILL TO BE ASSESSED

9.1 Southern Hemisphere baleen whales (see Annex E)

9.1.1 Estimates of abundance

9.1.1.1 *Blue, fin, sei and humpback whales*

The Committee considered these four species together, particularly to review the work required to provide detailed assessments in due course.

SC/44/SHB19 provided updated analyses of those reported in 1989 (*Rep. int. Whal. Commn* 40:47), which were based on cruises in the period 1978/79–1983/84. The update included results from the second set of IDCR cruises, 1984/85–1990/91.

The sample sizes of primary sightings were very small, ranging from a total of only 14 sei whale schools to 187 humpback whale schools over the 13 cruises. It had been necessary to pool data to obtain mean school size and effective search half-width. The abundance estimates were only meaningful for the circumpolar areas as a whole. Differences between the results reported now and those obtained earlier arose for several reasons: the areas covered in the two periods were not identical; the estimates for mean school size and effective search half-width were now based on 13 years' data; and there had been an error in the earlier calculation of coefficients of variation.

The results for sei whales were likely to be particularly unreliable because of the very low number of primary sightings of that species.

The results given in SC/44/SHB19 involved extension of the estimates to include the area north to 30°S. The IDCR results south of 60°S were scaled using relative abundance indices derived from Japanese scouting vessel data on sighting rates for 1965/66 to 1976/77.

Concerns over some assumptions used in the extrapolations included:

(1) possible bias in abundance estimates due to the fact that scouting boat data were from an earlier period than the IDCR data;
(2) the assumption of $g(0)=1$;
(3) the likelihood that scouting vessels had operated in areas different from those where concentrated whaling occurred and had concentrated on areas of high whale density;
(4) the method of calculation of pygmy blue whale numbers;
(5) the fundamental problem that the very low densities encountered will inevitably lead to a lack of precision in the estimates.

It was noted that some of these concerns had already been considered for Southern Hemisphere minke whales, under Item 7.1.2.

The Committee agreed that for humpback whales there was greater confidence in the results than for the other species, and believed estimates should be obtained by sub-areas for the next meeting. Recommendations on a breakdown of appropriate areas are provided in Annex E (Appendix 7). The relatively large numbers of sightings

obtained in Japanese dedicated surveys, outside the IDCR programme (see Annex E, Appendix 4, Table 1), particularly in Area IV, should be included in the abundance estimates.

The Committee **recommends** that studies to provide estimates of population size and, where practicable, rates of increase and linkage between areas for humpback whales should be encouraged. These would include photo-identification work and shore-based surveys as appropriate. Results for both, together with stock identity conclusions from genetic studies, should be available for review at the next meeting.

The Committee **recommends** that humpback whale assessments be given priority at the next meeting.

9.1.1.2 *Right whales*

Abundance estimates could not be obtained for right whales because of the extremely low number of primary sightings on the IDCR surveys. However, the Committee **recommends** that studies of current population size and increase rates, important in indicating their recovery, should continue. A Comprehensive Assessment of southern right whales would depend on a much more complete catch database than is currently available. Considerable work would be required to attempt to provide such a database. The Committee agreed this should be given low priority.

9.1.2 Future work

(1) *Possible time frame for Comprehensive Assessments*

Assessments may require a relatively long time frame – possibly three or more years. It was agreed that special methodologies need to be developed, for example, to deal with CPUE data; in this regard data must be encoded in a suitably flexible format.

(2) *Coding priorities*

The Committee adopted the priority proposals listed in Annex E, Item 12.2 for consideration under Item 17.

(3) *Photo-identification data*

The Committee **recommends** that: (i) the Secretary be asked to seek from national groups and individual researchers, listings of the nature and extent of data currently held, by location of sampling for all species where available but for humpback whales in particular; and (ii) the Commission be asked to recognise the importance of coordinated catalogues on the lines of those already being developed for humpback whales in the Northern Hemisphere (*Rep. int. Whal. Commn* (special issue 12):3–40), and to encourage development of similar catalogues for the Southern Hemisphere.

(4) *Incidental sightings data*

A proposal to code existing data from the South Pacific which could provide information relevant to humpback whale stock identity was considered under Item 15.2. The Committee agreed that information should be provided on the availability of incidental sightings data generally, including information on effort. Such data can provide indications of whale distribution, particularly for species such as humpback whales, in areas not otherwise covered by sightings surveys. For example, in the Southwest Pacific/New Zealand area, information on the recovery of right, blue, humpback and other whale species and on seasonality, movement relative to bathymetry and hydrography, behaviour and relative abundance had been obtained. The Committee **recommends** that information on incidental sightings be included in national progress reports in accordance with the guidelines (and see Item 4.2).

9.2 North Atlantic sei whales (see Annex F)

Planning for a future Comprehensive Assessment

SC/44/NAB10 reviewed the past status of sei whales in the North Atlantic and estimates of sei whale abundance for 1987 and 1989 from the Icelandic and Faroese NASS-87 and NASS-89 sightings survey data. The analysis itself was a standard stratified line transect analysis, similar to methods used to analyse the fin whale data. Abundance of sei whales in Icelandic and adjacent waters is estimated as 1,293 whales (CV=0.603; 95% CI 400–3,900) for 1987 and 10,339 whales (CV=0.268; 95% CI 6,100–17,700) for 1989. The difference in these estimates can largely be accounted for by the substantial survey effort in 1989 to the south of the area surveyed in 1987. The Committee accepted the 1989 estimate as the best estimate for the area surveyed.

The Committee noted that this was the first estimate of sei whale abundance for the Iceland-Denmark Strait stock area. It was further noted that although the survey in 1989 was designed to cover the main distribution of this species, the distribution of sightings suggested that animals were present outside the surveyed area, and that this would contribute to a negative bias in the population estimate.

SC/43/Ba8 (revised) reported on the status of Icelandic investigations pertinent to a future Comprehensive Assessment of North Atlantic sei whales. This work included genetic studies and mark-recapture analyses relevant to questions concerning stock identity, analyses to estimate life history parameters and energetic studies on animals caught off Iceland. Catch data are available on computer files. It was not likely that attempts to estimate CPUE indices would be useful because of the mixed sei/fin whale operation during the main sei whaling season.

Some members expressed concern that the lack of samples for genetic studies from areas other than Icelandic waters precluded studies of stock separation for sei whales in the North Atlantic. This will make it difficult to explore alternative hypotheses concerning stock identification which is seen as crucial for the Comprehensive Assessment. However, others considered that the available studies on stock identity for the Iceland-Denmark Strait stock show it to be a homogeneous population (Danielsdottir, 1991, *Rep. int. Whal. Commn* (special issue 13):115–24).

In light of the above, the Committee **recommends** that biopsy sampling be undertaken in Canadian and US waters, e.g. during the YoNAH field programme (SC/44/PS2), and that samples be made available to the relevant researchers. The Committee requests that samples be collected and stored in a manner that allows isozyme as well as DNA analyses. The representatives of YoNAH present reported that they will be pleased to collect such samples if the opportunity arises, provided it does not interfere with the main aims of the programme. Disposition of the samples will be at the discretion of the YoNAH sub-project co-ordinators.

The question of a Comprehensive Assessment of North Atlantic sei whales is considered under Item 11.

9.3 North Pacific Bryde's whales

The Committee noted that Japan would provide an updated status report on the available data for North Pacific Bryde's whales at next year's meeting. This would

include a new abundance estimate for the western North Pacific. Two years ago the Committee agreed that the Comprehensive Assessment should encompass the whole North Pacific (*Rep. int. Whal. Commn* 41:69). The Committee noted that relevant data should also be available in Russia and the USA. It **recommends** that information on data available in these countries be provided to next year's meeting.

9.4 Other

Sigurjónsson believed it would be appropriate for the Committee to reconsider its guidelines for priorities for determining candidates for the Comprehensive Assessment (see Item 11.1). He also thought it should begin to consider how it might carry out in-depth assessments of sperm whales.

10. COMPREHENSIVE ASSESSMENT – METHODOLOGY

10.1 Population Assessment Models

Last year a list of issues pertaining to population dynamics models and the population assessment models which are used to estimate their parameters was drawn up (*Rep. int. Whal. Commn* 42:259–61). Some of these issues have been at least partially addressed, and one new issue has been identified. The status of each of these issues is summarised in Annex J.

Three population assessment model approaches were discussed in greater detail.

(i) Butterworth described paper SC/44/O 22, which presents an improved maximum likelihood fitting procedure for the HITTER/FITTER program. It was noted that problems can arise in fitting population models to data, such as a solution that is only a local minimum, or a spurious minimum arising from the complex shape of the response surface. The improved method involves first finding minima for a set of fixed MSYR values, and then having the automated minimisation routine commence from parameter values corresponding to the lowest of these minima. This procedure was shown to give results for confidence intervals similar to those obtained with the likelihood ratio method used in the non-bootstrap version of HITTER/FITTER for the Eastern North Pacific gray whale, and an example was also given in Appendix 1 of SC/44/O 23 for the Bering/Chukchi/Beaufort Sea bowhead whale population. The bootstrap procedure is, however, computationally intensive.

It was noted that because the response surface being searched in fitting the HITTER/FITTER model may have complex shapes, inspection of this surface prior to accepting results was essential. De la Mare noted that his version of HITTER/FITTER includes such plots, but noted that inspection of each of the many fits required using bootstrap procedures is not feasible. However, it was agreed that it is sufficient to inspect the surface only for the fit to the actual data rather than for every bootstrap replicate. Further, it was noted that if the surface is particularly complex, then estimates of parameter variances using any method would be suspect.

(ii) Raftery described a new statistical methodology for estimating the parameters and outputs of a population dynamics model; the general method is described in SC/44/O 31 and an example application was presented in an addendum to that paper. The method is a modified Bayesian approach utilising importance sampling. To implement the method, information on the input parameter values must be specified, in the form of prior distributions. Further, information available on the prior distributions of the output variables is required, referred to as the output priors. Standard Monte Carlo sampling is conducted in the first step (primary sampling), with the calculation of the population trajectory implied by each randomly drawn set of input parameters. This is followed by a calculation of weights for each of the output trajectories based on the joint probability of that trajectory according to the output priors. The results of the primary sampling are then sampled with probability in proportion to those weights (secondary sampling), to give posterior or 'post-model' distributions for each of the inputs and outputs.

A discussion of the nature of and requirements for the specification of the priors on the inputs and on the outputs followed. It was noted that some priors can be taken as the sampling distributions of estimated quantities, while others are inherently intangible and their specification necessarily involves more subjective judgments integrating many sources of information.

(iii) De la Mare outlined the methods described in SC/43/O 19, which are designed to address assessment cases where the age of recruitment varies. This may be the case, for example, when there has been more than one catching operation with different age-specific selectivities, or when one operation has changed over time. The approach taken is to model both the length and age structure of the population simultaneously. The basics of the model are outlined, as a generalisation of a length-specific model developed for sperm whales, but the application differs in that changes in length structure are not proposed to be used as a criterion for fitting the model.

Validation of computer programs

The need for validation of computer programs implementing population assessment models was identified last year, and a timetable established for submitting completed programs with appropriate documentation was established. Two programs (de la Mare; Punt and Butterworth) were submitted, but completing the validation was given a lower priority than work on the catch limit algorithm of the RMP. In light of this and the high cost, at least in staff time, of completing such validation, the issue was reconsidered.

It was noted that the population dynamics model in both of these programs is similar, being based on original code by de la Mare. It was also noted that having this model validated separately from the estimation algorithms, possibly as a subroutine with a complete mathematical specification, would be useful to other groups which may be developing population dynamics models and estimation procedures. Further, the Secretariat indicated that if a common population dynamics model subroutine was used by both the de la Mare and the Punt and Butterworth programs, validation would be considerably quicker.

Based on these needs, the Committee **recommends** that the developers create a common subroutine and document both the computer code and the algebraic specification before further validation of programs implementing complete population assessment models of this type is

undertaken. It was agreed that this would require correspondence and may require a meeting of two or three days among at least three people. It was also noted that funding such a meeting would probably be more cost efficient than undertaking the task of validation of two different versions of the population dynamics model. It was suggested that this initial step could be completed by the end of the calendar year.

Priorities for future work

Primary focus will likely be on further development of three modelling approaches, one on inclusion of density dependence in adult mortality (Butterworth and Punt), one on direct use of length data (de la Mare) and one on the use of Bayesian approaches (Raftery, Givens and Zeh).

High priority during the year should be given to developing and validating a single common subroutine embodying the HITTER/FITTER population dynamics model and, subsequent to that work, to validating the computer programs for the Butterworth and Punt and the de la Mare population assessment models.

10.2 MSY rates

As previously agreed by the Committee (IWC/44/4A), a working group was convened by Fowler to develop draft terms of reference and a draft agenda to consider the question of maximum sustainable yield rates (MSYRs) at the 1993 Annual Meeting. The Committee reviewed and agreed Draft Terms of Reference and a Proposed Agenda for the 1993 meeting (Annex K). It agreed that interested members should provide the convener with suggested revisions before next year's Annual Meeting. The Committee also agreed that members attending should bring to the meeting one copy of any relevant background documents for use by participants.

10.3 Implications for whale management of interspecific interactions

Last year the Committee endorsed a recommendation arising out of the Special Meeting on North Atlantic Fin Whales concerning a Workshop on multi-species interactions, feeding ecology and marine ecosystems with special reference to whales (*Rep. int. Whal. Commn* 42:60).

The Committee discussed a draft proposal for such a Workshop focussing on the North Atlantic. Discussion centred on whether it was appropriate to focus on the North Atlantic and on the degree to which the terms of reference should relate specifically to the management of whales. It was agreed that interested scientists should consult informally with scientists from ICES and other appropriate organisations on this matter with a view to presenting revised proposals next year.

The sub-committee on Southern Hemisphere baleen whales had recommended that a comprehensive review of the food and feeding habits of Southern Hemisphere baleen whales should be undertaken (Annex E). The study has already been recognised to be important to the Committee and is relevant to the CCAMLR request for specific information on the needs of krill predators in specified regions of the Antarctic (see Item 5.2). The Committee **endorses** this recommendation and noted that this work might be carried out by Japanese scientists. Should this not be the case, then it might be appropriate to consider putting the study out to contract.

The Committee also recognised the importance of the development of multispecies models (Annex E) and agreed that at next year's meeting the Working Group on Population Assessment Models should address the issue of the most appropriate way to proceed. It was noted that models involving indicator species and interactions between baleen whales may be more relevant to the Committee's work than broad ecosystem modelling.

In making that recommendation, it is recognised that single species assessments should continue; they should proceed in parallel with, and not be supplanted by, multispecies assessments.

10.4 Data inventories

Last year the Committee had recommended that Chile, Peru and New Zealand be urged to submit data inventory forms. Donovan reported that some of the data inventory forms had been received from Chile and Peru. Cawthorn advised the Committee that some New Zealand catch effort and aerial sightings effort forms have been recovered and submitted to the Commission this year. He noted that most pre-1960 data were believed lost in a fire at the National Archive in 1958. Other relevant data continue to be sought. The Committee urges that the outstanding data inventory forms be submitted.

11. COMPREHENSIVE ASSESSMENT – FUTURE WORK

11.1 Priority work

The Committee agreed that its highest priority continued to be work associated with the Revised Management Procedure and its implementation.

The Committee also agreed that the Comprehensive Assessment of Southern Hemisphere baleen whales should continue and that humpback whale assessments should be given priority at the next meeting.

The Committee had insufficient time to discuss priorities for future comprehensive assessments but agreed to review the criteria which had been previously agreed (*Rep. int. Whal. Commn* 39:41) to determine these priorities. It noted, however, the discussions on North Atlantic sei whales under Item 9.2 and on North Pacific Bryde's whales under Item 9.3.

11.2 Intersessional Working Groups and meetings

The Working Groups on Populations Assessment Models and on MSYR were re-established under the convenorships of Smith and Fowler, respectively.

The Committee did not identify a need for an intersessional meeting but noted that if the Commission adopted an RMP and wished to implement it for North Atlantic or Southern Hemisphere minke whales before the next annual meeting, a Special Meeting of the Committee would be necessary (Item 7.3).

11.3 Work plan for 1992/93

Revised Management Procedure

Under Item 6.1.5, the Committee had agreed that full documentation of the catch limit algorithm was essential and that further documentation of the control program was also desirable. Under Item 6.2.4, the Committee recommended that a set of guidelines for conducting surveys and analysing the results should be developed. Under Item 7.3, the Committee agreed that the remaining implementation simulation trials for North Atlantic and Southern Hemisphere minke whales specified by the Working Group on Implementation Trials (Annex I) should be completed as soon as possible and the results

circulated to the Committee. These results will need to be considered at a full meeting of the Committee before recommendations can be made to the Commission on implementation of the RMP for North Atlantic and Southern Hemisphere minke whales.

Kirkwood was no longer able to convene the Steering Group on Management Procedures; the Committee agreed that the Chairman should appoint a new convenor as soon as possible.

Comprehensive Assessment of Southern Hemisphere baleen whales

Details of the work required for humpback whales are given under Item 9.1. In addition, several methodological tasks concerning estimates of abundance of minke whales were identified under Item 7.1.2.1. Bannister was appointed to convene the sub-committee on Southern Hemisphere baleen whales to meet next year.

The priority tasks of the Working Group on Population Assessment Models and the Working Group on MSYR are described under Items 10.1 and 10.2, respectively.

12. WHALE SANCTUARIES

The Committee had two items on sanctuaries to discuss. The Chairman noted that the Committee's discussions should only encompass scientific issues. Legal and technical matters are the responsibility of the Commission. The Committee recognised that there were many issues regarding sanctuaries common to both proposals. These are discussed here. Specific aspects of individual proposals are dealt with under Items 12.1 and 12.2. The discussion focussed on two main topics:

(1) the value of sanctuaries as a management tool; and
(2) the value of sanctuaries for research.

Holt and Slooten believed that, despite the dedicated and competent work carried out by the Committee in developing the RMP and the extensive testing of it with respect to uncertainty, the possibility that it might be flawed in some aspect could not be ruled out. In their view, the lack of substantive feedback and the less than exhaustive testing of some possible hypotheses regarding stock identity, migrations and population dynamics, meant that an approach to guard against possible major error is desirable. They felt that the designation of one or more sanctuaries in which the RMP would formally apply but in which its application would be held in abeyance represented a reasonable management approach. They noted that such an approach was not inconsistent with that taken for other groups of renewable resources. They saw sanctuaries as a management tool complementing the RMP. In addition to serving as a 'reserve' against error they noted that sanctuaries might also serve secondary purposes such as providing areas for research and comparison with other exploited populations. De la Mare drew attention to previous Committee discussions which had examined the relative merits of sanctuaries (e.g. *Rep. int. Whal. Commn* 30:48–9; 31:58–9) as a management tool and in promoting and facilitating research.

Several members commented that the RMP represented the culmination of several years of extensive development and had been tested against uncertainty with a rigour unparalleled in the management of any biological resource. They also noted that the RMP being proposed was not intended to be considered unchanging and the potential for modification and improvement was explicit in its development and suggested implementation. With regard to criticism by Holt and Slooten of the 'lack of substantive feedback' in the RMP, they believed that this was misplaced for reasons related to the tuning of the procedure as outlined in the report of this Committee under Item 6.1.3 (paragraph 5). The RMP had been developed to provide safe management in the absence of sanctuary areas. It was noted that the Committee had developed a substantial framework for evaluating management options using simulation studies. This might be adapted to provide a useful method for answering questions of an ecological nature that the Commission might ask. Only if the Scientific Committee develops such a methodology and if the Commission asks appropriate questions will it be possible to provide advice on the matter of sanctuaries. While there is potential value for sanctuaries in providing a 'control' area for comparison with exploited areas, this could only succeed if major research and monitoring programmes were designed and carried out.

Smith noted that the utility of sanctuaries can only be evaluated scientifically in the context of the information which would become available from it under specific research or data collection programmes. In the absence of concrete proposals for such specific data collection programmes, the utility of any specific sanctuary as a management tool cannot be evaluated in the way that other management tools have been evaluated in recent years. He believed that substantial additional study was required before the Committee could provide specific advice on this issue.

There was some disagreement as to whether sanctuaries hindered or encouraged research, and reference was made to previous discussions of the Committee (e.g. *Rep. int. Whal. Commn* 30:48–9; 31:58–9). Specific comments are made under Items 12.1 and 12.2.

12.1 Indian Ocean Sanctuary

The Committee had before it IWC/44/20, a proposal by the Government of the Seychelles to make the Indian Ocean Sanctuary a sanctuary for an indefinite period.

The most recent discussions of this issue by the Committee were in 1989 (*Rep. int. Whal. Commn* 40:72–3). The Commission's attention is drawn to that discussion. The Committee noted that thus far plans for implementing the RMP did not include catches within the current boundaries of the Sanctuary.

Holt noted that discussions of the RMP had so far centred on feeding grounds. He believed that the Indian Ocean could fill a management role by giving full protection to some breeding stocks. He noted that an extensive research programme had been drawn up since the inception of the Sanctuary (Leatherwood and Donovan, eds, 1991, UNEP *Mar. Mammal Tech. Rep.* 3). Lack of progress in this programme reflected lack of financial support from within and outside the Commission and limitations of expertise and facilities in many coastal states.

Several members commented on the apparent lack of research within the Sanctuary since its inception. They believed that if the area was to be considered as a 'control' area, then it was essential that a monitoring programme be developed and implemented. Ohsumi believed that there was now almost no substantial whale research being carried out in the Sanctuary. Best referred to the fact that if breeding stocks were to be considered a focus for research within the Sanctuary, then, for some species at least (e.g. humpback whales), a mechanism should be established to

facilitate research within 200 mile EEZs. Holt believed that a sufficient global mechanism existed under the Law of the Sea.

Smith, referring to his earlier comments, believed that substantial additional information on detailed research programmes was needed before the Committee could provide specific advice on this proposal. Polacheck noted that in the context of management, the available information suggested that the Indian Ocean Sanctuary would not serve as a 'failsafe' for the RMP even were one considered necessary. Zeh further noted that she believed the Indian Ocean Sanctuary would provide a poor 'control' area.

12.2 Proposal by the Government of France for a sanctuary in the Southern Hemisphere

The Committee had before it IWC/44/19, a proposal for a 'Southern Ocean Whale Sanctuary' by the Government of France[1]. In view of some questions regarding the inclusion of this Item on the Agenda, the Chairman stated that, following consultations with the Chairman of the Commission, the proposal would be discussed by the Committee, but not as a high priority item.

The proposal was introduced by Pascal. He stated that the aim of the proposal was to supplement the regulatory measures of the future RMP, by allowing for the recovery and/or the protection of at least one population of each different Southern Hemisphere whale species, taking into consideration the totality of the area where the life cycle of these populations is actually supposed to take place. The proposal is intended to take into consideration a complex of species and populations. He stated that scientific knowledge, data and concepts are also behind the proposal. He believed it was essential to have the advice of the Scientific Committee on diverse scientific topics. Some arguments which seemed to be most important are detailed as 'Suggested questions to the Scientific Committee' (Paragraphs 50 to 54, IWC/44/19). He clarified that he considered that the RMP theoretically gives a good guarantee that overexploitation will not occur. However, until the Commission has had some years of experience of its use he could not be sure how effective it would be in practice. Holt and Senn supported this rationale.

The Commission's attention is drawn to the general discussion of the value or otherwise of sanctuaries as a complementary management tool to the RMP given under Item 12.

Several members noted that Paragraph 40 of the proposal stated that a long-term monitoring programme be requested of the Scientific Committee *after* the adoption of the proposed sanctuary. They noted that this was symptomatic of a general problem with the proposal in that it appeared to specify and adopt a management tool before its utility and specific form had been tested. This was contrary to the Committee's recently developed method of working with respect to developing and testing such tools. They believed the specifics of management actions must be designed in the context of an evaluation of their likely value in the form in which they might be implemented in a long-term management programme.

Blix commented that the proposed Sanctuary covered an area for which other international organisations had management interests e.g. CCAMLR and SCAR. He also believed that for the foreseeable future the RMP would give protection in the area to all whale species except the minke whale. While he recognised that at present there was considerable uncertainty over the hypothesis that the blue whale was being hindered in its recovery due to competition with minke whales and other krill feeders, he believed it was unwise to rule out the possibility of culling, should future data suggest it was necessary.

Holt and de la Mare emphasised the uncertainty concerning the blue whale competition hypothesis (e.g. noting the observed increase in humpback whales) but noted that a Sanctuary did not necessarily preclude culling should the Commission conclude it was necessary, after long and careful consideration that this might be beneficial.

Swartz noted that while some part of the Antarctic might potentially serve as a 'control' area in a management context, he believed suggesting the whole of the Antarctic was inappropriate. In this regard Best noted that one implication of treating the whole of the Antarctic as a control, was that the 'treatment' areas would be the North Atlantic and the North Pacific. This appeared scientifically unsound. He drew attention to recent findings that the genetic distance between Northern and Southern Hemisphere minke whales was greater than distances between recognised species such as sei and Bryde's whales. He noted that under these circumstances, the choice of the whole of the Antarctic was contrary to the logic of those Committee members who believed inter-specific analogy was inappropriate. Schweder believed that to specify an entire circumpolar sanctuary was scientifically unsound and that there was no valid scientific justification for this presented in the proposal.

Best and Ohsumi believed that the establishment of the proposed sanctuary would result in a major reduction in cetacean research in the area, and particularly open ocean research. Holt, however, believed that the establishment of a sanctuary may well serve as an incentive to research. He thought the benefits of such incentives could be seen in the reservation of Antarctic and adjacent seas for scientific research under the Antarctic Treaty.

Several members commented that the proposal did not provide sufficient scientific information for the Committee to address it in detail. They reiterated that its value or otherwise as a management tool should be evaluated using simulation studies in the context of the RMP. With respect to the specific questions in paragraphs 50–54 of the proposal, they did not believe that they addressed the important scientific issues concerning the proposal.

Pascal responded that he believed the simulation methods used in developing the RMP could not be universally employed to evaluate all such proposed measures. He noted that the questions posed were not intended to limit discussion. If there were more important scientific questions these should be formulated and considered.

The Committee agreed that irrespective of their value it could not address the specific questions in the proposal in the time available. Comments on those questions from two members are given as Annexes L1 and L2.

13. ABORIGINAL SUBSISTENCE WHALING

13.1 Aboriginal Subsistence Whaling Scheme

Last year the Committee drew attention to the three broad objectives for the management of aboriginal subsistence whaling that had been accepted by the Commission in 1981 (*Rep. int. Whal. Commn* (special issue 4):84), and reaffirmed its view from 1990 that a full discussion of any

[1] *Editor's note.* This is included as Appendix 4 of the Chairman's Report of the Forty-forth Meeting and published in this volume.

new management scheme for aboriginal whaling could only usefully take place after a revised management procedure for commercial whaling had been established. The Committee had noted the importance of defined objectives to the development of revised management procedures and had requested that the Commission consider the question of objectives and provide the Committee with advice that could be used in the development of a new aboriginal subsistence whaling scheme (*Rep. int. Whal. Commn* 42:58). The Commission had agreed with the view put forward by the Committee but provided no further advice.

In the discussion this year, several members expressed the view that the Committee could profitably start considering the scientific problems inherent in the present aboriginal subsistence whaling scheme, and that this item should be given priority on the agenda for next year's meeting, if specific advice were received from the Commission.

13.2 Implications of carrying over catch limits or strikes

The Committee noted that last year the Commission had proposed that the Committee should examine the implications of carrying over catch limits or strikes when it is revising aboriginal subsistence whaling procedures (*Rep. int. Whal. Commn* 42:32). The intention of the USA to work with the Committee on this matter was welcomed.

13.3 Bering-Chukchi-Beaufort Seas stock of bowhead whales

The Working Group on Population Assessment Models (Annex J) had discussed papers SC/44/O 23 and SC/44/O 31, as they relate to this Item. The Working Group noted that there had been substantial advances in methods for estimating the parameters of necessary models, and some progress in comparing alternative biological models. However, the example calculations did not necessarily provide improved estimates of critical quantities. Further development of the methods might allow their application during the 1993 meeting, if needed, but the Working Group anticipated that substantial further work was needed before an assessment using this procedure could usefully be conducted.

Attempts to undertake simultaneous ice edge visual and acoustic censuses and aerial surveys were unsuccessful this year due to severe ice conditions, but it is planned that these studies will be undertaken in 1993 and it is hoped to provide data for a new assessment of this stock in 1994. A full assessment could only be completed in 1994 if time is allocated at the 1993 annual meeting for a full discussion of the new methodologies and their application.

The Committee noted that during the 1991 Alaskan subsistence hunt, 46 strikes resulted in 27 whales landed. One whale from this stock was taken by Canada.

This stock was most recently assessed by the Committee in 1991 (*Rep. int. Whal. Commn* 42:137–155). The advice given to the Commission at that time was (*Rep. int. Whal. Commn* 42:63–4):

> As in previous years, the Committee was unable to determine a value for the MSY level for this stock. It is therefore unable to provide advice in strict accordance with the Aboriginal Whaling Scheme. However, the Committee noted that the stock was clearly well above a 'minimum stock level ... below which whales shall not be taken' (Schedule Paragraph 13a)
>
> The Committee noted that the present catch limit is 44 strikes per year. Average annual rates of increase, over 1992–1994, can be calculated from the projections tabled above [*Rep. int. Whal. Commn* 42:63, Table 1]. These rates, as a percentage of 1992 population size, are 0.7% for the lower bound estimates and 2.5% for the 'most probable' estimates. Rates of increase above or below this range could occur with a smaller or larger hunting mortality, respectively.

The Committee had received no new information this year which would cause it to change this advice and reiterates the recommendations given last year (*Rep. int. Whal. Commn* 42:64).

13.4 North Pacific eastern stock of gray whales

SC/44/PS1 presented new analyses of the 1987/88 counts of gray whales passing Monterey, California. The correction factors used in obtaining the comprehensive assessment estimate of 21,113 (CV=0.0326, 95% CI 19,800–22,500) animals were re-examined and revised where appropriate. The double count data were analysed using logistic regression to adjust for the effects on detection probability of school size, distance offshore, visibility, wind speed, direction, observer etc. The correction to school size estimates was revised, and variance more fully accounted for. A correction for night passage rate was introduced. A provisional abundance estimate of 23,859 animals (CV=0.0536, 95% CI 21,500–26,500) was obtained. Further revision of the methods is likely to lead to a reduction in this estimate, but an increase in its variance. Generalised linear modelling of the sequence of estimates from 1967/68 to 1987/88 was carried out for predicting abundance as a function of year, and as an alternative method for estimating variances.

The Committee agreed that additional data on whales passing during night time collected by use of VHF radio tracking would be of value.

The most recent assessment of this stock was undertaken at the Comprehensive Assessment Special Meeting on Gray Whales in 1990 (IWC/42/4A). The Committee's most recent advice on the stock was given in 1991 and is a repetition of the advice given in 1990 as summarised in the Chairman's Report of the 42nd Meeting (*Rep. int. Whal. Commn* 41:29):

> Although the Scientific Committee was unable to determine the minimum level below which catches should not be taken, as required by the aboriginal subsistence management scheme, it agreed that the Eastern stock was well above any such level.
>
> The Scientific Committee noted the calculations of average sustainable yield of 670 whales (CI 490–850) and agreed that the current annual catch level of 179 was below the sustainable yield for this stock

The Committee had received no new information this year which would cause it to change this advice. It noted that the 1991 catch data had not been reported.

13.5 West Greenland and Central stocks of minke whales

Last year, the Commission set a catch limit for the years 1992, 1993 and 1994 for the West Greenland stock of minke whales. Thus, there was no need for advice on this stock this year.

The Central stock was most recently considered by the Committee in 1990 as part of the Comprehensive Assessment of North Atlantic minke whales (*Rep. int. Whal. Commn* 41:132–71) when a best estimate of abundance of 28,000 (approximate 95% CI 21,600 – 31,400) was accepted. The Committee has not given specific advice in relation to the aboriginal subsistence hunt conducted by Greenland on this stock. The Commission has in the past noted the information on abundance provided by the Committee on this stock, and established a catch limit of 12 animals.

The Committee had no new information this year on these two stocks on which to base any advice.

13.6 North Atlantic West Greenland stock of fin whales

The Committee provided the following management advice on this stock in 1989 (*Rep. int. Whal. Commn* 40:45):

> The Committee was unable to provide advice on classification of this stock because (i) there was no information to allow determination of whether or not it constituted a separate stock and (ii) if it was a separate stock there was no information with which to determine its status in relation to MSY level, initial level or replacement yield.
>
> If it is a separate stock, the small estimate of stock size and its approximate lower bound of 763 are a cause for concern. In particular, the Committee is unable to conclude whether or not the stock is above the minimum level below which aboriginal catches should not be taken.

At its 1991 Special Meeting, the Committee accepted a revised population estimate with a lower bound of 520, but no management advice was given (*Rep. int. Whal. Commn* 42:595–644). Last year the Committee reiterated its 1989 advice, while noting the new lower bound for the population estimate, but also stating its belief that it was unlikely that West Greenland fin whales constituted a separate stock (*Rep. int. Whal. Commn* 42:71).

New information on blow rates for fin whales from this stock was presented this year (SC/44/NAB14; Annex F). The Committee noted a revised population estimate for this stock area of 1,096 whales (CV=0.35; 95% CI 563–2,130) as discussed in *Rep. int. Whal. Commn* 42:606.

The Committee was not in a position to give any new advice this year, and reiterates its advice of earlier years.

14. SCIENTIFIC PERMITS

14.1 Review of research results based on existing Scientific Permits

14.1.1 Japan

Ohsumi briefly presented the results of the work carried out on Southern Hemisphere minke whales during the 1991/92 season in Area IV, the second time this Area had been covered. He noted that the programme had been in operation for five years. A large number of papers had been presented to the Committee over this period. In response to comments from the Committee, one vessel was dedicated to sightings alone, to increase sighting effort. The research in 1991/92 took place from December to March. A total of 616 primary sightings (2,061 animals) and 478 secondary sightings (1,668 whales) had been made during a total searching distance of 18,205 n.miles. Density was higher in the west, the reverse of two years ago. A total of 288 animals was taken (165 males and 123 females). Further details are given in SC/44/SHB11. Results from the overall programme were given in a series of papers presented to the meeting. These are summarised very briefly below.

SC/44/SHB7 continued theoretical studies on the estimation of mean natural mortality rates from the research catches using a Bayesian approach. Two papers (SC/44/SHB12 and 13) addressed studies of hormone levels. A new technique that may allow the estimation of the reproductive status of females from biopsy samples was described. Evidence from males suggested seasonal inactivity of the testes. SC/44/SHB9 examined the stock identity of minke whales using mt-DNA techniques (see Item 7.1.1). Abundance estimates from the 1990/91 cruise are presented in SC/44/SHB8, along with a discussion of their comparability with IDCR cruise estimates. SC/44/SHB10 examines monthly and area changes in the distribution and segregation of minke whales in Areas IV and V using the data from the research permit catches.

Comments and discussion

Insufficient time was available to discuss these in any detail. Several members commented on the high quality of the work described. Some aspects of these papers are referred to under Item 14.2.1.

14.1.2 Norway

A total of 51 minke whales had been taken between 1988 and 1990 under a Norwegian pilot study programme (SC/40/Mi7; SC/41/NHMi12) concentrating on methodological aspects of feeding physiology, digestion and energetics of minke whales in the northeastern Atlantic. Earlier results from this programme were discussed by the Committee in 1989 (*Rep. int. Whal. Commn* 40:64), 1990 (*Rep. int. Whal. Commn* 41:71) and 1991 (*Rep. int. Whal. Commn* 42:73).

Blix summarised the new information available at this meeting. Markussen *et al.* (1992, *ICES J. Mar. Sci.* 49:317–23) used a physiologically based simulation model to obtain a preliminary estimate of the food composition of minke whales in the northeastern Atlantic, incorporating information from the programme. Folkow and Blix (1992, *Acta Physiol. Scand.* 146:141–50) examined the available data and presented estimates of the metabolic rates of minke whales in cold waters. Ryg *et al.* (In press, *J. Zool., Lond.*) included minke whales in their examination of the scaling of morphological variables that influence total insulation in seals and whales. SC/44/NAB9 examined the *in vitro* digestibility of different minke whale prey species. The results indicated the high digestibility of the common prey species and suggested that minke whales have little difficulty, from a physiological perspective, of changing from one species to another.

Comments and discussion

In the short discussion that followed, Blix noted that the *in vitro* techniques being used followed standard physiological procedures in such studies. Albert commented on the high quality of the work carried out. Polacheck and Lyrholm commented on the need for associated variance statistics with any metabolic rates presented, particularly if such estimates are to be used in simulation models such as MULTSPEC (see Item 14.2.2).

14.2 Review of new or revised Scientific Permit proposals

14.2.1 Japan

The Committee noted that the proposal (SC/44/SHB14) was a continuation of the programme it had discussed extensively before (e.g. *Rep. int. Whal. Commn* 38:56–7; 39:76; 41:72–4; 42:73). It draws the Commission's attention to those discussions which are not repeated here. It further noted that the population estimate for Area V, where the research is to be carried out, is 294,610 (95% CI 225,000–386,000). The planned sample size is 300±10%. The plan had been slightly revised to take into account some of the comments made by the Committee in 1991 (*Rep. int. Whal. Commn* 42:73). In summary the changes are: (i) the immediate focus has been changed from age-specific natural mortality to average natural mortality; and (ii) as last year, sighting effort is being increased by devoting one vessel exclusively to sightings.

De la Mare noted that the heterogeneity in the samples by age and sex revealed in the results so far, particularly for Area V, showed that despite the careful design, the

realised sample was not representative of the population and that correcting for this may be difficult. Referring to the discussions of last year he noted that obtaining suitable estimates of natural mortality would take longer than envisaged.

Smith noted with appreciation the extensive effort and analysis that had been put into the programme. He particularly welcomed the change in emphasis to the question of average mortality and the increase in sighting effort. While noting that the attempt in this programme to achieve a representative sample was considerably better than any previous attempts to achieve this elsewhere, he noted that heterogeneity remained a cause for concern. He suggested that priority should be given to finding ways to improve the sampling procedure so that the data may allow more to be learnt of the seasonal and annual variability in minke whale distribution and segregation, which may be causing this heterogeneity.

Cooke noted that much of the material presented was of great interest, particularly the sightings data, which provided information on yearly variability in distribution. He suggested that the estimates should be presented in a format suitable for use in the RMP (see Annex E).

Kishino noted that some problems remained in simultaneously carrying out sighting and sampling work. Although the abundance estimates cannot as yet be viewed as reliable as those from the IDCR cruises for the reasons documented in SC/44/SHB8, improvements are being made for future surveys and analysis.

Sigurjónsson commented on the overall value of the work being carried out and referred to his comments of last year (*Rep. int. Whal. Commn* 42:73). In particular he commented on the major improvement in techniques for hormonal studies as documented in SC/44/SHB12. Schweder expressed his appreciation of the valuable papers presented, particularly SC/44/SHB7. However, he was disappointed that insufficient time was available to give them the attention that they deserved.

Ohsumi expressed his thanks for the positive and constructive comments received. He stated that he would review these comments in further consideration of the programme.

14.2.2 Norway

Given the importance of the MULTSPEC model (SC/44/O 9) to any discussion of the Norwegian proposal (SC/44/NAB18), the Committee agreed to examine this before addressing the guidelines for the review of research permits given in *Rep. int. Whal. Commn* 39:154.

Tjelmeland introduced SC/44/O 9. He noted that at its present stage of development, it was ready to be used for the management of capelin via the mature capelin-cod subsystem. To this end, the area structured MULTSPEC and an area integrated version (CAPSEX) incorporating only the cod-capelin-herring interactions had been used. The major feature of MULTSPEC is its area structure – unlike other models (e.g. MSVPA for the North Sea) the food suitabilities have no geographical overlap term and may thus be thought of in terms of ambient food concentrations. Another feature of MULTSPEC is that it assumes that input stock estimates (from acoustic surveys, VPA analyses or sighting surveys) are absolute estimates of abundance. Effort is being made to improve the VPA estimates in particular. The interaction between cod and other fish is estimated from stomach samples. Unlike MSVPA, stomachs are sampled each year (50,000 since 1989) and the temperature-dependent stomach evacuation rate is determined from laboratory experiments.

The development of MULTSPEC is a step-by-step process. The results so far have allowed progress on the capelin-cod subsystem to the level that it can be used for the management of capelin stocks. They have already given a considerably different perspective to that shown by the previous single species model.

Other parameters than those relating to cod predation on mature capelin used in the model are at present assumed 'non-unlikely' values based on a qualitative understanding of the major aspects of the ecosystem. The resultant estimated predation mortality for minke whales on capelin and cod represents 1/4–1/3 of the total natural mortality. However the main finding arising out of the simulations so far is the complexity that occurs when moving from a single-species to a multi-species approach. The direct effect on the capelin stock of increasing the minke whale stock by about 60% is rather small, and probably within the range of uncertainty in any capelin quotas as shown by CAPSEX. This is due to the limited geographical overlap of the two species and the counteracting effect of a reduced cod stock. However altering the suitability of cod as minke whale prey has a more dramatic effect on the capelin stock. The simulations thus show the importance of discovering more about the predation of minke whales on cod and other species, particularly herring which also plays a vital role in cod-capelin dynamics. In this respect coastal Areas 3 and 4 in the research proposal are especially important.

With respect to the direct minke whale-capelin interaction, it is particularly important to obtain knowledge of how the minke whale migrates into the area at the beginning of the season. At the same time knowledge of capelin movements in April-May require better monitoring. In this regard, Area 4 of the proposal is particularly important.

In summary, Tjelmeland noted that simulation studies revealed that minke whale predation on cod, even if it may be small, may be the most important factor to quantify in terms of the management of fish stocks.

Comments and discussion

In addition to SC/44/NAB18 and SC/44/O 9, the proposers had submitted the programme to ICES for review. The ICES comments[2] and the proposers response are given as Annex M. Several members of the Committee commented on the value of this, particularly in view of the considerable experience in ICES in multi-species fisheries modelling.

Holt raised a number of points concerning the purpose of the model, the choice of major species and the appropriateness of treating all other predation as a constant natural mortality particularly in terms of a model of local mass/energy exchange. He also found it difficult to identify the density-dependent features of the model with respect to the marine mammal elements and believed that a diagrammatic representation of the model, indicating *inter alia* which parameters were assumed constant would be helpful.

[2] Two reviews are included in the Annex. The first was carried out by selective members of the Multispecies Assessment Working Group, Study Group on the Analysis of Feeding Data and the Planning Group on Stomach Sampling while the second was done by a member of the study group on pilot whales. ICES informed us that neither review 'necessarily reflects any official position by ICES. They merely reflect the scientific views of some scientists within the ICES umbrella.'

Tjelmeland responded that the model was a tool for examining general relationships among the major species identified and as yet was not intended to address direct management issues. At present the primary aim is to assess the spawning stock of capelin (which could not be measured directly). The secondary aim is to forecast the growth of cod stocks. It is believed that most of the dynamics of the Barents Sea system is expressed by the major fish species (capelin, cod, herring and polar cod).

Stokes noted that the lower trophic levels, and particularly krill, were probably of more importance than top predators such as minke whales to the dynamics of the system and that the minke whale 'compartment' should probably be regarded as fine tuning rather than as being critical to the model. In view of the importance of such multi-species models in fisheries management and possibly in the management of whales, he proposed that a workshop be held that included experts from outside the Committee (see Item 10.3). Raftery suggested that the uncertainty surrounding the large number of assumed parameters in the model might well swamp any improvements likely to be achieved by obtaining better estimates of parameters in the minke whale component. De la Mare noted that it was appropriate for this Committee to comment on the whale component of MULTSPEC. He and Lankester noted that in the model, whales did not appear to be affected by their environment since recruitment, natural mortality and growth were all assumed constant.

In response Tjelmeland commented that he agreed with many of the points raised. It was the uncertainty in many of the parameters that the Norwegian programme was intended to address. While he agreed that krill warranted a separate compartment in any plankton/oceanography modelling, rather than being subsumed under 'plankton' as it was now, sampling and assessment of krill was not well advanced, although increased effort was being put into this. It was intended to work in a systematic way to obtain and improve estimates of all parameters and compartments when practical.

The Committee then examined the proposal in detail according to the guidelines given in *Rep. int. Whal. Commn* 39:154. Walløe introduced SC/44/NAB18 which detailed the proposal to evaluate the ecological importance of minke whales in the northeastern Atlantic. The proposal was slightly modified from that provided last year to the Committee as an information document. Much of the methodology is that used and developed during the 1988–1990 pilot study discussed previously by the Committee (*Rep. int. Whal. Commn* 39:56–9; 40:69–70; 41:71–2). That study had referred to the need for further larger catches when the results had been analysed. He noted that the 1992 catch of 110 minke whales was due to be taken soon after the Commission meeting and that 99 whales of the 136 whales which are planned for 1993 would be taken before and during next year's Scientific Committee and Commission meeting.

(A) The Proposal

The relevant guidelines are as follows:

'A statement as to whether the permit proposal adequately specifies the four sets of information required under paragraph 30 of the Schedule.' (*Rep. int. Whal. Commn* 36: 133)

1. 'Objectives of the research;' (Sched. Para 30)
2. 'Number, sex, size and stock of the animals to be taken;' (Sched. Para. 30)

Proposers' summary

The main objective of the research is to provide information on minke whale feeding ecology based on whale stomach sampling and concurrent estimates of prey availability, and changes in energetic status of the species in certain key areas of the northeastern Atlantic during the period March-October. The sampling design permits evaluation of both food selection and the relative contribution of various food items to the minke whale diet. The proposed research, therefore, will provide a better basis for the incorporation of minke whales in the multispecies model (MULTSPEC) which is now being developed for the northeastern Atlantic area. In addition to the information needed for the feeding ecology studies, other information of relevance to the management of whales as well as their surrounding biotic and abiotic environment (demography, productivity, stock identification, pollution, parasites etc.) will be obtained from the whales sampled (SC/44/NAB18).

The search operations preceding the catch will be scientifically controlled to ensure random sampling of whales, irrespective of the size and sex of the animals. The proposed research requires sampling 110 animals from the northeastern stock of North Atlantic minke whales during July and August of 1992, and 136 animals during the period April-October in each of the two following years.

Comments and discussion

In discussion Stokes commented that he found it difficult to separate the aims and objectives of the proposal as presented in SC/44/NAB18.

(B) Objectives

The relevant guidelines are as follows:

1. 'Comments on the objectives of the research to be carried out under the proposed scientific permit, including in particular how they might relate to research needs identified by the Scientific Committee.' (*Rep. int. Whal. Commn* 36: 133)
2. 'The proposed research is intended and structured accordingly to contribute information essential for rational management of the stock;' (*Rep. int. Whal. Commn* 37: 25)
3. 'The research addresses a question or questions that should be answered in order to conduct the comprehensive assessment or to meet other critically important research needs;' (*Rep. int. Whal. Commn* 38: 27–28)
4. 'The number, age and sex of whales to be taken are necessary to complete the research and will facilitate the conduct of the comprehensive assessment;' (*Rep. int. Whal. Commn* 37: 25)
5. 'Whales will be killed in a manner consistent with the provisions of Section III of the Schedule, due regard being had to whether there are compelling scientific reasons to the contrary.' (*Rep. int. Whal. Commn* 37: 25)
   This was later clarified by the Commission to refer to the use of non-explosive harpoons. (*Rep. int. Whal. Commn* 38: 12)
6. 'The research is likely to yield results leading to reliable answers to the question or questions being addressed.' (*Rep. int. Whal. Commn* 38: 27–28)

Proposers' summary

The main objective of the proposed research is to provide information on minke whale feeding ecology to meet critically important research needs for future multispecies management of the northeastern Atlantic area (see SC/44/NAB18).

It is argued (SC/44/NAB18) that the research also addresses questions that should be answered in order to meet research needs related to future improvements in management of this whale stock, but that the expected information is not important in the context of the

comprehensive assessment and the revised management procedure now under development.

The aims of the research are stated more specifically in SC/44/NAB18 in the Summary, in the Introduction and in section 5.

The sampling design is based on statistical analyses and is aimed at keeping the catch to the lowest possible level, and chosen to optimise performance with respect to future calculations of the relative consumption of the various prey items over the northeastern Atlantic (SC/44/NAB18).

The whales will be killed in a manner consistent with the provisions of Section III of the Schedule, i.e. by using harpoon guns equipped with 22g penthrite grenades (SC/44/NAB18).

The aim of the proposed research is to obtain estimates of the relative contribution of the various food items to an average diet of the whales occurring in an area and a period. By combining this information with previous estimates of energy expenditure and energy utilisation of food, and with results from sightings surveys and ongoing behaviour/telemetry studies, food consumption of individual whales and of the whole population in question can be estimated. Comparison of results from stomach analysis and concurrent resource surveys yields the possibility that selection probabilities for the various prey items can be estimated.

In addition to answering the main questions addressed, the proposed research is also likely to provide answers to important questions relating to demography, productivity, stock identity, pollution and possible future non-lethal studies.

Comments and discussion

In discussion, the Committee noted that the research was not intended to address management questions nor contribute towards the Comprehensive Assessment. Holt, de la Mare, Stokes and Polacheck cited the earlier discussion of MULTSPEC and believed that the information that might be obtained was relevant to the 'fine tuning' of MULTSPEC and thus could not be considered a 'critically' important research need. Raftery referred to his earlier comments on the uncertainty of such a multi-parametric model.

In response Walløe explained that he believed that the research programme addressed critically important research needs both in the context of the MULTSPEC model and in the wider context of general feeding ecology in the Barents Sea ecosystem not connected with any particular model. Schweder noted that in terms of the question of uncertainty, the results of the first year of sampling will be incorporated into a sensitivity analysis to look at the functional form of any prey-preference relationships.

Sigurjónsson commented that he considered that the programme should not just be viewed in the context of a complex and ambitious model alone but rather that it would provide important information on the ecology of both whales and fish stocks and particularly the relationship between minke whales and capelin. He also thought that the information from the programme was potentially of long term significance for management. Ohsumi believed that the programme would provide ecological information that may be important in the future comprehensive assessments of the remaining North Atlantic baleen whale species and in future attempts at multi-species management.

(C) Methodology

The relevant guidelines are as follows:-

1. 'Comments on the methodology of the proposed research and an evaluation of the likelihood that the methodology will lead to achievements of the scientific objectives. These comments may also include evaluation of the methodology in terms of current scientific knowledge.' (*Rep. int. Whal. Commn* 36: 133)
2. 'The objectives of the research are not practically and scientifically feasible through non-lethal research techniques;' (*Rep. int. Whal. Commn* 37: 25)
3. 'The research addresses a question or questions that cannot be answered by analysis of existing data and/or use of non-lethal research techniques;' (*Rep. int. Whal. Commn* 38: 27–28)

Proposers' summary

A thorough description of the survey design and the analytical and statistical methods planned to be applied to the problems addressed is given in SC/44/NAB18. The following is a brief summary.

Minke whales will be sampled in five different areas in Norwegian and adjacent waters during one (1992) and three (1993 and 1994) periods of the year. The whales will be sampled randomly along predetermined transects within each area. Concurrent surveys of prey resources will be performed in all areas and periods.

Based on statistical analyses aimed to optimise performance with respect to future calculations of relative consumption, a sampling, implying a take of 110 minke whales in 1992 and 136 animals in each of the two subsequent years (the minimum required), has been designed.

Stomach contents will be analysed according to methods generally used in diet studies of top predators. Results from the stomach analyses will be used to evaluate the relative composition of minke whale diets in the various areas. Comparison of stomach data with results from the concurrent resource surveys will provide the opportunity to obtain answers to questions concerning possible selectivity in minke whale prey choice.

One important reason to conduct the proposed research is the lack of relevant historical data. It is also evident that the objectives of the research are not practically and scientifically feasible through non-lethal research techniques (SC/44/NAB18). However, after the relative diet composition and the food selectivity have been estimated in direct studies of minke whale stomachs, data on prey availability in combination with non-lethal studies of whales (sightings, telemetry, behaviour studies, etc.) may be of use when estimates of the quantity of the various prey items consumed by minke whales are needed at a later stage.

Comments and discussion

In discussion, Smith noted that the comments from ICES had raised two inter-related methodological issues that he did not feel had been satisfactorily answered. These concerned the collection of whale sightings data during the fishery resource surveys and the spatial and temporal scale of the overall study. The ICES review had noted that the sightings data would considerably enhance the value of the stomach contents data and promote a better understanding of the co-distribution of minke whales and their prey. The 1992 programme does not include the collection of such data, assuming that previous summer sighting data will be sufficient. This assumes an unproven low inter-annual variability in minke whale distribution. Some idea of the validity of this could perhaps have been obtained by examining previous fishery resource data but this was not done. Without information on inter-annual variability and

an indication of an appropriate field methodology, the utility of the proposal is severely reduced.

Lankester noted that the estimated sample size was dependent on a number of decisive assumptions for which there was no relevant data. Schweder responded that the proposal had used the limited information available but pointed out that lack of knowledge was the very reason that the programme was necessary.

Sigurjónsson made a number of comments. Firstly, he believed that the overall research was well-planned and revealed a high level of expertise and effort by Norwegian scientists. However, he thought that inter-annual variability might reveal a need to carry out a larger sampling programme than envisaged. He noted that the random sampling design covered both inshore and offshore waters using six vessels simultaneously in different regions. While he recognised the value of some of the non-lethal techniques suggested in SC/44/NAB13, as supplementary tools to the Norwegian proposal, he believed that the authors had not fully appreciated the practical difficulties in using them on the scale envisaged. The paper gave no indication of the time needed to obtain useful results. In particular, many of the studies referred to used the photo-identification of minke whales in sheltered North Pacific coastal waters. He thought it unlikely that these could easily be transferred to offshore North Atlantic waters and doubted that the requirements to photo-identify whales and collect faeces samples according to a random sampling strategy could be met. He concluded that the non-lethal research techniques could not replace the lethal methods proposed.

While recognising the value of the fish resource surveys and whale sighting surveys, Lyrholm did not believe that the lethal aspects of the programme would give suitably reliable estimates of feeding rates. In particular, in view of likely temporal and spatial variability in whale and prey distribution, variability in foraging strategies in a patchy environment, and shortcomings in the stomach analysis methodology, he believed that non-lethal approaches such as those in SC/44/NAB13 would provide better information on the feeding ecology of minke whales in the context of modern foraging ecology. He also believed that this complex ecological problem required a long-term approach. Holt concurred with this view, noting that such information which would be of value to future multi-species modelling, could not be obtained using lethal methods.

Lockyer commented on the value of the techniques outlined in SC/44/NAB13, particularly that regarding the analysis of free-fatty acids in the blubber to provide information on the feeding history of individuals. However, she noted that some results could currently only be obtained using lethal methods and believed that a combination of non-lethal and lethal techniques represented the most comprehensive approach. This view was shared by Kato, Blix and Ohsumi.

Ohsumi believed this programme represented an excellent example of how feeding ecology research programmes should be carried out. He stressed the need to ensure that the associated data on prey distribution must be collected and noted that the question of sample size might need to be revised to take into account the fact that some animals may have empty stomachs.

In response to comments made above, Wallløe noted the value of complementing the data collected from the sampled whales with data obtained using non-lethal techniques such as those outlined in SC/44/NAB13. He noted that the programme envisaged the use of such techniques and noted that they would be increasingly used after baseline data had been obtained from the three-year sampling programme. He did not believe further catches would be necessary after this period.

(D) Effect of catches on the 'stock'

The relevant guidelines are:

1. 'A review of the most recent information on the stock or stocks concerned, including information on any exploitation, stock analysis and recommendations by the Scientific Committee to date (including, where appropriate, alternative analyses and conclusions and points of controversy).' (*Rep. int. Whal. Commn* 36: 133)
2. 'An evaluation of the specification in the permit proposal of 'possible effect on conservation of the stock'. As appropriate, the Scientific Committee may carry out its own analysis of the possible effects. (*Rep. int. Whal. Commn* 36: 133)
3. 'The research can be conducted without adversely affecting the overall status and trends of the stock in question or the success of the comprehensive assessment of such stocks;' (*Rep. int. Whal. Commn* 38: 27–28)

Proposers' summary

The Scientific Committee had agreed last year that the best available estimate for northeast Atlantic minke whales based on the then current information was 68,447 (*Rep. int. Whal. Commn* 42:58). The proposers stated that proposed sample sizes of 110 in 1992 and 136 in each of the two following years will not affect the conservation of the stock.

Comments and discussion

In response to questions, Wallløe noted that should catch limits be established for this area under the RMP, this would be taken into account in that if the limit is higher than the proposed permit catch, only the difference would be available for commercial whaling operations. Should the catch limit be less than the proposed permit catch, the full permit catch would be taken but no commercial whaling would then be allowed under the RMP. He emphasised that no permit catches beyond 1994 were envisaged.

The Committee had agreed a new population estimate for this area of 86,736 (CV 0.1655; 95% CI 61,000-117,000). The Committee believed that the take of 382 whales over the three year period would have little effect on the status of the stock. However it believed that the effect of a small take for a short period would always be negligible. The Committee noted that the stock is currently classified as a Protection Stock in the Schedule. This is discussed further under Item 8.3.

(E) Research co-operation

The relevant guideline is:-

1. 'Comments on the adequacy and implications of specified arrangements for participation by scientist of other nations.' (*Rep. int. Whal. Commn* 36: 133).

Data could be collected for research projects in other nations upon request and there will also be opportunities for participation in the research by scientists of other nations to the extent allowed by accommodation and other logistic considerations, provided that such participation does not cause inconveniences for the proposed research operations (SC/44/NAB18).

Comments and discussion

The Committee agreed that the proposal adequately specified such arrangements. Wallløe noted that these arrangements had been included in the document provided

last year. No Scientific Committee members had asked to participate in the 1992 season. Data were being collected on behalf of several institutions.

14.2.3 Russia

The proposal received ('Russian Program for Research of Whales in the Sea of Okhotsk') arrived by fax to the Secretariat with no covering letter. Despite the lack of information as to whether this was an official submission from the Government of Russia, the Committee agreed to proceed on the assumption that it was. The proposal appeared to be a slightly modified version of one discussed last year (*Rep. int. Whal. Commn* 42:73–5).

The Committee reviewed the proposal only with respect to the proposed lethal taking of minke whales from the waters of the Okhotsk Sea. It noted that the proposed lethal research was apparently part of a wider programme, but no details of this were given. At its 1986 meeting, the Committee had agreed that documents on any proposed scientific permits should be provided to the Secretary at least 60 days in advance of an Annual Meeting of the Scientific Committee so that the proposal and supporting documentation may be sent out at the same time as the provisional Agenda (*Rep. int. Whal. Commn* 36:20). Last year's proposal had been received only 20 days before the Annual Meeting. The present paper had arrived 9 days *after* the start of the meeting. The Committee agreed it was unacceptable to expect it to be able to review adequately even a well-prepared written proposal presented in person at such short notice. The Committee **strongly recommends** that such proposals be submitted at least 60 days in advance of an Annual Meeting and that they be presented in sufficient detail for them to be reviewed in the light of the usual guidelines (*Rep. int. Whal. Commn* 39:154). In the absence of any Russian scientists at the meeting, and because of the rather brief and inadequate description in the Russian proposal, it was possible to make only the following comments.

(A) The Proposal

The relevant guideline is as follows:

'A statement as to whether the permit proposal adequately specifies the four sets of information required under paragraph 30 of the Schedule.' (*Rep. int. Whal. Commn.* 36:133)

1. 'Objectives of the research;' (Sched. Para. 30)
2. 'Number, sex, size and stock of the animals to be taken;' (Sched. Para. 30)

The main objective of the research is to obtain material that will provide morphological and physiological characteristics of the populations. In addition, biological samples will be collected for determining age, sexual and physical maturity, and reproductive condition. Stomach contents will also be examined to investigate the role of minke whales in the food web.

The proposal envisages a catch of 100 minke whales. No selection for size or sex will be made of the minke whales taken. No information was available on future catches after 1992 although the proposal intimated that this was a multi-year programme. All catches will be from the Okhotsk Sea but the proposal did not specify the stock from which animals would be taken nor did it provide details of the geographic area within which catching would occur.

Based on discussion of North Pacific minke whales at last year's meeting (*Rep. int. Whal. Commn* 42:156–9), the Committee noted that whales killed in the Okhotsk Sea might be from two previously accepted stock divisions, the Okhotsk Sea-West Pacific and Sea of Japan-Yellow Sea-East China Sea.

The Committee noted that the proposal had not adequately specified the objectives of the research.

(B) Objectives

The relevant guidelines are as follows:

1. 'Comments on the objectives of the research to be carried out under the proposed scientific permit, including in particular how they might relate to research needs identified by the Scientific Committee;' (*Rep. int. Whal. Commn* 36:133)
2. 'The proposed research is intended, and structured accordingly to contribute information essential for rational management of the stock;' (*Rep. int. Whal. Commn* 37:25)
3. 'The research addresses a question or questions that should be answered in order to conduct the comprehensive assessment or to meet other critically important research need;' (*Rep. int. Whal. Commn* 38:27–8
4. 'The number, age and sex of whales to be taken are necessary to complete the research and will facilitate the conduct of the comprehensive assessment;' (*Rep. int. Whal. Commn* 37:25)
5. 'Whales will be killed in a manner consistent with the provisions of Section III of the schedule, due regard being had to whether there are compelling scientific reasons to the contrary;' (*Rep. int. Whal. Commn* 37:25)
   [The Commission agreed that it has been intended by this for the Committee to report if cold grenade harpoons were used in special permit catches.(*Rep. int. Whal. Commn* 38:13)]
6. 'The research is likely to yield results leading to reliable answers to the questions being addressed;' (*Rep.int.Whal.Commn* 38:27–28)

There is insufficient information given regarding methodology to be able to comment on sample size. No reasons are given in the proposal justifying sample sizes other than that the proponents believe that such catches will not deplete the stock (see D below). There is no statement of the method of killing to be used.

(C) Methodology

The relevant guidelines are as follows:

1. 'Comments on the methodology of the proposed research and an evaluation of the likelihood that the methodology will lead to achievement of the scientific objectives. These comments may also include evaluation of the methodology in terms of current scientific knowledge;' (*Rep. int. Whal. Commn* 36:133)
2. 'The objectives of the research are not practically and scientifically feasible through non-lethal research techniques;' (*Rep. int. Whal. Commn* 37:25)
3. 'The research addresses a question or questions that cannot be answered by analysis of existing data and/or use of non-lethal research techniques;' (*Rep. int. Whal. Commn* 38:27–28)

Despite the lack of detailed information several observations were made on the methodology proposed. It was observed that morphological analysis would only be useful if similar suites of information were available for other areas of the Pacific. To the Committee's knowledge, no such other suites of information exist. In addition, difficulties in interpreting variation in morphological characteristics from the view point of population genetics were pointed out (*Rep. int. Whal. Commn* 40:90). The value of such data would be further limited given the mixing of populations in the southern Okhotsk Sea noted under (A) above.

It was noted that this proposal includes mention of some biopsy sampling for genetic studies, as advised by the Committee last year. However, not enough information is included on experimental design and other aspects of methodology to allow the Committee to evaluate the likelihood of success in achieving the stated aims. The Committee drew attention to the value of biopsy sampling and subsequent genetic analysis (*Rep. int. Whal. Commn* (special issue 13):3–21).

With respect to the allozyme protein analysis, Sigurjónsson noted that a considerable body of comparable data from other areas was available (e.g. Wada *et al.*, 1991, *Rep. int. Whal. Commn* (special issue 13):125–54; SC/44/NAB15). If suitable methodology was applied, tissue samples from this area might be of some value in stock identity studies.

The Committee noted that the generally poor level of information given in the proposal made it difficult to comment in detail on the methodology or to ascertain the likelihood of the scientific objectives being met.

(D) Effect of catches on the 'stock'

The relevant guidelines are:

1. 'A review of the most recent information on the stock or stocks concerned, including information on any exploitation, stock analysis and recommendations by the Scientific Committee to date (including, where appropriate, alternative analysis and conclusions and points of controversy).' (*Rep. int. Whal. Commn* 36:133)
2. 'An evaluation of the specification in the permit proposal of possible effect on conservation of the stock. As appropriate the Scientific Committee may carry out its own analyses of the possible effects.' (*Rep. int. Whal. Commn* 36:133)
3. 'The research can be conducted without adversely affecting the overall status and trends of the stock in question or the success of comprehensive assessment of such stocks;' (*Rep. int. Whal. Commn*38:27–28)

The Committee noted the abundance estimate of whales in the Okhotsk Sea of 19,209 (95% CI 10,069–36,645) given last year (*Rep. int. Whal. Commn* 42:65–6). It also noted that some degree of mixing from animals from two populations occurred in the Okhotsk Sea north of Japan, at least in April. There was insufficient information to allow minke whales from the Sea of Japan-Yellow Sea-East China Sea stock area to have been assessed as part of the Comprehensive Assessment of North Pacific minke whales last year. The stock is currently classified as a Protection Stock by the Commission. It is not possible to say what proportion of the proposed catch will be from each of the two populations nor what the levels of mixing might be.

(E) Research co-operation

The relevant guideline is:

1. 'Comment on the adequacy and implications of specified arrangements for participation by scientists of other nations'. (*Rep. int. Whal. Commn* 36:133)

The proposal stated that the plan included the 'participation of foreign specialists'. However the arrangements were not specified nor were the dates of the research period specified. The Committee agreed that the information provided was inadequate.

15. SECOND INTERNATIONAL DECADE OF CETACEAN RESEARCH

15.1 Review results from 1991/92

(a) IWC/IDCR Southern Hemisphere minke whale cruise 1991/92

The report of the 1991/92 cruise is given as SC/44/SHB4. It was noted that the analysis of the 1990/91 cruise data was not yet complete. It was expected that it would be completed by the end of September. The data for the 1991/92 cruise will be validated by the Secretariat and the analysis put out to contract.

(b) 'Distribution and abundance of humpback whales on their southern Mozambique breeding grounds'

A report of a cruise to study the above is given in SC/44/SHB5.

(c) Humpback whales wintering off northwestern Australia

A report on this work is given in SC/44/O 8.

(d) Genetic variability and stock identity of humpback whales, worldwide

A report on this work is given in SC/44/O 7.

15.2 Review proposals for 1992/93

15.2.1 IWC/IDCR Southern Hemisphere minke whale cruise 1992/93

The Committee noted with appreciation that the Government of Japan had again allocated resources and vessels for a cruise. Details of the cruise are given in Annex N. It is provisionally proposed that the cruise be carried out in the west of Area III, between 0°-50°E. However, it was agreed that if the preparation of a detailed cruise track suggested that this area was too large to achieve adequate coverage, the longitudinal boundaries could be changed at the pre-cruise planning meeting, provided that complete 10° sectors south of 60°S were covered.

Given the Committee's current interest in southern baleen whales other than minke whales (Item 9.1), it **recommends** that every opportunity should be taken to take individual identification photographs and biopsy samples from humpback, blue and right whales during closing mode. It was noted that this would not interfere with the primary purpose of the cruise. The Committee agreed that the cruise budget should enable the cruise leader to attend the Annual Meeting (Item 18.1).

15.2.2 Other

The Committee reviewed two research proposals submitted to the meeting (SC/44/RP1, SC/44/RP2) and a further two arising during the meeting. Each proposal was considered on the basis of its relevance to the Commission's work, the scientific quality of the project, its chances of success, the scientific competence of the proposers, the feasibility of the work schedule and the reasonableness of the budget.

(i) The Dampier Archipelago Humpback Whale Project, Western Australia (SC/44/RP1). A request for funding for data handling expenses at $2,450/£1,400.

The project is an ongoing proposal (in its second year) to undertake a population study of Southern Hemisphere Group IV humpback whales over a period of five years and to determine the relationship of the stock to breeding aggregations elsewhere in the Southern Hemisphere, using photo-identification techniques. The Committee agreed that this project was relevant to its work, that the competence of the proposers was good and that the budget was reasonable. There was some doubt expressed as to the chance of obtaining reliable population estimates in time for next year's meeting because of the large numbers of photographs needed for this. This was, to some extent, reflected in the referee's reports, along with several other relevant criticisms. It was also pointed out that the value of the project in addressing stock identity questions will depend on whether the fluke photographs can be compared with others from the Southern Hemisphere. The Committee, however, accepted the proponents' response to the referees' reports and agreed that, in the light of the

modest proposal for expenditure, it was a project worth supporting and thus **recommends** it for funding.

(ii) Genetic variability and Stock Identity of Humpback Whales Part II (SC/44/RP2). A request for partial funding of £9,500.

This is a continuation of a project already funded by the Commission (SC/44/O 7). It aims to describe the genetic identity of humpback whale stocks in the Southern Hemisphere based on analysis of mtDNA variation in already available samples from Group IV, V, and VI-I stocks in the Southern Ocean. Direct (i.e. demographic) estimates of migratory interchange, based on the results of Discovery marking data and photo-identification data, where available, will be compared with phylogeographic analysis of mtDNA variation.

The Committee agreed that the proposal was relevant to the Commission's interests, that it was of high scientific quality, the chances of success were good and that the proponent was highly competent.

There was some question as to whether the proponent could keep to the time schedule proposed. However, given his past record, the Committee agreed that this would be feasible and thus **recommends** the project for funding.

(iii) Geographic Information System (GIS) analysis of the distribution of major whale species in the South Pacific, and their relationship to environmental parameters. Partial funding of £5,000.

This was a proposal to establish a GIS computer database of approximately 6,000 incidental whale sightings collected from many sources (commercial shipping, yachts, aircraft, coastal observers, whale watching fleets and research programmes) and analyse this information in order to enhance understanding of distribution and migration patterns of the major species in the area. These analyses were to be extended in a second year to include physical oceanographic parameters.

The Committee agreed that, although the proponent had overestimated the potential of analytical studies of incidental sightings, such a database would be useful. It also agreed that if the system was expanded to include other areas (ideally the entire Southern Ocean) and if the data were readily accessible to other researchers, it would be of further interest to the IWC. The Committee **recommends** that the project be partially funded (£5,000).

15.3 Disposition of IDCR photo-ID and biopsy specimens

The Committee discussed the disposition of biopsy samples collected during the IDCR cruises. Given the discussions under Item 9.1 and especially the identification of humpback whales as a priority species, the Committee agreed that the question of the disposition of biopsy samples from blue and humpback whales at least should be considered carefully by the Committee, as should the possibility that their analysis be given out to contract.

It was agreed that institutions requesting biopsy specimens should be requested to submit research proposals according to the Committee's guidelines. These would then be reviewed by the Committee at Annual Meetings.

The Committee also agreed that the Secretariat should continue to try to obtain the negatives and prints of all photographs taken on the cruises suitable for individual recognition studies. In recent years, the IWC has supplied film to researchers for this purpose. These photographs should be considered as data under the Committee's Rules of Procedure governing data availability.

16. SMALL CETACEANS

Last year an extensive review of white whales and narwhals was carried out (as part of the major review of small cetaceans requested by the Commission), resulting in a number of recommendations (*Rep. int. Whal. Commn* 42:185–97). The Committee this year confined itself to a review of new information and any action arising from past recommendations. The references included under this item are given in full in Annex G.

16.1 White whales

16.1.1 Distribution, migration and stock identity

The distribution of white whales along the west coast of Greenland has changed since 1920 (SC/44/SM3). While large numbers previously appeared during winter in the fiords of southwest Greenland (61–63°N), white whales are now rarely seen or caught at any time of the year south of Sisimiut District (67°N).

SC/44/SM3 suggested that the most likely explanation of this apparent change in distribution was depletion by the drive fisheries in the fiords south of Sisimiut during the first decades of this century. There may also be a connection between the white whales in Southwest Greenland and the currently depleted stocks off southeastern Baffin Island and the northern Labrador coast.

The Committee noted that there was little new information on distribution and stock identity in other areas. It concluded that there is insufficient knowledge on stock identity and stock boundaries throughout the range of this species.

16.1.2 Abundance

New information on abundance was only available for the Baffin Bay stock. For this stock a correction factor was applied to the strip census made in 1981 (Smith *et al.*, 1985) to account for whales submerged. The correction factor (1.72) was based on satellite telemetry data for white whales in Barrow Strait indicating that white whales spend about 42% of the time submerged (Martin and Smith, 1992). The new agreed estimate was 10,000 – 28,000 white whales in 1981. The approach followed was the same as that used by the SWG (the Scientific Working Group of the Canada-Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (Anon., 1992)).

Replicate aerial surveys of white whales wintering off West Greenland in 1981/82 and in 1990/91 were carried out to provide an index of relative abundance. Differences between years were tested using a resampling method (bootstrap distribution) based on combined transect densities from 1981, 1982 and 1991. The results suggest a decline in relative abundance of 30% or more (SC/44/SM4).

16.1.3 Directed and incidental takes

The Committee noted that catch statistics from the Baffin Bay stock (Canadian and Greenlandic hunts) (SC/44/SM3) and from East Greenland (SC/44/SM5) were incomplete or under-reported with no account for whales killed but lost. In Greenland the proportion of unreported catches has increased during the past decade because the participation in the reporting scheme has become increasingly sporadic.

Records on directed catches were available for Alaska (SC/44/ProgRep USA). However, the Committee noted the absence of progress reports from Russia in 1992 and annual reports from Canada in 1991 and 1992, and thus information on their most recent catches.

16.1.4 Status of stocks and recommendations

Sufficient information to evaluate status was only available for the Baffin Bay stock (SC/44/SM3; SC/44/SM4). The evidence indicated that white whales wintering in West Greenland had declined during the 1980s and that the Greenlandic and Canadian catches from this stock have not been sustainable.

The Committee reviewed action arising from the recommendations made in 1991 (*Rep. int. Whal. Commn* 42:192–3). It expressed its appreciation of work initiated by the USA to obtain more accurate population estimates in Alaskan waters, measures introduced by Greenland that could lead to reduced killed but lost rate, and the sampling of Alaskan, Canadian and West Greenland white whales for genetic studies.

In view of the lack of information on stock identity, the Committee **recommends** that genetic studies of white whales be undertaken in several laboratories, applying different techniques, and that samples be analysed from all the putative stocks. The Committee also noted the potential contribution of satellite tracking to questions of stock identity and **recommends** that this work continues.

In view of the evidence for decline of the Baffin Bay stock under the current harvesting regime, the Committee **advises** that hunting mortality be reduced to below current levels.

The lack of precise information on stock status makes it impossible to specify the reduction in hunting mortality that would either maintain the stock at its current level or allow it to increase. The Committee therefore **recommends** that surveys be initiated to provide new population estimates and allow continued monitoring of trends. Satellite and VHF radio-tagged animals can provide important information towards correcting for submerged animals in such studies and the Committee **recommends** that this work continues.

16.2 Narwhal

16.2.1 Distribution, migration and stock identity

New information was presented on narwhal distribution in the Greenland and Barents Sea regions (SC/44/SM5; Gjertz, 1991). There is evidence of almost continuous distribution of narwhals from East Greenland to the Svalbard-Barents Sea region. The apparent hiatus in distribution between East and West Greenland and a preliminary analysis of mt-DNA from narwhals from east and west coasts of Greenland (Heide-Jorgensen, pers. comm.) indicated that narwhals from East and West Greenland belong to separate stocks.

Stock identity in West Greenland waters was discussed in the light of the available information on distribution and migration (SC/44/SM3). While recognising the possibility that stock structure for narwhals, as for white whales, is complex and that female groups in particular may tend to return to the same fiord system in summer, the Committee believed it appropriate to consider narwhals summering in the Canadian High Arctic and Northwest Greenland as one stock, and that it be called the Baffin Bay stock based on the presumed common winter distribution.

16.2.2 Abundance

New information on abundance was only available for the Baffin Bay stock. Information on diving behaviour of narwhals based on satellite telemetry (Martin, unpublished data) facilitated correction of previous abundance estimates to account for animals submerged. A new estimate of 28,000–43,000 animals for the Baffin Bay stock was calculated based on counts in Inglefield Bay, West Greenland and the Canadian High Arctic in 1984, using the new correction factor and the same approach as the SWG (Anon., 1992).

16.2.3 Directed and incidental takes

Reported Canadian and Greenlandic catches from the Baffin Bay population since 1954 and from East Greenland since 1955 (except 1990 and 1991 data from Canada) were provided in SC/44/SM3 and SC/44/SM5. Some of the statistics were incomplete or under-reported, with no account for whales killed but lost. In Greenland the proportion of unreported catches has increased during the past decade because participation in the reporting scheme has become increasingly sporadic. There was no information on catches in other areas and there was no evidence of incidental catches of narwhals.

16.2.4 Status and recommendations

The Committee did not have sufficient data available to carry out a stock assessment. Based on the evidence presented (SC/44/SM3; Anon., 1992) on the possible decline in narwhal abundance in the Baffin Bay stock, the Committee shared the concern expressed by the Canada-Greenland Joint Commission that the present level of harvest is not sustainable.

Last year the Committee expressed concern about catch levels and loss rates in the Canadian and Greenlandic hunts and recommended that more effort be made to assess stock size and removal rates for the Baffin Bay stock (*Rep. int. Whal. Commn* 42:192–3). None of the information available at this year's meeting has reduced the concern of last year. The system of catch reporting in Greenland has continued to deteriorate and catches are still not reported for Avanersuaq District. The Committee thus **recommends** that both Canada and Greenland improve the quality and completeness of their catch reporting schemes. It further **recommends** that surveys of the entire Baffin Bay stock area be conducted soon.

Estimates of hunting losses and under-reporting must be added to catches to estimate total removals. Although the Committee notes the practical difficulties of obtaining accurate and generally applicable estimates of hunting loss, it **recommends** that effort continue towards obtaining them.

In view of continuing problems with respect to stock identity and population estimation, the Committee **recommends** that satellite telemetry of narwhals in both Greenland and Canada continues for the same reasons given under Item 16.1.4. It also recommends that ongoing genetic studies with respect to stock identity within Greenland be expanded to include narwhals in other areas.

16.3 Dolphin stocks harvested by Japanese drive fisheries

The Committee reviewed the history and present catch levels in directed fisheries of small cetaceans in Japanese coastal waters, and expressed its appreciation for the effort made by Japanese scientists to collect, analyse and submit information.

Three types of coastal fisheries (drive fishery, hand-harpoon fishery and small-type whaling) targeted eleven species of small cetaceans. Abundance estimates for the six species most frequently occurring in the catches were presented in SC/44/SM15 (striped dolphin, spotted dolphin, bottlenose dolphin, Risso's dolphin, southern form short-finned pilot whale and false killer whale) and

are given in Annex G. The estimates covered the Western Pacific from the coast of Japan to about 180°.

The Committee noted the evidence for coastal and offshore stocks (Kasuya and Miyashita, 1989; IWC, 1991) of striped dolphins in the western North Pacific. The size of the populations exploited by the drive fishery is unknown. Catches at both Izu and Taiji have declined in recent years. Before 1963 annual catches ranged from 10,000–20,000. After 1980, the catch dropped to 800–5,000 per year (mean 2,390). In 1991, only 1,003 striped dolphins were taken in the drive fishery. The Committee recalled that the status of striped dolphins has been a major item of concern since the mid-1970s. In 1981 the Committee noted that 'there is a clear need for re-assessment of the populations of this and other species taken in the drive fisheries and management of the stocks on a scientific basis' (*Rep. int. Whal. Commn* 32:59).

During the current review of the striped dolphin drive fishery off Japan, the Committee noted that:

(1) total catches and CPUE have declined over a long period of time (about 30 years);
(2) some reproductive parameters have probably changed in a manner consistent with a density dependent response (Kasuya, 1985);
(3) all available data support the likely existence of a coastal stock which is of unknown size;
(4) an unknown number of striped dolphins are incidentally killed in the Japanese large-mesh and Korean squid driftnet fisheries inside the Japanese EEZ;
(5) although some scientific advice was taken into consideration, quotas were mainly set on the basis of past catches; and
(6) drive fishermen have noted a decline in striped dolphins and accepted the suggested decrease in the quota.

The Committee believes that the best scientific advice that it can give at this time is that the population cannot support continued exploitation at the current level.

Further, because of:

(1) its long-standing concern regarding the status of the striped dolphin taken in the coastal waters of Japan; and
(2) the lack of appropriate data on which to estimate a sustainable catch limit under which the population can begin to recover;

the Committee **strongly recommends** that an assessment is made of this population as a matter of urgency. This assessment would include sufficient information on stock identity and distribution for a reliable estimate of abundance to be obtained and an evaluation of the effects of incidental catches and possible direct catches on the population and estimates of sustainable catch limits that will allow recovery of the population.

The Committee also **strongly advises** that there should be an interim halt in all direct catches of striped dolphins until this assessment is completed. Goto, Kanto, Komatsu, Matsuoka and Ohsumi believed that it was not appropriate to suggest an interim halt but advised that a substantial reduction in catches should be made.

The Committee noted that there is insufficient information on the status of the other populations exploited by the fisheries and expressed concern that low catches of one species in the fishery resulted in a switching of effort to other species. The Committee **advises** that limits on the catches of all species exploited in fishery be set by species, based on available scientific information and that research be conducted to provide reliable estimates of abundance and to determine stock structure and boundaries.

16.4 Information on other stocks

16.4.1 Harbour porpoise Phocoena phocoena

A new abundance estimate based on a line transect shipboard survey in July-August 1991 (45,000 porpoises; 95% CI 23,000–79,000) was presented for the northern Gulf of Maine and the Lower Bay of Fundy area (SC/44/SM24).

Smith reported by-catches in the Gulf of Maine estimated to be 2,300 (95% CI 1600–3500) in 1990 and 1,700 (95% CI 1,100–2,500) in 1991. The by-catch figures were 5% (95% CI, 2.6–10%) of the population in 1990 and 4% (95% CI 1.8–7.7%) in 1991. These figures did not include catches in some other US fisheries known to take harbour porpoises and some Canadian fisheries in the Bay of Fundy with assumed takes from this population. A Workshop held in Woods Hole in May 1992 concluded that the best estimate of by-catch rate was high relative to an earlier recommendation of the IWC Scientific Committee[3], and the Workshop recommended that the by-catch rates be reduced, that surveys be conducted and mortality rates be obtained for other areas.

The Workshop also recommended that improved estimates of by-catches be obtained for populations in St. Lawrence and Newfoundland, that the by-catch of harbour porpoise be reduced in the Gulf of Maine and Bay of Fundy area and that surveys be conducted and mortality estimates be obtained in other areas. The Committee **endorsed** the Workshop recommendations.

After reviewing the new information on harbour porpoises, the Committee also re-iterates its **recommendations** of 1990 and 1991 (*Rep. int. Whal. Commn* 41:184–6; 42:208). It noted that information on incidental capture was lacking for some countries and **recommends** that all countries implement a recording scheme for incidental takes of harbour porpoise in their waters and provide the data to the Commission.

16.4.2 Dall's porpoise Phocoenoides dalli

New information on struck and lost rates in the Japanese harpoon fishery for Dall's porpoise was obtained from surveys conducted in 1989 and 1992 (SC/44/SM18). The Committee noted that SC/44/SM18 was prepared in response to its recommendation last year, and it expressed its appreciation of the timely and full responses.

In response to previous concerns expressed in the Commission about the level of take in the Dall's porpoise fishery, Japan had announced that it would progressively reduce the catch. The catch levels of porpoises have decreased from about 40,000 in 1988 to 17,000 in 1991 in accordance with Japanese regulations.

Matsuoka noted that a new abundance estimate of about 440,000 (*dalli*-type: 226,000 – CV=0.15 95% CI 169,000–303,000; *truei*-type: 217,000 – CV=0.23 95% CI 139,000–339,000) had been agreed by the Committee last year. The new estimate of abundance was higher than previous estimates. Taking this into account, Japan has reduced the rate of reduction of the catch limit. The Committee, however, noted that the catch was taken from two stocks,

[3] When reviewing *Phocoena* in 1990 the Committee believed that total take rates of harbour porpoises should be lower than half the estimated value of r_{max}. It noted that all estimates of r_{max} presented was less than 0.10 (*Rep. int. Whal. Commn* 41:182–5).

which had not been considered separately when the quota was set. The extent of the Japanese adjustment and any new target level of exploitation is yet to be known.

16.4.3 Long-finned pilot whale Globicephala melas

A new abundance estimate was provided for the central and eastern North Atlantic (SC/44/SM19). The estimate is based on shipboard surveys in 1989 (NASS89), and the estimated abundance in the survey area was 778,000 (CV=0.295; 95% CI 442,000–1,370,000).

16.4.4 Small cetacean abundance and mortality in the Eastern Tropical Pacific

The relative abundance of seven dolphin stocks in the eastern Pacific was estimated using the 1991 data collected on commercial tuna vessels by trained observers (SC/44/SM23). The authors stated that there is no evidence of a trend in population size for six stocks in recent years. The northern stock of common dolphin, however, shows a significant decrease over the last ten years. SC/44/O 18 provided additional information on the abundance of 19 cetacean species in the Eastern Tropical Pacific.

Estimates of the incidental dolphin mortality in the eastern Pacific tuna fishery were calculated from 284 observer trips in the international fleet (Colombia, Ecuador, Honduras, Mexico, Panama, the USA, Vanuatu and Venezuela) in 1991 (SC/44/SM6). The mortality was estimated to be 27,292 dolphins (SE 1,439), based on kill per set and 28,439 (SE 1,537), based on kill per ton.

16.4.5 Concern about poorly documented takes of small cetaceans

The Committee again noted that various reports since the late 1970s have appeared regarding the use of small cetaceans as bait in the Chilean crab fishery. This problem is one of the most poorly understood small cetacean issues recorded by the Committee. Therefore, the Committee **recommends** a complete review of this problem at the earliest possible date.

Noting that some IWC member nations did not submit data on incidental and directed catches of small cetaceans the Committee **recommends** that IWC member nations again be requested to submit all catch statistics, and it further **recommends** that a scheme for recording of incidental takes be established in countries where such schemes do not exist. Attention should be given to ensuring that such schemes provide accurate estimates, e.g. by considering observer schemes, incentive schemes etc., where appropriate.

Further, the IWC Secretariat is encouraged to establish and develop arrangements with appropriate governmental and international organisations (including bilateral and regional bodies) whereby it can continue to receive and tabulate catch data and other relevant documentation for all cetaceans, and make these records available to FAO and other intergovernmental organisations.

16.4.6 Priority topics for future meetings

Three priority topics for future meetings were discussed.

(1) For the reasons given under Item 16.4.5 a review of the abundance and exploitation of small cetaceans in South American coastal and riverine waters with special reference to the fishery of small cetaceans for bait in Chile is necessary.

(2) The Workshop on Report of the Workshop on Mortality of Cetaceans in Passive Fishing Nets and Traps revealed that although incidental catches of small cetaceans were known to occur in inshore waters of Southeast Asia, Indo-Malay region, very little quantitative information on exploitation rates and population abundance exists. A review of the status of cetaceans is necessary. The Committee agreed that UNEP and FAO should be approached to see if they might provide financial support for scientists from the region to attend the meeting.

(3) A global review of the status of the genus *Lagenorhynchus*, including *L. obliquidens* that is incidentally captured in North Pacific fisheries (*Rep. int. Whal. Commn* 42:212), is necessary.

In light of the Committee's deliberations under Item 16.3, it believed it appropriate to review striped dolphins in the western Pacific when new information is available.

The priority topic for the 1993 meeting will be decided by the Chairman of the Scientific Committee, in consultation with the Chairman of the sub-committee on small cetaceans, taking into account the location of the meeting, the availability and analysis of data, etc.

17. DATA PROCESSING AND COMPUTING NEEDS FOR 1993

These needs were all part of the Comprehensive Assessment. Work related to the RMP was described under Items 6 and 11.3. Work related to the Comprehensive Assessment of Southern Hemisphere baleen whales was described in Annex E, Item 12.2. Work related to the development of population assessment models was described under Item 10.1.

Attention had been drawn in the sub-committees on North Atlantic and Southern Hemisphere baleen whales to difficulties concerning estimation of abundances for Small Areas from sightings survey results. The Committee agreed that it must readily be able to calculate revised abundance estimates during meetings in response to possible changes in area boundaries. In addition, accredited scientists require easy access to the primary data from surveys to facilitate additional analyses.

The Committee **recommends** the appointment of a permanent database manager to the staff of the Secretariat to address these concerns. Specifically, this appointee would be responsible for the following work.

(i) The development of a database for the sighting survey data used to provide the abundance estimates which may be used for implementation of the RMP. The appointee should present a proposal for the structure of this database to the next Annual Meeting of the Committee.

(ii) The development of software for rapid calculation of abundance estimates from available primary sightings survey data for Management Areas, the boundaries for which may change.

(iii) Analysis of the annual IWC/IDCR Southern Hemisphere cruise data to provide abundance estimates, and supervision of the coding and validation of these data carried out by other Secretariat staff.

The appointee should have an appropriate first degree (at least). The financial implications of this recommendation are given under Item 18.1.

18. FUNDING REQUIREMENTS FOR 1992/93

18.1 Comprehensive Assessment

The estimated cost for the appointment of a database manager (Item 17) in the next financial year is £40,000. This includes costs associated with the appointment and

limited use of consultants to advise the appointee in the initial stages of the appointment. These costs will not be necessary in subsequent years.

The cost of the 1992/93 IWC/IDCR Southern Hemisphere minke whale cruise, as recommended under Item 15.2, is £45,000.

The three unsolicited research proposals described under Item 15.2, which the Committee had recommended for funding were all related to the Comprehensive Assessment of Southern Hemisphere baleen whales. The cost of these three proposals is £15,000.

18.2 Priorities

The Committee gave high priority to all funding requirements under Item 18.1. Highest priority was given to the appointment of a database manager, followed by the IWC/IDCR cruise, and finally, the unsolicited research proposals.

19. INITIAL AGENDA FOR 1993 MEETING

An initial agenda and a revised workplan will be drafted by the Chairman in consultation with convenors and the Secretariat following the meeting of the Commission and circulated to Committee members.

20. PUBLICATIONS

The Committee agreed, in accordance with the procedures outlined in *Rep. int. Whal. Commn* 32:63, that the Editorial Board should comprise Donovan, Hammond, Reilly, Bannister, Bjørge and Kirkwood.

21. ELECTION OF OFFICERS

Hammond and Reilly were re-elected Chairman and vice-Chairman, respectively.

22. OTHER BUSINESS

The Committee drew the attention of the Commission to a procedural problem that had arisen over Item 8.3, which had been placed on the agenda in response to a specific request. Some members had undertaken work during the meeting to address this Item. When the Committee came to discuss this Item, it was informed that a direct response was not required and that the question could be considered to be withdrawn (see Item 8.3).

The Committee requests that given its heavy workload as noted under Item 23, Commissioners exercise restraint when placing additional items on the Committee's Agenda.

23. ADOPTION OF THE REPORT

The majority of the report was adopted by the Committee at 19:45, 22 June. It was agreed that Items 1–5, 10–12, 15 and 17–22 could be finalised by the Editorial Board.

The Committee had worked for 14 consecutive days usually until 22:00 each day. Despite this, the agenda had only just been completed and several sections of the report had not been formally approved. The Committee noted that it had been unrealistic to expect to complete the agenda it had set itself this year and believed that the workload had been unacceptably high. The Committee wishes to draw these points to the attention of the Commission.