Report of the Scientific Committee

The Committee met at 9.00 am on 29 June 1985 and following days at the Moat House Hotel, Bournemouth under the chairmanship of M. F. Tillman.

A list of participants is given in Annex A.

1. CHAIRMAN'S WELCOME AND OPENING REMARKS

The Chairman welcomed the Committee Members and invited participants.

2. APPOINTMENT OF RAPPORTEURS

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

3. ADOPTION OF AGENDA

The Agenda adopted is given in Annex B.

4. ARRANGEMENTS FOR MEETING

4.1 Meeting procedures

The Committee agreed to a work schedule proposed by the Chairman. This took fully into account comments, suggestions and procedures agreed to at earlier meetings (*Rep. int. Whal. Commn* 32: 127; *Rep. int. Whal. Commn* 33: 36) and the list of priority stocks developed in accordance with the procedure agreed to in 1982 (*Rep. int. Whal. Commn* 33: 65). Sub-committees were reminded that a full day must elapse between receipt of their reports by the Committee and discussion of them in Plenary Session.

4.2 Establishment of sub-committees

In accordance with Rule C1 of the Rules of Procedure, five sub-committees were established at last year's meeting (sperm whales, Southern Hemisphere minke whales, Northern Hemisphere minke whales, other baleen whales and protected species and aboriginal/subsistence whaling); a sixth (small cetaceans) remained as a standing sub-committee. Reports arising were dealt with under the relevant Agenda Items and as Annexes.

Annex D Report of the sub-committee on sperm whales
Annex E Report of the sub-committee on Southern Hemisphere minke whales
Annex F Report of the sub-committee on Northern Hemisphere minke whales
Annex G Report of the sub-committee on other baleen whales
Annex H Report of the sub-committee on protected species and aboriginal/subsistence whaling
Annex I Report of the sub-committee on small cetaceans

Additional working groups were established and their reports are incorporated under the relevant items. The report of the working group on strandings is given in Annex K and that on whale habitats and pollution in Annex M.

4.3 Time schedule

A group comprising the Chairman, Vice-Chairman, chairmen of sub-committees, the Secretary and the Senior Analyst/Programmer was established to determine the business of the day and the priorities for computing work.

4.4 Computer arrangements

Free described the arrangements for access to the University of Cambridge computer system. A digital link had been installed from the hotel to the national packet switching system (PSS), providing up to four communications channels. The installation was essentially the same as the one used at the previous meeting, which had proved to be reliable.

5. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

5.1 Documents submitted

A list of documents submitted is given in Annex C.

5.2 National progress reports on research

The Committee noted with concern that despite its comments of the last two years many member nations had failed to submit progress reports: Antigua and Barbuda, Belize, Chile, People's Republic of China, Costa Rica, Egypt, Finland, Federal Republic of Germany, India, Jamaica, Kenya, Monaco, Netherlands, Oman, Peru, Philippines, St Lucia, St Vincent and the Grenadines, Senegal, Seychelles, South Africa, Sweden, Switzerland and Uruguay. It also noted that several of the progress reports which did arrive were not available on the opening day of the meeting. The Committee reiterated its view of the importance of national progress reports, some of which are the only source of data necessary for stock assessments, and **recommends** that the Commission urges member nations to ensure that they submit progress reports to the Committee (following the guidelines given in Annex K; *Rep. int. Whal. Commn* 35: 144) and that they are available on the first day of the meeting.

5.3 Reports of special meetings and workshops

The report of the Workshop on Minke Whale Sightings held in Cambridge just prior to this meeting is given in SC/37/Rep 3 and discussed in Annex E. The report of the

determined using a non-linearity factor of 2. It should be noted that the rates of expected increase in the short term are much higher than the equilibrium rates which are implied by the estimates of resilience and the assumed values of M. The members of the Committee observed that with catching at the proposed permit level of 80, the rate of increase would be slowed.

Table 2

Effects of zero catch and scientific permit catch on Central Atlantic minke stock. n.c. = not calculated in SC/36/Mi4

Resilience					% Annual rate of increase		
					Zero catch		Permit catch
A	M	RY_{86}	N_{86}	% of initial	1986/87	1986/90	1986/90
3.4% rate of stock decline							
0.28	0.10	158	2181	35	6.7	5.2	4.3
0.07	0.10	128	2920	38	4.0	3.1	1.5
0.40	0.08	163	2230	34	6.7	n.c.	n.c.
0.13	0.08	129	3060	32	3.9	n.c.	n.c.
4.2% rate of stock decline							
0.28	0.10	153	1700	29	8.3	6.3	5.1
0.07	0.10	126	2220	32	5.2	3.9	2.9
0.40	0.08	156	1750	28	8.2	n.c.	n.c.
0.13	0.08	126	2340	31	5.0	n.c.	n.c.

Other members felt that until the problems with the Northeast Alantic stock CPUE series had been resolved, the parameter A for stock density response, derived from these data should not be used. These members also noted that the non-linearity parameter of 2 is adapted from an analysis of the Norwegian offshore operation which is different from the small vessel coastal operation in Iceland. This parameter value applied to other stocks has in several cases been found inapplicable (see Okhotsk Sea stock and West Greenland stock, Annex F). These members therefore believed it was more appropriate to refer to the recommendations of last year, given in Table 1 above, for advice on replacement yield (RY).

(b) Fin and sei whales

The Committee believed that there was insufficient information available to assess the effect of the proposed permit catches on the conservation of the stocks concerned. However, it was agreed that the possible effect of the proposed catch might be examined by referring to the estimate of RY for fin whales (in Table 1) and to the fact that the RY of the sei whale stock is unknown.

General

Some members of the Committee observed that, in some respects, the proposed catches would offer opportunities for a wide scope of research which might yield results of general scientific interest.

Some members considered that there might be justification for a well planned programme which addressed specific outstanding problems of a kind where a relatively small catch could yield fundamental biologically valuable results which might also be useful in management. Other members considered that such general suggestions were inappropriate until such time as a suitable planned programme might be presented.

Some members believed that the proposed Icelandic permit did not address specific questions of direct relevance to the management of the affected stocks. That is, specific experiments had not been designed which would for example validate the assumptions of assessment models, improve the precision and accuracy of estimates, or determine trends in abundance or other parameters. They expressed the view that as a consequence the information obtained from the scientific catch would not materially improve the quantitative knowledge required as a basis for management. These members therefore urged that the Government of Iceland be requested to refrain from issuing any scientific permit until such time as a proposed research permit is developed which provides for improving the knowledge required for management. They further expressed a willingness to assist with this development.

With respect to the above statement other members believed that it was not appropriate to provide any advice regarding the Committee's review of this proposed permit, other than commenting in accordance with the guidelines. They noted, however, that although the research catch itself would not alone solve all problems of short term management of the stocks, it would secure a continued flow of biological and other relevant information for management. This, along with other studies proposed (Item 19.2) would contribute to improved assessments of the stocks.

5.4.3 Korean research permit (SC/37/O 27) for the Sea of Japan—Yellow Sea—East China Sea stock of minke whales

The Committee examined this proposal in the light of comments made by the sub-committee on Northern Hemisphere minke whales (Annex F, Item 9) and the guidelines adopted in Annex L.

The Committee found that the proposal did not adequately fulfil the request for information under Paragraph 30 of the Schedule, particularly with respect to the specification of objectives, which it considered too general. It noted that the Government of Korea had invited scientists of other nations to participate in the programme.

The Committee examined the most recent assessment of this stock (*Rep. int. Whal. Commn* 34: 107, 109–11, 178) and agreed that the stock had been depleted to a level below the Protection Stock level; the suggested catch of 200 whales, which probably represents about 2% of the exploitable stock, may exceed the replacement yield of this stock.

Until a plan for research sampling has been prepared and evaluated, and arguments provided as to the ways it would contribute to improved knowledge for the management of this stock, most members of the Committee urge that the Government of Korea be requested to refrain from issuing this special permit.

Ikeda, Shima, Ivashin and Borodin considered that the approach of asking a contracting government to refrain from issuance of a permit exceeds the purview of the Committee. They believed that the Committee's competence only extends to the point where they advise the preparation of more detailed materials for full review of the proposed permit.

5.5 Previous season's catches and other statistical material

The Secretariat has now taken over the work of the Bureau of International Whaling Statistics and it provided the Committee with two documents (SC/37/BIWS) which follow the style of previous issues of BIWS statistics:

(1) Antarctic season 1984/85 (as all data have been provided this can be considered final).

Working Group to Examine Methods for Determining Natural Mortality which carried out its work by correspondence (*Rep. int. Whal. Commn* 35: 38) is given in SC/37/Rep 4 (and see Item 10.1).

5.4 Scientific permits

A series of Guidelines were developed to facilitate the review of scientific permits (Item 10.4 and Annex L).

5.4.1 Faroe Island permit to take fin whales

The Committee reviewed the status of a scientific permit issued by the Faroese Home Rule Authority in 1981, under which nine fin whales per year are to be taken indefinitely by the Faroese from the West Norway—Faroe Island stock. Between 1981 and 1984, 13 whales have been taken (SC/37/ProgRep Denmark). The Committee reconfirmed its previous view (*Rep. int. Whal. Commn* 32: 44) that the current research will not yield answers to any significant questions relating to biology or stock management. If the catch is to continue, the Committee requests more comprehensive sampling data and analyses than presented to date.

5.4.2 Icelandic research permit

SC/37/O 20 detailed an intensified research programme into whale stocks around Iceland, intended to obtain information on the status of such stocks and to study the role of cetaceans in the ecology of these waters. Sigurjónsson noted that although the essence of the programme was reported in the document, ideas and suggestions for improvements were sought and that for a successful implementation of the programme, it would be desirable to have active participation from scientists of other nations.

The Committee agreed under this agenda item to address only those aspects of the programme which related to a scientific catch and hence required a scientific permit. This involved the taking of 80 minke whales, 80 fin whales and 40 sei whales per year during the period 1986–1989. The Committee reviewed the proposed permits in accordance with the guidelines given in Annex L and in the light of comments from relevant sub-committees (Annex F, Item 9; Annex G, Item 5.2). Substantive discussion from sub-committee reports is not repeated here.

Guideline 1 (Information required)

The Committee agreed that in general the proposed permit adequately specified the four sets of information required under Paragraph 30 of the current Schedule.

Guideline 2 (Objectives of research)

(a) Minke whales

Most members of the Committee agreed that the general objectives given in SC/37/O 20 did not directly relate to the research needs identified for the management of this stock i.e. obtaining estimates of absolute abundance, determining trends in stock size and estimating vital parameters necessary for providing management advice.

(b) Fin and sei whales

The Committee noted that certain of the objectives (Sections 3 and 4 of SC/37/O 20) related to the research needs identified for these stocks i.e. estimation of stock size, current population trends and productivity. Other objectives (Sections 1, 8 and 10) did not directly relate to these issues although they were aimed at providing demographic parameters.

Table 1

Review of recent information on the stock assessments of baleen whales off Iceland. RIWC = *Rep. int. Whal. Commn*; * = IWC catch limit

Exploitation	Recent assessments	Recommendations
Minke (Central Stock)		
Recent catches: 1980 - 321 1981 - 247 1982 - 322 1983 - 326 1984 - 291 1985 - 242*	RIWC 35:44. CPUE series indicate a probability of stock decline by 40% of 1960 level of 0.43.	RIWC 35:44. Unclassified, catch limit = 151 for 1985 (half of average catch for the period 1974–1983).
Fin (East Greenland–Iceland Stock)		
Recent catches: 1980 - 236 1981 - 254 1982 - 194 1983 - 144 1984 - 167 1985 - 161*	RIWC 31:113. Mark-recapture 9,507 (4,501–21,905) RIWC 34:127, and 35:101. Mark-recapture 3,250–3,734	RIWC 34:49. SMS, RY=151 (average for the period 1962–1982). RIWC 35: 46. No evidence to judge SMS or PS; RY=143–180, or 129–162 (10% safety factor)
Sei (Iceland–Denmark Strait Stock)		
1980–85 block quota 504 (<100 per year): 1980 - 100 1981 - 100 1982 - 71 1983 - 100 1984 - 95 1985 - 38*	No population assessments have been obtained.	RIWC 33:55, and 35:47. Unclassified, no RY value calculated, no advice on setting catch limits.

Guideline 3 (Review of information on status of stocks)

Table 1 outlines the most recent information concerning exploitation, stock analysis and recommendations by the Scientific Committee.

Guideline 4 (Comments on methodology)

The methodology and likelihood of achieving the stated objectives were discussed in detail by the relevant sub-committees (Annex F and Annex G). Most members of the Committee believed that the information likely to be obtained from the proposed permit would provide only a minimal improvement in our current knowledge with respect to providing management advice. It was noted that some qualitative biological information might be obtained from the sampling.

Guideline 5 (Participation by scientists from other nations)

The Committee agreed that the arrangements specified for participation by scientists were more than satisfactory.

Guideline 6 (Possible effect on conservation of the stock)

(a) Minke whales

Some members noted that although the Central Atlantic stock had not been assessed by the sub-committee on Northern Hemisphere minke whales at this meeting, because it had not been identified as a priority stock, a detailed assessment had been provided in SC/37/Mi4. This was derived directly from that made by the Committee in 1984 and which had led to the conclusion (with Icelandic scientists dissenting) that a 1985 catch of no more than 151 might halt the decline of this stock. The further calculations in SC/37/Mi4 had been used by these members to assess the effects on the stock of a proposed catch under a scientific permit.

The effects of zero catch and the proposed permit catch can be calculated in the same way as for the Northeast Atlantic stock. The results given in Table 2 were

(2) Catches outside the Antarctic in 1984 (not all data were provided before the tables were compiled; some of the data are contained in National Progress reports).

Annex I, Appendix 2 details known catches of small cetaceans (direct, incidental and live-capture). It was noted that several nations have not submitted statistics in response to last year's request (*Rep. int. Whal. Commn* 35: 139), including Denmark, Federal Republic of Germany, Finland, France, India, Mexico, Netherlands, Norway, Peoples Republic of China, Sweden, USA and USSR. The Committee urges that these nations be again requested to submit statistics.

The Committee noted that the Commission had agreed in 1976 to collect and report to the Scientific Committee catch statistics for small cetaceans, including those taken incidentally as well as directed catches and live-captures, to be included in Annual Progress Reports (Resolution, Appendix 6, *Rep. int. Whal. Commn* 27: 31).

A minority view is given in Annex N1.

5.6 Whale marking and reports of special cruises

5.6.1 Whale marking

The Committee received Annex J, which reviewed whale marking using 'Discovery' marks in 1984 and 1985. The disposition of whale marks is discussed under Item 10.3 and the computerisation of marking data under Item 15.

5.6.2 Reports of special cruises

Reports arising out of the IWC/IDCR minke whale assessment cruise are presented in SC/37/Rep 3 and SC/37/Mi6. Reports arising from other cruises include SC/37/Ba1 (Bryde's whales in the Western North Pacific), SC/37/Ba2 (fin whales in the North Atlantic), SC/37/Mi3 (minke whales in the Barents Sea), SC/37/SM13 (Baird's beaked whales in the western North Pacific).

6. COOPERATION WITH OTHER ORGANISATIONS

6.1 International organisations

6.1.1 FAO

The Committee had before it the Report of the IWC observer at the World Conference on Fisheries Management Development held in Rome from 27 June–6 July 1984 (IWC/37/11G). Of particular relevance to the Commission was a paper on the net entanglement of non-target species, including marine mammals, in both active and discarded drift nets. The Committee expressed its thanks to Ms Fox who had acted as observer. The FAO/UNEP Global Plan of Action is discussed under Item 13.2. The Committee regretted that for the first time FAO had been unable to arrange for the presence of an advisor at the Scientific Committee.

6.1.2 UNEP

In view of the Committee's discussions last year concerning the integration of the Second International Decade of Cetacean Research within the FAO/UNEP Global Plan of Action, it agreed to discuss this topic under Agenda Item 13.2.

6.1.3 CCAMLR

The Committee had before it the Report of the IWC observer to the Third Meeting of CCAMLR held in Hobart from 3–13 September 1984 (IWC/37/11A). Of particular interest to the Committee were the following items:

(1) The CCAMLR Scientific Committee was unable to agree on an appropriate spatial scale for the collection of catch statistics; the IWC Scientific Committee has previously expressed its desire for statistics to be collected by 1° square (*Rep. int. Whal. Commn* 35: 33).
(2) There was no discussion of the availability of IWC-held data to CCAMLR.
(3) The CCAMLR Scientific Committee again expressed interest in the proposed IWC Workshop on the Feeding Ecology and Distribution of Southern Baleen Whales (see Item 9.3).
(4) The CCAMLR Scientific Committee endorsed the importance of the IWC/IDCR minke whale assessment cruises and encouraged their continuation.

The Committee thanked Kirkwood for attending the meeting on its behalf and noted that he had been accorded full co-operation and had been allowed to participate fully in discussions.

The Committee also had before it the Report of its observer to the CCAMLR Scientific Committee *Ad Hoc* Working Group Meeting on Ecosystem Monitoring (IWC/37/11H). The Working Group submitted several points and recommendations for the consideration at the next Annual CCAMLR Scientific Committee Meeting which are of relevance to the IWC.

The Committee thanked Braham for attending the meeting on its behalf.

6.1.4 IUCN

The Committee had before it the report of the IWC observer at the joint IUCN/SCAR Symposium on Scientific Requirements for Antarctic Conservation (IWC/37/11E). A series of working group sessions were held to discuss various aspects of Antarctic conservation including the role of whales and other consumers in the krill-dominated ecosystem. The reports of the working groups and associated papers will be published. The Committee thanked Gambell for attending the meeting in place of Tillman, and agreed that it would be pleased to participate in any further meetings of a similar nature.

Beddington reported that in 1985 the *Tulip* began work around the Galapagos Islands with a similar aim to the work already conducted in the Indian Ocean. To date some 100 individual sperm whales have been identified from tail fluke and other markings.

6.1.5 CITES

Berney reported that the administrative infra-structure of CITES had changed. It no longer had links with IUCN but has special status within UNEP. The IWC observer at the 5th meeting of the Conference of the Parties held in Buenos Aires from 22 April–3 May 1985 reported that the only proposal concerning cetaceans, that the narwhal should be transferred from Appendix II to Appendix I, was rejected (IWC/37/11F). It was noted that the minke and pygmy right whales would be transferred to Appendix I on 1 January 1986 in accordance with a decision taken in 1983.

The Committee thanked Iglesias for attending the meeting as IWC observer.

6.1.6 IATTC

Hall reported on the activities of the IATTC with respect to cetaceans. His report and that of the IWC observer at the 1984 IATTC meeting (IWC/37/11C) was considered by the sub-committee on small cetaceans (Annex I). The IWC observer had noted that the effectiveness of efforts to

estimate incidental dolphin mortality accurately were hampered by the failure of Mexico to participate in the collection programme. Hall reported that the Mexican Government (a non-IATTC member) had expressed its concern about the problem of incidental dolphin mortality to the IATTC. The Committee thanked Perrin for attending the meeting on its behalf and requested that, if possible, a Japanese scientist should represent it at the 1985 meeting in Tokyo.

6.1.7 ICES

The Committee had before it the report of the IWC observer at the 1984 meeting of ICES in Copenhagen (IWC/37/11B). Only one paper (concerning seals) was submitted on the Marine Mammal Committee's special topic 'Parasites and Diseases in Marine Mammals'. It will remain a special topic at the 1985 meeting to be held in London and additional contributions will be solicited. The Marine Mammal Committee will also be holding a joint session with the Marine Environmental Quality Commission on 'the effect of organochlorines on marine vertebrates'.

The Committee thanked Harwood for attending the meeting on its behalf and agreed that he should again represent it at the 1985 meeting.

6.1.8 ICCAT and 6.1.9 ICSEAF

No cetacean related matters were reported at the 1984 meetings of either ICCAT or ICSEAF.

6.1.10 BIOMASS

The Committee noted that the BIOMASS Executive has established a data centre at the British Antarctic Survey in Cambridge.

6.1.11 CMS

The Committee noted that the Commission has received an invitation to attend the first meeting of the Parties to the Convention on Migratory Species, to be held in Bonn in October 1985. The Convention, which includes certain whale species (e.g. blue and humpback whales), supports IWC and CITES conservation actions. As yet there is no scientific activity.

6.2 Other organisations

6.2.1 AEWC

The Report of the IWC observer to the Third Conference on the Biology of the Bowhead Whale is given in IWC/37/11D and the report of the meeting itself in SC/37/Rep 2. These were considered by the sub-committee on protected species and aboriginal subsistence whaling (Annex H). Gambell and Hammond, who attended the Conference and observed the spring census activity, expressed their thanks to the North Slope Borough for financial support. Bannister also attended the census by courtesy of the North Slope Borough and thanked both the Borough and those involved in the NMFS aerial survey work for their cooperation and support.

The Committee thanked Hammond for attending the Conference on its behalf.

7. FUTURE ACTIVITIES OF THE COMMISSION

7.1 Report of Working Group on the Future Activities of the Commission

The Committee had before it relevant extracts of the Report of the first meeting of the Working Group which met in February 1984 (SC/37/Rep 1). It noted that the Working Group agreed that the Scientific Committee should consider questions raised at the 36th Annual Meeting and report to the Finance and Administration Committee meeting before the Plenary Session of the 37th Annual Commission meeting. The topics discussed below follow the structure of SC/37/Rep 1.

7.1.1 Commercial Whaling and the Comprehensive Assessment

The Working Group had outlined four items the Commission should pay attention to during such time as it maintains zero catch limits on commercial whaling (Schedule Paragraph 10(e)), of which two are related to the Scientific Committee:

(1) to assess on a comprehensive basis the effects of the decision to set catch limits at zero;
(2) to monitor compliance with applicable regulations other than catch limits and assess annually the status of the stocks involved.

It was noted that the Committee had in the past indicated that it was not in a position to define the term 'comprehensive assessment' (*Rep. int. Whal. Commn* 35: 36).

Moreover, there had not been any progress in clarifying within the Commission what is meant by a comprehensive assessment, nor has specific advice been provided to the Scientific Committee that would allow it to structure its consideration of the issue.

The Committee considered that at a minimum it would need to provide the Commission with information and advice on each stock directly affected by the decision to set catch limits at zero. Satisfactory assessments of stock status, especially in a period of reduced or zero catches, would require information on abundance, distribution and other characteristics that would have to be obtained from surveys and other studies carried out in addition to or independently of whaling activities.

In its report in 1984 (*Rep. int. Whal. Commn* 35: 36–7), the Scientific Committee had identified a broad sequence of tasks to be undertaken as part of a comprehensive assessment. In the near future, work towards that comprehensive assessment is likely to be a major part of the Committee's function. It is essential that the variety of reviews and special studies that will be required are planned and co-ordinated carefully.

Therefore it is **recommended** that a Special Meeting of the Scientific Committee be held to identify specific tasks, assign priorities and establish a timetable for undertaking a comprehensive assessment of whale stocks. More specific objectives will need to be developed, but would include:

— establishment of priorities for providing advice to the Commission;
— identification of specific reviews and other studies of existing information or assessment techniques required;
— establishment of requirements for new information for assessment, and identification of surveys or other work to be undertaken to provide that information;
— establishment of a timetable that will allow timely advice to the Commission;
— examination of the likely costs of the proposed programme;
— exploration of new management regimes (as suggested under Item 8).

7.1.2 Aboriginal Subsistence Whaling
The Committee noted and concurred with the Working Group's Report concerning the role of the Scientific Committee with respect to aboriginal subsistence whaling, i.e. that it should consider the status of such stocks and that stocks whose viability is in danger or uncertain should be of special concern.

7.1.3 Revision of the Present Management Procedure
The Committee noted and concurred with the Working Group's Report concerning the need for revision of the present management procedure and draws the Commission's attention to the fact that it is prepared to participate fully in such discussions. Further consideration of how the Committee might contribute to this effort is discussed under Item 8.

7.1.4 Humane Killing
While noting the discussion of humane killing was now outside its purview, the Committee notes that the experts sent by Governments to the sub-committee on Humane Killing should include biologists with expertise in relevant fields (e.g. cetacean anatomy and physiology).

7.1.5 Sanctuaries
This topic is discussed under Item 9.1.

7.1.6 Publications and statistics
This item is discussed fully under Item 7.2.2. However the Committee draws the attention of the Commission to its view that IWC publications form an essential and integral part of its work. In a similar manner the provision and compilation of statistics is essential.

7.1.7 Special permits
This topic is discussed under Item 10.4.

7.1.8 Other activities
The Committee noted that the Working Group had identified five other subject areas which might generate more active interest in the future, all of which are relevant to the Scientific Committee and have in fact been considered to some extent during this and earlier meetings.

(1) Aspects related to the non-consumptive utilisation of cetacean resources, and the development of benign research techniques (e.g. see *Rep. int. Whal. Commn* 35: 55–7).
(2) Research on small cetaceans, including the problems of incidental kills (e.g. see Item 9.2 and Annex I); a minority view is given in Annex N2.
(3) Ecosystem based management of whale resources (e.g. see *Rep. int. Whal. Commn* 34: 39).
(4) The effects on whales of changes in environmental quality (e.g. see Item 14).
(5) The IWC's role as a focus of expertise in all matters related to whale stocks, assessment and management, as recognised in other fora (e.g. see Item 6 concerning our relationship with other intergovernmental organisations and Item 9.3).

7.2 Review the Operations of the Scientific Committee
At the 36th Annual Meeting the Commission had agreed to establish a Working Group to consider certain financial aspects of the operations of the Scientific Committee, i.e.

(i) the financial aspects of all the operations of the Scientific Committee, including small cetaceans;
(ii) possible cheaper alternatives to the publication of scientific papers;
(iii) the question of paying overheads on research proposals submitted for funding.

Subsequently it was decided not to constitute the Working Group but to ask the Scientific Committee to comment on the above questions so that its views could be considered by the Finance and Administration Committee prior to the 37th Annual Commission meeting (Iglesias, *in litt.* 19 February 1985). These items are discussed below.

7.2.1 Operations of the Scientific Committee
Six potential areas for cost saving were considered: reducing the size of the Scientific Committee; shortening the length of its meetings; reducing the frequency of its meetings; eliminating one or more of its sub-committees; introducing a *per capita* charge for participants; radically restructuring the *modus operandi* of the Committee. To some extent the issues arising out of these suggestions overlap and the ensuing discussion reflects this.

The most likely financial benefits from reducing the size of the Scientific Committee would appear to be a reduction in the cost of meeting rooms and in the cost of copying meeting papers. One might expect similar benefits from reducing the number of sub-committees. However, the Secretary reported that the cost of meeting rooms had already been reduced to minimal levels. Savings in paper costs could be made if authors were required to bring sufficient copies of their papers with them; at present papers received by the Secretariat sufficiently in advance of the meeting are copied at IWC expense. However, the savings would not be large (of the order of a few hundred pounds).

Shortening the Scientific Committee meeting would save money in that Secretariat costs are some £1,000 per day. However the Committee already works very long hours in order to fulfil its tasks and without a reduction in its workload a reduction in the length of the meeting would not be practical.

Clearly if the Scientific Committee were to meet biennially, this would represent a substantial saving of around £20,000 every 2 years. However, it should be noted that SC/37/Rep 1 states that the Scientific Committee should 'assess annually' the status of stocks (Item 7.1.1). In addition, it should be noted that SC/37/Rep 1 identifies a large number of areas which require Scientific Committee advice and thus time. One possibility would be for the Scientific Committee to meet biennially and in the intervening year hold a special meeting on a specific topic (e.g. the comprehensive assessment) but this would not necessarily result in any savings.

There was some discussion as to whether a system similar to that used by ICES could be adopted by this Scientific Committee: this would involve a series of sub-committee meetings being held in various national laboratories during the year, who would report to a smaller 'Advisory Body'. It was noted that the occurrence of Special Scientific Committee meetings between Annual Meetings is not dissimilar to this in some respects. However, it was noted that the considerable overlap of expertise within the Committee could result in many members having to attend several meetings a year, which is impractical. In addition, particularly for this world-wide international organisation, the increased travel costs in

sending Secretariat and national participants may well result in no financial benefit to the Commission or Contracting Governments.

However, perhaps the most serious practical difficulty with this approach is in determining the composition of the 'Advisory Body'. This is in many respects similar to the idea of establishing an Executive Steering Group which was discussed fully at the 1983 meeting of the Committee. At that time the Committee noted that such a group had no precedent within the Commission and it also noted the problem of investing too much authority in a small group (*Rep. int. Whal. Commn* 34: 624).

The Committee agreed that *per capita* charges should not be introduced as they would reduce the expertise of the Committee, particularly with respect to scientists from developing countries; for the same reason it believed the provision of a small fund for invited participants should be retained.

In summary, the Committee noted that the changes in the nature of the advice it would have to provide to the Commission (discussed under Items 7.1 and 8) may require a radical restructuring of the sub-committee system. It also noted the financial concerns expressed by the Commission and will consider these in detail when re-organising its structure so that it can most efficiently and economically address itself to its main tasks and species as determined by the Commission. Until this re-organisation has been carried out it is premature to discuss eliminating any of the sub-committees.

However, in view of the specific mention of the sub-committee on small cetaceans in the request, the Committee noted:

(i) the elimination of the small cetacean sub-committee would result in very small savings in meeting costs (about one hundred pounds for copying since no reduction in Secretariat costs could be made) because there would still be the same number of participants in attendance;
(ii) in this regard it is relevant to mention some of the topics which have been addressed by this sub-committee which have been of particular interest to the Commission—bottlenose whales; killer whales; Bairds beaked whales; pollution; and, at one time, minke whales;
(iii) in response to some expressions of concern at last year's Commission meeting, the number of small cetacean papers in the current Annual Report has been reduced such that they take up only 2% of the total volume.

A minority view was expressed (Annex N1).

7.2.2 Publications

The Committee examined several possible ways in which the cost of its publications could be reduced.

(a) *Page charges*

Although some journals have either compulsory or optional page charges, certain problems were identified. Compulsory page charges tend to discriminate against authors from developing countries or poorer institutions; criteria for inclusion should be scientific merit and importance within the Committee's discussions rather than the ability to pay. Although optional page charges reduce this problem to a degree, it makes accurate budgeting almost impossible if the merit of papers is the sole basis for inclusion.

(b) *Inclusion of advertisements*

The Committee did not believe that this would be appropriate.

(c) *Use of printers in other countries*

The Committee noted that two printers were being used in Cambridge and that competition between these helped to keep costs down. Tillman reported that IUCN had found printing costs in the UK to be favourable. In addition to this, several problems were identified in terms of efficiency and speed of production, and postal and shipping charges, if the printers were located outside the UK.

(d) *Subscription charges*

The Committee noted that at present, publications are distributed free to Committee members, Commissioners and Contracting Governments. The Committee **recommends** that this agreement be continued with respect to Committee members, as the information contained within them is vital to its work. It also noted that apart from a small number of exchange arrangements, all other recipients of IWC publications purchase them.

The Committee then reviewed the several measures already taken to reduce costs. In 1981, the Committee drew up guidelines to ensure that the papers published were of most relevance to its work (*Rep. int. Whal. Commn* 32: 62–3). Papers are subject to anonymous review and considerable efforts made to ensure brevity and increase scientific merit. This has resulted in both a reduction in the percentage of presented papers which are published (from 62% in the 1980 volume to 40% in the last volume) and the mean number of pages per paper (6.4 in 1980 to 5.2 in 1985). In addition to this, the Tables in the latest volume were provided to the printers as camera-ready copy—this has two advantages:

(i) type-setting of Tables is complex and hence is the most expensive item per page of text if set by printers;
(ii) in-house editing of content and style enabled many tables which would have been set as double-column width to be condensed to single column width, thereby helping to reduce the number of pages in the volume.

The Committee commended this approach and the care taken to ensure that the overall quality of the production was retained. It draws the Commission's attention to the fact that the current volume is 208 pages shorter than the previous volume as a result of these measures. The use of new technology is being investigated and utilised to the extent practical. However, at the present stage of development, type-setting all the text within the Secretariat would not result in significant savings as further staff, equipment and space would be required.

In conclusion, the Committee believes that IWC publications play an essential and integral role in the Committee's work. It notes the great improvement in the quality of the production and the scientific content in recent years. This has resulted in a significant and continuing increase in sales (expected to reach at least £28,000 this year), which will substantially defray the production costs and which draws the attention of the wider scientific community to the Committtee's work. Measures which reduce the quality of the publications may well be counter productive in that a decrease in sales may result. It commends the current efforts to improve sales and believes that further methods of increasing them (e.g.

the FAO/UNEP promotion service, the wider utilisation of abstracting services and advertising at the Society of Marine Mammalogists meeting being held in Vancouver in November 1985) be investigated with the aim of making the publications self-sufficient. In addition, Member Governments are encouraged to take steps to increase sales of IWC publications in their own countries. The Committee **recommends** the continued funding of publications and publicity material for them. It also notes that discussions concerning the future workings of the Committee reported in Item 7.2.1 (e.g. the holding of biennial meetings) may affect the nature of future publications.

7.2.3 Policy on overheads when funding research

The Committee **recommends** that payment of overheads should be negotiated on a case by case basis, and that potential applicants should be informed that inclusion of overheads may lead to only partial funding, in accordance with one of the views expressed last year (*Rep. int. Whal. Commn* 35: 35).

8. COMPREHENSIVE ASSESSMENT OF WHALE STOCKS

Papers SC/37/O 10, 11, 13 and 24 analysed the properties of the current management procedure and an alternative management procedure using assessments based on fitting population models to either relative or absolute abundance data. These studies were intended both to clarify issues involved in the further development of management procedures and to illustrate an approach for the evaluation of possible management paradigms.

The author believed that the current management procedure 'New Management Procedure (NMP)' of the IWC was an important landmark in the development of management procedures for living resources, but that it required information about exploited populations which was unobtainable in practice. Simulation studies of the NMP showed that it would lead to catch limits varying over several orders of magnitude until between 50 and 100 years of data were available. It was shown that management based on catch and effort data could lead to a failure to realise the potential from the stocks. This problem is due to the reliance of information on catches. It was shown that the problem does not arise when independent estimates of absolute abundance are used as the basis for management, but at the cost of increasing the risk of the stock declining below the protection level. SC/37/O 24 showed that the NMP and an alternative were only modestly successful, even under ideal circumstances, where the flow of data about the exploited stocks is greater, and the data themselves less complicated, than for any real whale stock.

Tanaka noted that the incorporation of a degree of feedback into the model was an improvement on previous work although he believed further factors should be taken into account.

The Committee welcomed this series of papers. It believed that further work along similar lines would represent a valuable approach to formulating a new management regime which may be very different in kind to those previously suggested and which takes into account the kind of the data and methodology likely to be available. The Committee has already stressed the relationship between management policies and assessment methods (*Rep. int. Whal. Commn* 35: 36). It **recommends** that a workshop be held to explore this further within the context of the Comprehensive Assessment and that experts on the use of control theory in fisheries management be invited to attend.

9. FUTURE MEETINGS AND SPECIAL STUDIES

9.1 Indian ocean sanctuary scientific meeting

At last year's meeting, the Commission had agreed with a proposal from the Seychelles that the Commission's review meeting should be held in 1986 immediately before its Annual Meeting, and that the scientific review meeting could be held early in 1986. Holt advised the Committee that after consultation with other Indian Ocean states, the Seychelles was prepared to host the scientific meeting. The Committee had undertaken some planning for this meeting in 1983 (*Rep. int. Whal. Commn* 34: 41, 62, 167). It noted that March or early April 1986 was probably the most appropriate time for the meeting. It was agreed that a steering group (comprising Kirkwood, Holt, Harwood, Brownell and Gambell) should work by correspondence during the year, if the Commission agrees that the meeting should occur. Beddington reported that it was hoped that a full report of the data obtained from the Tulip cruise (Annex D, Item 7.1) would be available for this meeting. The Committee agreed that it would be appropriate for this to be a primary paper. If the paper was not available, the Committee **recommends** that Beddington informs the researchers via IUCN of its desire to discuss data collected by the Tulip at the 1986 Annual Meeting. Funds of £10,000 are required for the meeting in addition to money provided by the Seychelles and UNEP.

9.2 Incidental take of cetaceans in fisheries

The sub-committee on small cetaceans discussed the planning of a Workshop on the Incidental Take of Cetaceans in Gillnet Fisheries (Annex I, Item 5.2). The meeting will be convened by Brownell in late November 1986 at the US National Marine Laboratory in Seattle. The main objectives will be:

(i) to identify new and expanding gillnet fisheries which take cetaceans;
(ii) to investigate how and why entanglement occurs;
(iii) to estimate mortality and assess its impact on cetaceans;
(iv) to consider possible ways of reducing levels of gillnet mortality in cetaceans.

It was stressed that the meeting's scope should be limited to scientific and technical matters related to cetacean entanglement in gillnets. The participation of a behaviourist, a sensory physiologist, a fisheries development officer and a gear expert will be encouraged.

The Committee endorses the holding of this workshop, noting that it will be held in the 1986 financial year and that non-IWC funds are being sought. The Committee **recommends** that the Secretariat be represented at this meeting, noting that the meeting will include an examination of the incidental taking of gray, humpback and right whales e.g. (see Item 12.2), species which are listed in the Schedule. The meeting is thus of direct relevance to the management of these species by the Commission.

A minority view was expressed (Annex N1).

9.3 Workshop on the feeding ecology of southern baleen whales

The report of the working group on a 'multi-organisational, multi-disciplinary workshop concerning whales and their ecosystems', developed at the 1984 meeting of the Committee (*Rep. int. Whal. Commn* 34: 171), was reviewed at this meeting with the aim of providing advice to the Commission on whether the workshop should be convened. It was understood that the scope of the proposed workshop had subsequently been restricted to feeding ecology of baleen whales in the Southern Hemisphere. The Committee **recommends** that plans should proceed and the workshop be held outside the Southern Hemisphere field season perhaps just before the annual meeting of the CCAMLR Scientific Committee in Hobart, Australia in 1986 or later. The Committee further **recommends** that the workshop be co-sponsored by the IWC and CCAMLR, and that this proposal be transmitted to the CCAMLR Secretariat for consideration at the next CCAMLR meeting in September 1985. Partial funding of £10,000 is sought.

9.4 Other meetings or studies arising

(a) Review of IWC/IDCR data other than for minke whale assessments.

In 1983, the Committee agreed that a meeting should be held to provide a more comprehensive review of the information contained in the IWC/IDCR database to focus on species or aspects not covered under normal minke whale assessments. Last year the Committee recommended that this meeting be held for two days prior to the 1986 Annual Meeting and that funding be sought this year. A sum of £2,000 is required. In this context it is noted that Annex D (Item 7.4) reported that such a study would be useful for sperm whale assessments.

(b) Special Meeting to plan for the comprehensive assessment.

This is discussed under Item 7.1.1. The Committee believed that the meeting should be held for one week in April or May 1986. If the meeting is held in Cambridge and meeting rooms are free, then funds of £1,000 are required. It was noted that this meeting would also discuss the planning of the workshop on management procedures outlined under Agenda Item 8.

9.5 Order of priority of proposed meetings

The Committee agreed the following priority:

(1) Special Meeting to plan for the Comprehensive Assessment;
(2) Review of IWC/IDCR data other than for minke whale assessments;
(3) Joint Workshop on Feeding Ecology of Southern Baleen Whales;
(4) Indian Ocean Sanctuary Meeting.

10. GENERAL SCIENTIFIC CONSIDERATIONS

10.1 Methods for estimating natural mortality rates

At last year's meeting a working group was established to examine methods for estimating natural mortality. The preliminary report of the group is given in *Rep. int. Whal. Commn* 35: 142–3. The group continued its business throughout the year and its report (SC/37/Rep 4) was distributed with the draft agenda. The Committee noted that the conclusions in SC/37/Rep 4 agreed with those of the preliminary report.

10.2 Ways of maximising information from strandings (see also Annex K)

The report of the Working Group established last year (*Rep. int. Whal. Commn* 35: 53) to examine this matter was reviewed. The Committee agreed with the Group's conclusion that the collection and review of information on existing arrangements had been a valuable exercise (Annex K, Appendix 2). The Committee also agreed that strandings, in conjunction with other information, are an increasingly valuable source of information for some aspects of the management of cetaceans.

The specific recommendations of the Group relating to additional data collection were noted (Annex K). The Committee **recommends** that:

(1) nations without a strandings programme consider establishing one;
(2) institutions with experience and special expertise in strandings networks and in analysis of specimens and data be encouraged to assist new and developing programmes;
(3) responsible authorities be encouraged to facilitate exchange of scientific materials among cooperating national schemes;
(4) the importance of adequate professional curation and long term storage of scientific material be recognised and institutions providing such services be supported;
(5) programmes should involve specialists in biological data collection; and notes
(6) that new information on strandings recording schemes will be welcomed by the Scientific Committee.

10.3 Disposition of whale marks

The Secretary reported that the Commission had 1,000 .410 and 1,000 12-bore Discovery marks and 12 marking guns in stock. In view of the fact that they would be damaged unless stored properly, and that such storage would require Commission funds, he requested guidance as to whether they were likely to be used in the future.

The Committee noted that this was largely an administrative problem and agreed that it was not appropriate to enter into a full discussion of the value of marking at this time. The Secretary noted that the problem was not yet serious although it would worsen with time and the Committee agreed to review the matter on a yearly basis.

10.4 Principles and procedures for reviewing Scientific Permits

The Committee noted that Article VIII of the 1946 Convention grants for each Contracting Government the right to issue special permits 'to kill, take and treat whales for purposes of scientific research'. It noted further that Paragraph 30 of the current Schedule states that a Contracting Government 'shall provide the Secretary . . . with proposed scientific permits before they are issued and in sufficient time to allow the Scientific Committee to review and comment on them'. This review procedure has been incorporated into the Committtee's Rules of Procedure as Section F.

To improve its effectiveness in reviewing proposed scientific permits in accordance with Section F of its Rules of Procedure, the Committee formulated the guidelines given in Annex L.

The Committee noted that the analysis suggested in Guideline 6 (An evaluation of the specification in the permit proposal of 'possible effect on conservation of the stock') may require allocation of time at its regular meetings. It also draws the attention of the Commission to the fact that its work in reviewing proposed scientific permits would be enhanced if the information required under Paragraph 30 of the Schedule was provided to the Secretary at least 60 days in advance of a regular Scientific Committee meeting, so that such proposals and supporting documents can be promptly sent by the Secretary to all members of the Committee, at the same time as the provisional agenda.

Should a scientific permit be granted by a Contracting Government for catches to be taken in more than one year, the Committee believed it would be appropriate to review that permit in each year of its duration. Such a review would take into account scientific results arising from work carried out under the permit, other available information and the Committee's previous comments.

The Committee noted that the above does not exclude the mail procedure provided for under Section F, paragraph 4 of the Rules of Procedure. However, in that event, consideration will have to be given to the development of a mechanism for coordinating comments for transmission to the Commission. Holt noted that other problems concerning this procedure need to be addressed, including determining membership of the Committee between meetings and determining a 'Committee' view as distinct from a compilation of the individual views of its members. The Committee agreed that this question warranted further discussion but agreed to the procedure outlined by the Secretary in the meantime. He will distribute by mail copies of any special permit proposal to the members of the Scientific Committee as constituted at the Commission's Annual Meeting. Comments received will be collated and forwarded to the Chairman of the Scientific Committee for decision as to further action in consultation with the convenors of the Committee's sub-committees as appropriate.

The Committee agreed early in its meeting that the guidelines should be used by the sub-committees in examining scientific permits, and that they would be reviewed later in the meeting in the light of that experience.

Subsequently, the Committee noted that the sub-committees had found the guidelines to be helpful in both focussing discussion and structuring their reviews. It was emphasised that the two scientific permits received had been submitted before these guidelines had been developed, and that this had resulted in some initial difficulty in applying the guidelines.

There was some discussion as to whether the guidelines should be added to the Committee's Rules of Procedure. Some members believed that the guidelines, particularly Guideline 2, did not sufficiently take into account the question of permits issued for scientific purposes which were not directed towards management questions. It was also noted that the research needs of the Committee were not always easily or consistently identified in the Committee's report. These members therefore believed it would be premature to formalise the guidelines by recommending their inclusion in the Rules of Procedure at this meeting. Other members believed that the current wording was not exclusive of research directed towards issues other than management, but noted that the Committee's major concern was the provision of management advice to the Commission. They believed that to ensure a consistent approach to the review of such permits, it would be desirable to include them in the Rules of Procedure.

In the absence of consensus the Committee agreed to adopt the guidelines as internal guidelines, noting that they would be kept under review as experience in their use accumulates.

In view of this the Committee draws the attention of the Commission to the guidelines, and notes that its work in reviewing future permit proposals would be facilitated if the guidelines were utilised when such proposals were formulated.

A minority view is expressed in Annex N1.

11. WHALE STOCKS, STATUS AND ADVICE

Given the implementation of Schedule paragraph 10(e), the Committee observed that catch limits for commercially exploited stocks will be set at zero for the 1986 coastal and the 1985/86 pelagic seasons and thereafter. Early in its deliberations, the Committee discussed how this decision might affect the nature of the advice it provides to the Commission based upon the results of its stock assessments. Noting the likelihood that for some stocks exploitation would continue, most of the Committee believed it should examine the possible effects of catch levels upon such stocks. However, others objected to providing any advice on catch levels, citing the facts that catch limits were already set at zero and that one could not forecast the catches to be set by national governments under objection. In the absence of consensus, the Committee Chairman ruled that implementation of the majority view would be deferred until specific advice on the matter was provided to the Committee by the Commission.

At a subsequent session, a majority of the Committee expressed a desire to re-open this subject for discussion, pointing out that the Commission had already provided clear instructions to proceed with stock assessments in the normal way and to provide the usual management advice (paragraphs 6.1 and 6.2, Chairman's Report of the 36th Annual Meeting, *Rep. int. Whal. Commn* 35: 10). The Committee Chairman then permitted further discussion of the matter. Subsequently, most of the Committee agreed that, where there was a likelihood of exploitation, it should assign such stocks high priority and assess the effects of a zero catch upon them.

Some Committee members were perplexed to face a new instruction from the Chairman which virtually required estimates of likely productivity at the final stage of sub-committee meetings. The inclusion of a critical subject requiring substantive discussion such as estimating the likely productivity of stocks which may be exploited under objection, would most appropriately be treated by the Committee at this stage as a topic to be held pending an instruction by the Commission for the following reasons:

(i) there is a problem of determining which stocks might be exploited under objection;

(ii) when the level of the catches which might be taken under objection is unknown, a rational approach would be to assess the effect of the actual catches after they are taken;
(iii) the effects of zero catches on the stocks should be more appropriately considered within the scope of the comprehensive assessment;
(iv) when a likely productivity of a stock has been fully agreed upon, consensus may be expressed in the report of the Committee. However, the inclusion in its report of any divergence of views, which may emerge in the Committee, would only lead to controversy in the Commission.

11.1 Sperm whales (see also Annex D)

The priority stock for assessment at this meeting was the western North Pacific stock. Any new data received on the North Atlantic stock were to be examined if time permitted, but no assessment was to be attempted.

11.1.1 Western North Pacific stock

11.1.1.1 *Review of new data*

The Committee noted that, in response to its recommendation last year, all available BIWS sperm whale catch records for the North Pacific have now been coded and validated.

It is also noted that, again in response to a previous recommendation, the practice of slitting carcases of females at sea in the Japanese coastal sperm whale fishery had been discontinued, thus allowing the collection of reproduction data. An analysis of data for the 1983/84 season (SC/37/Sp1) indicated that there were considerable discrepancies between the determinations of reproductive status by a biologist and non-biologist inspectors and observers, particularly in the proportions of lactating and resting females. For this and other reasons, no estimate of population pregnancy rate could be obtained from these data.

The Committee agreed that these discrepancies cast substantial doubt on the utility of reproduction data collected by non-biologists. For the Japanese coastal operations, it stressed the importance of finding some solution to this problem.

11.1.1.2 *Validation of computer programs*

The Committee had repeated last year its recommendation that the computer programs implementing the two length-specific estimation techniques should be validated by Free. At the start of the sub-committee meeting, Free had advised that he had completed the requested validations. The steps he had taken to do this, including detailed checking of the coding of the programs against the algorithms in the published descriptions of the procedures, are described in Appendix 2 of Annex D. He reported that both programs were found to be substantially correct. Minor errors were detected in each program, but they were either unlikely to be triggered in practice, or were numerically insignificant. At the conclusion of the validation exercise, each program was revised and converted to FORTRAN 77 (a new international standard for the FORTRAN programming language).

Later in this meeting, however, when attempting to repeat a comparison test of the two programs at the request of the sub-committee, he had detected errors in both new versions of the programs. These were sufficient to preclude use of these programs for assessments during this meeting. Free advised the Committee that, although he had not yet traced the exact source of these errors, he believed they had been introduced during conversion of the programs to FORTRAN 77. These errors had not been present in previous versions of the programs.

The Committee expressed its deep regret that once again a thorough assessment of this stock could not be carried out due to a lack of properly validated programs. It agreed that, while much work had been done to validate these programs, adequate testing of the final versions of the programs before the meeting would have detected these errors and enabled error-free programs to be used at this meeting. Such testing was considered by the Committee to be part of a proper validation process, and it should have been carried out before the meeting. While acknowledging this, Free explained that the approach to validation that he had decided to take had been influenced by the financial climate of the Commisssion and a consequent desire to minimise use of the Cambridge University computer.

The Committee's discussion on means of ensuring that properly validated programs and results necessary for a stock assessment are available for next year's meeting are discussed under Item 15.4 of this report.

11.1.1.3 *Review of assessment techniques*

The Committee noted that the conclusions of a review of problems in assessment techniques that had been applied in the past to this stock (SC/37/Sp2). These were that the current understanding of sperm whale population dynamics and the available data do not appear to be sufficient in themselves to fit an explicit population model to abundance or size composition data to obtain an estimate of the population trajectory. It agreed, however, that length-specific simulations may be of greater utility if used in combination with reliable data on absolute abundance, such as from properly designed sightings surveys.

11.1.1.4 *Stock assessment*

As noted earlier, the Committee had been unable to examine estimates of stock sizes from validated length–specific procedures because of errors detected in the programs. The Committee was unable to agree on recommendations for classification of this stock. Instead, the following three views were expressed:

(i) All the available evidence, when considered together, is sufficient to indicate that the male sperm whale stock in the Western North Pacific has been reduced to a level well below the standard level at which a protection classification would follow. Accordingly, the male stock should be classified as a Protection stock pending the establishment of a satisfactory basis for its future management. No classification is proposed for females, but the stock would rebuild at the fastest rate if catches of females were not taken.
(ii) Once again, the Committee had been unable to examine results from length-specific estimation procedures. Consequently, there were no reliable estimates of initial or current stock sizes or MSY levels available, and thus no information on which to base recommendations on stock classification under the New Management Procedure.
(iii) While the weight of evidence is sufficient to indicate that this stock had been very heavily exploited, the prevailing levels of uncertainty are such that it is at present impossible to classify the stock under the New Management Procedure.

11.1.1.5 *Effect of zero catches*
The Committee did not have the requisite information to evaluate the effect on this stock of a zero catch.

11.1.2 North Atlantic stock
No new information was received for this stock.

11.2 Southern Hemisphere minke whale stocks (see also Annex E)
The status of all the Southern Hemisphere stocks was reviewed, paying particular attention to the results of the 1984/85 IWC/IDCR sightings cruise in Area IV. It was agreed to base management advice on the present Areas.

11.2.1 Biological parameters
Further studies of apparent changes in age at sexual maturity, measured in a number of different ways, had been undertaken. Some members considered that observed changes were strong evidence that age at sexual maturity and growth rates had been changing before the stocks were exploited. Other members were unconvinced of this, and concluded that the observed results were explained equally well by age-specific patterns of ovulation, changes in selectivity and methodological problems.

The sub-committee had noted the unsatisfactory nature of this discussion which was, in part, a consequence of the limited availability of the data on which the report analyses were based. It recommended a workshop on biological data from Southern Hemisphere minke whales as a way to resolve some of these problems. However, in discussion within the Committee it became clear that national policies about access to data would make it impossible to hold an effective workshop before the next Annual meeting.

11.2.2 Current recruitment rates
In its previous discussions (*Rep. int. Whal. Commn* 35: 77) the sub-committee had considered the use of a multi-cohort analysis of the age structure of the catch to estimate trends in recruitment. It had been noted that the observed catch at age could be explained by a natural mortality rate which increased with age or a decreasing selectivity with age, as well as by increasing recruitment. At this meeting, further analysis of the sensitivity of the method to age-specific mortality and different selectivity patterns was presented to show that the method was robust to these and that recruitment rates before exploitation were between 2 and 4%. However, some members considered that the effects of selectivity, mortality and recruitment could not be distinguished in this way and noted that the age-structure of the catch was explained equally well by the pattern of age-specific mortality estimated in *Rep. int. Whal. Commn* 35: 242 and a constant recruitment rate.

Other indications of the possible range of recruitment rates came from estimates of parameter values for the Pella-Tomlinson stock-recruitment relationship based on data from Northern Hemisphere minke whale stocks (see Annex F). Some members concluded that these calculations indicated that net recruitment rates near MSYL are probably no more than 2%, and may be substantially lower. Other members believed that the Pella-Tomlinson relationship was inappropriate for Southern Hemisphere minke whale stocks which, they believed, had been increasing before exploitation.

Further estimates of recruitment rate were available from comparison of observed and expected catches, but these were not discussed by the sub-committee.

11.2.2 Estimates of stock size and trends in abundance
(i) *Mark-recapture estimates*
The Committee noted that the recommended review of mark-recapture analyses had not been conducted. It concluded that until this review had been completed, doubts would remain about the reliability of estimates of abundance for Southern Hemisphere minke whales from such analyses, and no such estimates were made. The Committee **recommends** that the review of mark-recapture techniques for minke whales (originally proposed in *Rep. int. Whal. Commn* 34: 85) should be carried out as soon as possible.

(ii) *Sightings estimates*
The 1984/85 IWC/IDCR cruise in Area IV had been designed primarily to conduct experiments to resolve some of the problems with the analysis of data from previous cruises which had been identified at the sub-committee's last meeting. Most of the results of these experiments had been discussed at the Workshop on Minke Whale Sightings (SC/37/Rep 3). These discussions had been principally concerned with the estimation of the correction factor 'e.h'. Some members concluded that there were still problems with the interpretation of the experimental results and that, until the analyses recommended by the Workshop had been completed, the appropriate course of action was to adopt a value of e.h = 1 for estimating abundance from the sightings surveys. This was the course that had been adopted in 1984 (*Rep. int. Whal. Commn* 35: 79). Other members believed that the discussions at the Workshop had indicated that a robust estimate of the effective strip half-width ($g(0).\bar{y}$) could be made from the results of some of the experiments and proposed that abundance should be estimated using a value of 0.5 for this parameter. No change was proposed in the other correction factors to be used, and estimates of recruited population using both approaches are given in Table 3.

Table 3

Population estimates for Southern Hemisphere minke whales from sightings. Estimates from the Area I 1984/5 survey have not been included because the data have yet to be validated

Area	Year	Recruited population	CV	Area	Year	Recruited population	CV
For e.h = 1.0							
I	1982/83	25,617	0.183	IV	1978/79	53,303	0.147
II	1981/82	22,873	0.167	V	1980/81	66,666	0.282
III	1979/80	50,016	0.189	VI	1983/84	39,846	0.172
For $g(0).\bar{y}$ = 0.5							
I	1982/83	36,064	0.181	IV	1978/79	37,926	0.127
II	1981/82	25,163	0.163	V	1980/81	71,617	0.268
III	1979/80	50,115	0.180	VI	1983/84	36,010	0.151

The Committee discussed problems in estimating mean school size, the proportion of 'takeable' animals, and the stratification of survey results. It **recommends** that further work be carried out on these topics.

Although the 1984/85 cruise had been designed primarily for experimental purposes, it was possible to calculate preliminary estimates of abundance from the western half of Area IV using unvalidated data. The Committee

recognised that these results would not be strictly comparable with those from the previous survey in 1978/79 because the data were unvalidated, and because there were substantial differences in the design and timing of the two surveys. There was no significant difference between the estimates obtained from the two cruises, nor was there a difference between the estimates obtained from the two different survey techniques used in 1984/85. However, the Committee drew attention to the preliminary nature of these analyses and the wide confidence limits associated with each estimate.

(iii) *Additional estimates*
A revised analysis of Antarctic catch per unit effort (CPUE) data, which made allowance for the effects of a large number of weather and operational factors, was presented. This showed no significant trends over the period 1972/73–1982/83. The Committee suggested some modifications which might usefully be made to the statistical analysis.

Some effort data for the Brazilian whaling operation in the 1984 season was available. However, in the time available, it was not possible to recalculate all the different corrected measures of effort that were used in the comparisons reported in *Rep. int. Whal. Commn* 35: 79–81. The different opinions about the status of this stock expressed in *Rep. int. Whal. Commn* 35: 41–2 remained unresolved. It was noted that the discussions on this topic would have been facilitated if more detailed effort data had been available; guidelines for the sort of data that are needed are given in Appendix 7 of Annex E. The Committee **recommends** that such data should be lodged with the Secretariat and made available to interested members of the Scientific Committee.

11.2.4 Population estimates
The Committee agreed that the sightings estimates presented in Table 3 provided a basis for further advice. It was noted that these estimates did not account for whales inside the pack ice or north of the surveyed area.

11.2.5 Classification
A number of different views were expressed about the status of the Southern Hemisphere stocks before exploitation; after hearing these the Committee **recommends** that the stocks should not be classified.

11.2.6 Response to continuing catches
The Committee was unable to reach agreement over the effect of zero catches on these stocks. A number of views are presented in Annex N.

11.2.7 Description of differences from recommendations of last year
The estimates of stock size and the recommendation regarding classification do not differ substantially from those given in *Rep. int. Whal. Commn* 35: 41–2.

11.2.8 IWC/IDCR cruise in 1985/86
The Committee noted that the government of Japan had offered to provide two or three sightings vessels for a research cruise in the Southern Hemisphere in 1985/86 and that a Soviet vessel would probably also be available. It **recommends** that such a sightings cruise should take place as part of the second IDCR and that, provided ice conditions in the Ross Sea are satisfactory, it should cover Area V. The rationale for this choice is given in Annex E, Item 16. The Committee also noted that the design and success of experiments to be conducted on that cruise would depend on the outcome of the analyses recommended in the Report of the Sightings Workshop, and it **recommends** that such analysis should be conducted before the anticipated pre-cruise planning meeting in September/October.

11.2.9 Priority stocks
It was agreed that priority should be given to the stock in Area II (see Annex E) but that all Southern Hemisphere stocks should be considered next year.

11.2.10 Review of research recommendations
The recommendations for research are that:

(i) An IWC/IDCR minke whale sightings cruise should take place in Area V in 1985/86. Important analyses of the results of the experiments conducted on the 1984/85 cruise should be completed in time for the pre-cruise meeting.
(ii) A review of mark-recapture techniques should be carried out as soon as possible.
(iii) Studies of size at recruitment, mean school size and various methods of stratification should be conducted for use in the analysis of data from the IWC/IDCR sightings cruises.
(iv) Effort data for the Brazilian fishery should be lodged with the Secretariat and analysed in time for the next meeting of the Scientific Committee.

11.3 Northern Hemisphere minke whale stocks

11.3.1 West Greenland stock

11.3.1.1 *Stock division*
The present division of North Atlantic minke whales into four stock units was proposed by the 1976 Working Group on North Atlantic whales (*Rep. int. Whal. Commn* 27: 370). Stock area boundaries were defined by the Scientific Committee in 1977 (*Rep. int. Whal. Commn* 28: 63, 77–78) and two of the stocks were renamed without revision of the boundaries at the 1980 Committee meeting (*Rep. int. Whal. Commn* 31: 61).

The present stock units are:

(i) Northeastern stock;
(ii) Central stock;
(iii) West Greenland stock; and
(iv) Canadian East Coast stock.

The validity of these stock units was examined by the Committee to investigate the possibility of mixing implied in SC/37/Mi4. In addition to previous arguments, recent markings and recaptures in the North Atlantic were reviewed. With no record of crossovers between Northeastern and Central stock unit areas, where 83% and 17% of total catches in the two areas have been taken through 1974–84, and no recovery reported from markings in the other areas, it was agreed that there was no need to revise the present definitions of stock units or area boundaries.

11.3.1.2 *Population estimate*
Preliminary results of an aerial survey in West Greenland waters in 1984 were reported (SC/37/O 19). The first survey in a planned series of three was aimed at supplying data for abundance estimates of large cetaceans. Because

of adverse sighting conditions and the late arrival of minke whales at West Greenland in 1984, abundance estimates by line transect procedures were not carried out. The Committee encourages Denmark to continue line-transect surveys at West Greenland.

11.3.1.3 *Assessments*

Revised catch statistics in 1983 and provisional figures in 1984 were reported (SC/37/ProgRep Denmark).

Of four updated indices of abundance for Norwegian whaling operations off West Greenland, catch per good day of weather (C/GW), and catch per net catcher day − 1 (C/NCD − 1) were believed reliable. While the former index was available for the years from 1977 to 1984 from a single vessel operating, the latter was not available separately for 1984 when the two vessels operated. It was agreed to use both of the above indices, but the latter index for the years from 1977 to 1983 only, which is identical to last year (*Rep. int. Whal. Commn* 35: 93 Table 6).

As indicated by regression analysis, trends in these CPUE series were −3.03% per year and −5.7% per year for C/GW and C/NCD − 1, respectively. Probabilities that CPUE is stable or increasing, or that it has declined to a certain level at the start of the series (1977) were also calculated (Table 4).

Table 4

Trends as indicated by regression analysis and probabilities of increase/decrease for the West Greenland Stock of minke whales, based on CPUE indices for the Norwegian small-type whaling vessel *Kato*. Data 1977–83 from *Rep. int. Whal. Commn* 35: 94.

	C/GW 1977–84	C/NCD-1 1977–83
Slope (% per year)	-3.03	-5.7
t	-1.38	-1.56
df	6	5
Probability CPUE stable or increasing	0.11	0.09
Probability CPUE has declined to		
90%	0.78	0.84
80%	0.59	0.73
70%	0.38	0.57
60%	0.20	0.40
of level at the start of the data series		

A new stock assessment was presented at this meeting. SC/37/Mi4 presented an analysis of the data for the Northeastern Atlantic stock which estimated parameters in a population model and then applied them to other stocks in the North Atlantic. The estimation procedure projects a trajectory through two targets—a recent estimate of stock size and the rate of change in the stock size in an identified period. In this case estimates of the initial stock size, N_o, and the maximum net recruitment rate, A/M, are obtained for given values of the median age at recruitment, the natural mortality coefficient, M, and the exponent n. The final parameter corresponds to the MSY level relative to the initial stock size and equals 2.39 when MSY level is 60% of initial stock size. Since there is no estimate of stock size for the West Greenland stock, estimates of A from the analysis of the Northeastern stock were adopted in SC/37/Mi4. The target used is the estimated rate of change in stock size (change in CPUE multiplied by a factor for non-linearity) and N_o is the parameter to be estimated.

The procedures described in SC/37/Mi4 were applied to four combinations of targets for the Northeastern stock: N = 22,000 and 30,000 (i.e. half the total stock, see *Rep. int. Whal. Commn* 35: 91); possible range of annual rate of change in stock size = −3.0% and −6.0%, (i.e. change rate in CPUE × non-linearity factor of 1 or 2 as given in Table 2, (*Rep. int. Whal. Commn* 35: 91). The greater rate of change in stock size could not yield a positive value of A and only two estimates of A were obtained (Annex F, Table 4). Several possible explanations for this include problems in the observed change in CPUE (−3.0% per year), the non-linearity factor (2.0), the target stock size or any combination of these.

Two acceptable estimates of A (0.28, 0.07) from the Northeastern stock were then applied to the West Greenland stock, targetting on two estimates of the rate of change in population. The larger rate (−10.4% per year) resulted in elimination of females from the available stock before 1986 for all values of A (Table 5).

Table 5

Probabilities (P) that the West Greenland stock of minke whales is in PS category, calculated for alternative estimates of A and trends, taking account of the variance of trends. M = males, F = females

	Rate of change in available stock %		1986 stock / Initial stock			
A	1978%	CPUE data	M + F%	F%	P	RY
0.28	-5.64	C/GW (1977–84)	28.8	13.2	0.79	70
0.28	-10.40	C/CND-1 (1977–83)	12.2	0	0.90	(negative)
0.07	-5.64	C/GW (1977–84)	29.5	15.8	0.74	50
0.07	-10.40	C/CND-1 (1977–83)	15.3	0	0.88	(negative)

These results indicated that the probability is greater than 74% that the stock is in the Protection Stock category. Some members of the Committee expressed their doubt about the validity of the model and objected to its use as a basis for making recommendations. A minority view is expressed in Annex N8.

11.3.1.4 *Recommendations*

The Committee noted the statement made by Øritsland that this stock would not be subject to commercial whaling by Norwegian vessels as from 1986. Thus it observed that minke whales of this stock will likely continue to be hunted only under provisions for aboriginal subsistence whaling.

Based on the above probability that this stock is in the Protection Stock category, most members of the Committee were in favour of classifying this stock as a Protection Stock. However, referring to uncertainties in the assessments, other members proposed that this stock should remain unclassified.

Noting the fact that the Committee had not yet been able to provide advice on the criteria in footnote 1 to Schedule paragraph 13(a) (2), and having regard to the depleted state of females, the Committee **recommends** that the catch limit be set for one year only, at less than 50 whales, the lower estimate of the current replacement yield (Table 5).

11.3.2 Okhotsk Sea – West Pacific stock

11.3.2.1 *Stock division*

No new information was available to the Committee at this meeting to indicate a revision of definitions of stock units or boundaries. It recalled the results from the electrophoretic study which revealed genetic differences between minke whales of this stock and the Sea of Japan—Yellow Sea—East China Sea stock (*Rep. int. Whal. Commn* 34: 47, 345–47).

11.3.2.2 *Population estimate*

The Committee agreed that the estimated population from Japanese sightings discussed last year would be useful as a basis for assessments, even if it refers only to a part of the total area designated for this stock. Following the discussions made at the sub-committee on Northern Hemisphere minke whales, it agreed to use two values for the correction factor e.h: 1.00, 1.35. The population in 1981 was thus estimated as 10,015 (e.h = 1.00) and 13,520 (e.h = 1.35).

Ohsumi wished to record his previous estimate of population for the total area designated for this stock, at least 20,000 and possibly at least 30,000 (*Rep. int. Whal. Commn* 33: 283–6).

11.3.2.3 *Assessment*

A revised and updated analysis of two CPUE indices for this stock was presented (SC/37/Mi12). The 8-year series of $CPUE_2$ (catch per hour of operation) did not show a statistically significant change (−1.39% per year). An attempt was made to calculate $CPUE_2$ for the years 1975 and 1976 by a regression between $CPUE_2$ and $CPUE_1$ (the total catch through the season divided by the pooled gross tonnage of all vessels).

The $CPUE_2$ series for the extended ten years 1975–85 showed a slightly greater decline (−1.41% per year) than the original 8-year series, but the trend was still not significant. Probabilities of increase and decrease in the trend of $CPUE_2$ were calculated for the extended 10-year series (Annex F, Table 6). Although it was recognised that a regression estimate might level off possible variations in the data, and consequently also influence the slope of the extended $CPUE_2$ series, it was felt that this effect might be small.

An analysis of the CPUE data from SC/35/Mi12 was also carried out using a model and procedures analogous to that used in the assessment for the West Greenland stock. The 'n' value was fixed at 2.39. Targets were chosen as two population estimates of 10,015 and 13,520 (from 11.3.2.2) and trends in CPUE of −1.4% per year and upper and lower 95% confidence limits. The parameters chosen were M = 0.095, median age at first parturition 8 years and age at recruitment 3 years. The non-linearity factor was set at 1.0 and 2.0. Among 12 combinations tried, only three yielded estimates of positive A (Table 6).

Table 6

Population trajectories for various estimates of exploitable stock size (1981) and trend (1976–84) for the Okhotsk Sea—West Pacific stock of minke whales. NF = not feasible

	Case 1	Case 2	Case 3	Case 4
Population in 1981	10,015	13,520	10,015	13,520
Annual change in CPUE(%)	-1.4	-1.4	-1.4	-1.4
Non linearity factor	1.0	1.0	2.0	2.0
Mean annual rate of change*	-1.4	-1.4	-2.8	-2.8
A	0.406	0.212	0.0525	NF
Exploitable population 1952	14,804	19,446	17,319	
Exploitable population 1986	9,363	12,646	8,784	
N(1986)/N(1952)	63.2%	65.0%	50.7%	

* Percent in the recruited population 1976–84

Confidence limits on CPUE slope were −4.6% to +1.8% per year. Neither limit could be fitted by a population trajectory with A > 0.

11.3.2.4 *Recommendation*

Some members of the Committee felt that the probabilities estimated in Table 6, Annex F were sufficient as a basis for classifying this stock as SMS (provisional) since the apparent trend in CPUE for 10 years is not statistically significant under a regime of approximately constant catches.

Other members believed that this stock should be classified as SMS (provisional), although the estimates indicated that the stock may be in the range 51–65% of its initial size, so there may be a possibility that the stock is in PS status.

The Committee therefore **recommends** that the Okhotsk Sea—West Pacific stock of minke whales should be classified provisionally as Sustained Management Stock.

11.3.2.5 *Productivity/effect of zero catch*

Two different views were expressed in discussing productivity/effect of zero catch on this stock.

Some members provided a summary of the population projections for this stock, including RYs and the effect of zero catches, as given in Table 7. These results are based on the three cases which yielded positive values of A in Table 6 above. These members believed that the RYs shown in this table were the best available estimates.

Other members of the Committee objected to the unrealistic value (MSY = 26) in Table 7 and believed that the best estimate of RY for this stock is 339, the average catch over the period of 1975–84, on the basis of the stable catches and the available CPUE during the period.

Table 7

Summary of population projections for the Okhotsk Sea—West Pacific Stock of minke whales assuming a zero catch in 1986. Natural mortality coefficient = 0.095, age at first parturition = 8 yrs, age at recruitment = 3 yrs

	Case 1	Case 2	Case 3
Population in 1981	10,015	13,520	10,015
Av. annual rate of change (1976–84)	-1.4%	-1.4%	-2.8%
Exploitable population 1952	14,804	19,446	17,319
Exploitable population 1986	9,363	12,646	8,784
N(1986)/N(1952)	63.2%	65.0%	50.7%
Exploitable population 1987	9,545	12,778	8,843
Projected increase 1986–87	182	132	59
Replacement Yield	200	145	65
MSY	200	117	26
Classification	SMS	SMS	PS

11.3.3 Northeastern Atlantic stock

Some members recalled that the Committee had assessed this stock at its 1984 meeting and had agreed that 22,000–30,000 spanned the likely range of the exploitable stock size (see 11.3.1.3) in the late 1970s and that the values 300–747 spanned the likely range of the average replacement yield. No stock classification had been recommended (*Rep. int. Whal. Commn* 35: 44).

These members also noted that this year calculations had been presented (SC/37/Mi4) which utilised last year's results, and a population model that has been used by the Committee on several occasions, to determine the current status of this stock. They also pointed out that the sub-committee on Northern Hemisphere Minke Whales had not considered these calculations in detail, but nevertheless had used them in an assessment of the West Greenland stock.

These members noted that SC/37/Mi4 had concluded, on the basis of the 1983 assessments, that this stock is certainly below its level of maximum productivity, and that the available stock is probably in the range 20 to 30% of its initial size (MSY level = 60% of initial). Moreover the females were found to be substantially more depleted than the males. They further noted that the stock trajectories for this assessment, projected forward with zero catches from 1986, indicated that the available stock would increase annually at an average rate in the range 0.6–2.0%, during the period 1986–1990. The females would increase more rapidly. This conclusion held for a wide range of values of natural mortality and other parameters.

SC/37/Mi4 gives tabulations of estimates of 1986 RY for a range of estimates of the available stock at the beginning of 1986, for various values of the recent CPUE trends identified in 1983. For a stock trend of −3.0% per year (for the linear and quadratic regressions of adjusted C/NCD − 1 used in 1984, and non-linearity factor 2.0) the current stock is found to be in the range 17,600 to 23,900. The RY's corresponding with this range are 574 to 360. From these the 1987 stock size with no catching in 1986 may be calculated as:

$$N_{87} = N_{86} + RY \times \exp(-M)$$

where N_{86} and N_{87} denote stock size in 1986 and 1987, respectively.

The results are shown in Table 8.

Table 8

Northeastern stock of minke whales. Estimates of RY for 1986 and available population sizes for 1986 and 1987, based on SC/37/Mi4 (see text)

M	RY for 1986	Available stock N_{86}	Available stock N_{87}	% change
0.08	574	17650	18180	+3.00
0.08	385	23850	24205	+1.49
0.10	544	17670	18162	+2.78
0.10	360	23950	24276	+1.36

Most members of the Committee, considering that these calculations were based directly on the analysis made last year and agreed by the Committee, believed that the Commission should be advised that this stock should probably now be classified as a Protection Stock. Since Norwegian scientists have made a commitment urgently to review and if possible extend the CPUE series on which this conclusion in part depends, and to present the results of that review to the Committee in 1986, these members believe that the Commission might consider postponing a decision on the classification until next year. In these circumstances, however, they would strongly urge that the 1986 catch not exceed the lower estimate of RY in Table 8, i.e. 360.

The Committee noted the report in Annex F(Item 6.3), that indications of under-reporting of catches in 1984, provisionally estimated to be nearly 30%, had been discovered. It was also suspected that under-reporting had occurred at an increasing rate since the introduction of quotas in 1977. Butterworth commented that if such under-reporting had occurred since 1977, the apparent trend in CPUE would be negatively biased, and that the results of assessments incorporating CPUE might also be negatively biased.

Gunnlaugsson and Ikeda questioned the methodology and procedures in the above calculation and in SC/37/Mi4 and wished to record their statement (Annex N9).

11.4 'Other Baleen Whales'

11.4.1 Western North Pacific Bryde's whale

This stock was last reviewed at the 1984 Scientific Committee meeting.

The catch in 1984 was 528, comprising 481 by Japan and 47 by the Philippines. This total was eight below the catch limit of 536.

SC/37/Ba1 reported results of two sightings cruises. A total of 102 primary sightings were made resulting in an estimate of 18,119 exploitable animals for the surveyed areas, and this plus an estimated 4,520 animals outside the survey area but within the stock area resulted in an estimate by the author of a total exploitable population of 22,639. It was noted that the vessel pathways shown in SC/37/Ba1 represented considerable deviation from the trackline, following sightings, while on primary effort. These deviations might lead to upward biases in estimates of abundance. It was suggested by the author that the forecast of severe weather conditions contributed to deviations of the ships away from the trackline.

Concern was expressed over the choice of different distribution curves to fit the perpendicular sighting distances of the two vessels. Abundance estimates generated from the effective half-width of the trackline varied by 80%. The two data sets on perpendicular distances between the vessels did not differ significantly and thus were pooled. After considerable discussion and preliminary analyses, evidence was produced (Appendix 2 of Annex G) and adopted by the Committee in support of either a half normal or negative exponential distribution truncated at about 2.1 n.miles producing an estimated track half-width of about 1.5 n.miles (95% confidence interval of 1.31 to 1.88). The use of 1/w = 0.65 (Appendix 2 of Annex G) results in an amended estimate of 13,098 from that reported in SC/37/Ba1 and this combined with 4,520 results in an exploitable population size of 17,618.

The Committee noted that 70 marks were added to this stock in 1984 and that five were recovered from whales marked in previous years. A mark-recapture analysis using the midpoint of the time series was adopted and a figure of 25,591 whales in 1981 was assumed from the mark-recapture evidence. The relatively few mark recoveries precluded use of these data to determine a trend in population size, and thus the Committee agreed that only the estimate of abundance would be accepted for stock assessment.

Using a simulation model very similar to BALEEN and mortality rates adopted last year, as well as published estimates of mean ages of first parturition and recruitment and density dependence set at the values for neutral compensation, estimates of exploitable population size, replacement yield (RY), MSY and classifications were derived independently from mark-recapture and sightings data (Table 9). CPUE data were not used owing to inconsistencies in the time series. Some members believed that the trajectories based on the mark-recapture estimates should not be used for an assessment because the estimates did not take into account possible initial mark loss, marking mortality and the inability to verify the successful placing of marks.

Also included in Table 9 are results showing the effect of a zero catch in 1986. It was assumed for these calculations that the 1985 catch is equal to the quota set. The equation for calculating replacement yield in year n was:

$$RY = (P_{n+1} - P_n)e^M$$

where P_n is the population in year n, and M is the assumed mortality rate.

In commenting on the model used in the assessment and calculation of population trajectories some members believed there was not adequate justification for the specific upper limits and values of the 'resilience' parameter. This results in a somewhat restricted set of values for the maximum net recruitment rate (which is subsumed in the 'resilience' parameter). They noted however, that the projected decline over the period 1972–86 was only slightly more than that predicted by the marking analysis.

Classification and effect of zero catch

The Committee agreed that four proposals should go forward, two concerning mark-recapture estimates and two sightings estimates, based upon estimates of mortality rates of 0.07 and 0.087, as shown in Table 9.

Table 9

Western North Pacific Bryde's whale stock assessment values, assuming a quota in 1985 and a zero catch in 1986. T = Target

	Mark-recapture T (1978) = 25,591		Sightings T (1984) = 17,618	
Natural mortality rate	0.07	0.087	0.07	0.087
Age at lst parturition	9	9	9	9
Age at recruitment	3	3	3	3
Exploitable pop. 1946	32,616	32,048	26,755	26,000
Exploitable pop. 1986	23,498	23,786	17,276	17,321
Replacement yield 1986	289	324	248	278
MSY	295	337	242	274
% above MSYL 1986	20.1%	23.7%	7.6%	11.0%
Classification (1986)	IMS	IMS	SMS	SMS
Exploitable pop. 1987	23,769	24,083	17,507	17,576

11.4.2 Peruvian Bryde's whale

No new data were presented on this stock. SC/36/Ba7, submitted to last year's meeting but not reviewed, was discussed. The author applied a deLury model to estimate stock size using an adjusted CPUE series, but it was unclear whether the estimate assumed zero recruitment or constant recruitment. Neither approach was considered appropriate for the estimation of this stock which has a long history of exploitation and is probably depleted or possibly declining. Given the lack of sufficient information to make an assessment, the Committee urges that updated catch and effort data series be provided for this stock.

11.4.3 Spain, Portugal, British Isles fin whale stock

SC/37/Ba2 reported results of a sightings cruise in July and August 1984 in which 57 fin whales were sighted. An exploitable population estimate of 1,261 was reported, or 1,377 if 'unidentified' balaenopterids are included. Once again, this estimate was obtained from a small proportion of the stock and should be considered a minimum population size estimate.

The Committee also noted that 102 fin whales were taken from this stock in 1984 from the residual of 270 set for the three years 1983 to 1985 inclusive. No new marks were applied in 1984. The Committee had insufficient information upon which to base a new assessment.

11.5 Bottlenose whales

11.5.1 Baird's beaked whale (and see Annex I, Item 5.1)

SC/37/SM11 reported information on sightings of this species from aerial and ship surveys made mainly between the 1,000 m and 3,000 m depth contours north of the Boso Peninsula (east of Tokyo Bay). Although considerable searching effort was made outside this area, few whales were observed offshore (>3,000 m) or west of 140°E. Aerial sightings data show that these whales arrive in the southern part of the range in May, reach their peak numbers in July and then decline in October. It was concluded that the southern limit of this species appears to coincide with the southern limit of the cold sub-surface Oyashio Current. This study agreed with previous work.

SC/37/SM13 provided estimates of population size of Baird's beaked whales off the Pacific coast of Japan. The corrected population estimate using the data from the sightings cruises in 1984 was 4,220, but the estimate was still considered to be an underestimate to some degree.

The Committee expressed appreciation to their Japanese colleagues for conducting these ship surveys and welcomes plans to conduct a further survey in the same area in August and September this year.

It was noted that in 1984 a total of 38 whales were taken from a national quota of 40 in 1984. The Committee noted that this catch was approximately 1% of the current population estimate of 4,220. The Committee also noted that, in the absence of an estimate of gross reproductive rate, it did not know whether or not the population could sustain the present level of catch.

11.6 Consideration of stocks not assessed

The Committee agreed that all stocks currently classified as Protection Stocks should remain so. For those stocks not assessed at this year's meeting the Committee draws the Commission's attention to its most recent assessments and advice, summarised in Table 10.

12. STOCKS SUBJECT TO ABORIGINAL SUBSISTENCE WHALING

12.1 Bering–Chukchi–Beaufort Seas stock of bowhead whales

Recent catches

The Committee noted the final catch and strike figures for 1984, and for the 1985 spring season given in Table 11.

Struck and lost rates

In 1984, 52% of the whales struck were lost, as were 38% of those struck in the spring 1985 hunt. The probable fate of lost whales is evaluated by the Alaskan Eskimo Whaling Commission after hearings with relevant captains. From data available at the meeting the Committee agreed that at least four of the 11 whales struck and lost in spring 1984 probably died.

The Committee noted that it is useful to receive information on the circumstances in which struck whales are lost as well as the AEWC evaluation of their fate. It urges that such information, also consistently including details of whether gear (e.g. lines and floats) was still attached, should continue to be provided to the Committee.

Table 10

Summary of most recent assesments and recommendations for those stocks not assessed at this meeting (excluding Protection Stocks)

Species and Stock	Most Recent Recommendations	Recent Assessments
Sei		
Iceland-Denmark Strait	RIWC 35:47. No basis for advice on classification or catch limits	From RIWC 33:128. Little chance of obtaining a reliable series for indices of abundance.
Eastern North Atlantic	RIWC 34:117. Unclassified with 0 catch limit	No assessment available. Average catch from Spain of only 12 whales per season up to 1980.
Nova Scotia	RIWC 33:55. PS with 0 catch limit	Not exploited since 1972. No assessments carried out.
Minke		
Sea of Japan-Yellow Sea-East China Sea	RIWC 34:47. No consensus; majority recommendation PS with 0 catch limit	DeLury analysis indicated a decline in stock size to between 40% and 50% of the 1970 level. RIWC 34:47
Remainder (N. Pacific)	RIWC 33:53. IMS with 0 catch limit	No assessments have been carried out. RIWC 35:51
Central Atlantic	RIWC 35:44. Insufficient information to recommend a classification. Majority recommends catch limit of 151	CPUE series indicates a probability of stock decline by 40% of 1960 level of 0.43.
Northeastern Atlantic	RIWC 35:44. Insufficient information to recommend a classification. Catch limit in range of 300-747	8 valid estimates of RY based on stock size and CPUE trends.
Canadian E. coast	RIWC 33:53. Unclassified with 0 catch limit	No assessments carried out (RIWC 35:51). Whaling ceased in 1972.
Northern Indian Ocean	RIWC 33:53 IMS with 0 catch limit.	No information on this species in this area.
Fin		
British Isles-Spain-Portugal	RIWC 35:45-6. Unclassified. Insufficient information for advice on catch limits	Sightings and mark recapture data considered insufficient for any recommendation.
North Norway	RIWC 33:54. No consensus recommendation	No assessments carried out. Whaling ceased in 1971.
Newfoundland-Labrador	RIWC 33:54. Unclassified. 0 catch limit	No consensus recommendation in 1981 (RIWC 32:54). The 1980 recommendation had been for IMS with catch limit of 90 pending completion of studies.
East Greenland-Iceland	RIWC 35:46 Unable to choose between SMS or PS. 2 views on catch limits: 129-169; or 143-180.	CPUE estimates; catch limits based on range of RY, (1) with, or (2) without, a safety factor.
Bryde's		
East China Sea	RIWC 34:117. No consensus recommendation.	Assessment RIWC 30:317
Peruvian	RIWC 34:49. Two views: (1) PS, based on DeLury estimate; (2) IMS, 313 catch limit.	Sightings cruise in 1982 and 16 years of CPUE. No consensus on interpretation.
South Indian Ocean, Western South Pacific Solomon Islands	RIWC 33:55. No consensus, (2 recommendations)	No satisfactory stock estimates (but see RIWC 30:53 and 31:56).
Eastern (N.Pacific)	RIWC 33:56. IMS with 0 catch limit	No assessments carried out. Stock never substantially exploited.
North Atlantic	RIWC 33:56. IMS with 0 catch limit	No assessments carried out. Stock never substantially exploited.
Northern Indian Ocean	See item 9 of sub-committee report	RIWC 35:106
South Atlantic	RIWC 33:56. Unclassified, 0 catch limit.	No assessments carried out.
South Africa Inshore	RIWC 34:50. Unclassified, 0 catch limit	Est. pop. size 519 (S.E. 84), RIWC 34:50. No catches since 1967.
Eastern South Pacific	RIWC 34:50. Unclassified, 0 catch limit	On the basis of the historical catch which may have affected the size of the stock, the Committee recommended that it be unclassified with a 0 catch limit (RIWC 34:50). 3 Bryde's whales were taken by Chile in April 1983 (RIWC 34:50).
Sperm		
North Atlantic	RIWC 35:51	Unclassified, males 210, females 42 for 1981 (RIWC 31:63). Assessment attempted: males and females have declined, but no consensus on the degree: caution recommended, catch limits no higher than last year; some recommend PS (RIWC 32:53-4).
Southern Hemisphere		Most recent assessments attempted in 1979, (RIWC 30:50-1) but no consensus on results.
Divisions 1-9	Not considered	PS with 0 catch limit for both sexes recommended (RIWC 31:62)
Eastern North Pacific	Not considered	Most recent assessments carried out in 1978 but no consensus on results (RIWC (special issue 2):114)
Northern Indian Ocean	Not considered	No assessments have been carried out.
N. Bottlenose whale		
North Atlantic	Not considered	Assessment attempted: no consensus (RIWC 27:49). Recommended PS for 1978 (RIWC 28:56).

Table 11

Final catch and strike figures for the 1984 and 1985 (spring only) seasons for the Alaskan bowhead whale fishery

	Landed	Landed catch Imm.(<13m)	M	F	Struck lost	Assumed dead	Total strikes	Strike limit
1984								
Spring	11	7	6	5	11	4[1]	22	
Autumn	1	1	0	1	2	0	3	
Total	12	8	6	6	13	4	25	27[2]
1985								
Spring	10	8	6	4	6	2[1]	16	18[3]

[1] Plus 1 unknown.
[2] Maximum permitted in either 1984 and 1985, subject to a total of 43 not being exceeded in the 2-year period.
[3] Remainder of 2-year limit of 43, to be taken in spring and autumn hunts combined (2 strikes were not used in 1984).

Some information was available on bowheads trailing gear after being struck, and the fate of such gear in certain conditions. The Committee was also informed of attempts to locate and secure struck and lost whales by means of transmitters inside floats (SC/37/PS19). It was pleased to hear that the technique will continue to be tested and developed. Attention was also drawn to efforts being made to improve the reliability and killing power of the bombs used in the hunt (SC/37/Rep 2: 144–5). The Committee noted that issues related to the effectiveness and humaneness of the techniques used in the hunt will be addressed by the Aboriginal/Subsistence Whaling sub-committee of the Technical Committee.

The Committee welcomed the continued efforts being made to reduce the struck and lost rate.

Biological parameters

Aerial photogrammetry in the Canadian Beaufort Sea (SC/37/PS23) gave calf percentages ranging from 8 to 15% and the proportion of mature animals (>12.5 m) as 29 to 46%, but the authors concluded that segregation on the summer feeding grounds would have affected the results. The Committee looks forward to receiving a detailed analysis of the 1985 spring aerial survey results, in which over 700 whales were photographed, at its next meeting.

Gross annual reproductive rate (GARR)

Although no new information was before it this year, the Committee reviewed an approach for estimating GARR (Annex H, Appendix 2), updating one received last year; a range of 0.05–0.095 was obtained. The Committee considered this was a useful approach, although it is sensitive to some uncertain input parameters.

Given that a major aerial survey with the express objective of providing data for estimating GARR will take place this summer in the Beaufort Sea, the Committee reviewed the problems associated with such work. It agreed with the conclusions in Annex H, Item 6.2.5 and its Appendix 3. It looks forward to receiving at its next meeting the results of any work undertaken to estimate GARR.

No new information was available on a value of M, the natural mortality rate, or therefore on an appropriate value for annual net recruitment. An estimate of average fishing mortality (F) of 0.006 from 1978 to 1984 was provided (Annex H, Appendix 2).

Stock size

The Committee had no new information this year on initial stock size.

Three complementary approaches had been used in estimating current stock size—visual census, aerial survey across the lead, acoustic census.

Because of poor environmental conditions, reliable population estimates could not be obtained from visual census data for either 1984 or 1985.

Based on a review of statistical methods for obtaining minimum population estimates from visual census data (SC/37/PS14) the Committee agreed that for years prior to 1984, and where environmental conditions were reasonable, only the 1978 and 1982 data satisfied the criteria necessary to permit the use of visual data in estimating population abundance at this time. The major criteria are that perch heights and distances from the ice edge should be similar, and that a sample is obtained of around 200 whales passing during the two-perch sampling period. Revised allowances for 'missed' days, and introduction of a new procedure for estimating confidence intervals, led to new visual census population estimates (uncorrected for offshore distribution) for 1978 and 1982, of 2,909–3,971 and 2,590–5,170 (95% confidence intervals) respectively.

A problem addressed in earlier years has been the extent to which visual census estimates may underestimate population size because a proportion of the migrating whales may pass outside the visual range. Flights up to 30 km from the ice edge in 1984 and 1985 confirmed that whales can be found a considerable distance beyond the perch-based observers' visual range (SC/37/PS17). In 1985, 58% of whales sighted from the aircraft were more than 5 km from the ice edge, but what proportion this represents of the total population could not be determined. The 1985 results were, however, different in this respect from earlier years.

The Committee received detailed reports on acoustic census methods, developed in 1984 and considerably improved in 1985, particularly to obtain figures for the minimum numbers of animals passing (SC/37/PS10–13). It noted that the Arctic marine environment is a particularly stable one for acoustic measurement purposes, particularly by comparison with the situation in temperate waters.

Comparison of acoustic and visual results for periods of different lead condition in 1984 and 1985 showed that whales migrate under heavy ice conditions when visual methods are limited, and that many whales are swimming at distances beyond the range of reliable visual observations. This conclusion was confirmed by observations in the two years of whales migrating in heavy ice and of hummocks in the ice, produced by whales breaking through the pan to breathe.

The results of validation tests applied to the 1984 acoustic data were accepted by the Committee. The tests addressed the extent to which individuals located acoustically represent migrating whales; the extent to which directions of migration obtained from the acoustic data are likely to be realistic, and the extent of agreement between visual and acoustic census results. It was demonstrated that while a significant number of migrating animals will be identified from visual data only, a higher number will be identified from acoustics data only (SC/37/PS15). In one case at least, nearly all the whales identified were beyond the range of the visual observers. The Committee noted the authors' conclusion that

estimates of population size based either on visual or acoustic data alone would be underestimates. It also noted that the assumption that vocalisation is independent of an animal's distance from the ice edge on migration, or of its age, size or maturity, is as yet untested.

Corrections to account for whales passing beyond the visual census range were made to the visual census data available, using aerial survey data since 1979 and acoustic location data from 1984 and 1985. The Committee agreed that for the reasons already discussed it was appropriate to attempt to obtain population estimates for 1978 and 1982 only at this time.

An average value of 0.734 was obtained for the proportion (P_{3000}) of migrating bowheads passing within 3,000 metres of the nearshore lead edge from aerial and acoustic data available for 1979, 1981, 1984, and 1985 (Annex H, Appendix 4). Unfortunately data on whale distribution across the lead were lacking for those years for which it was most needed (1978 and 1982), but the average proportion was derived from survey periods during which lead conditions were judged to be as close as possible to those prevailing in 1978 and 1982.

The Committee concluded that the values obtained for the 1978 and 1982 visual censuses of 3,400 ± 271 and 3,880 ± 658 respectively (SC/37/PS14) were the best available estimates of current population size for that proportion of the population that passed within visual range of the ice-based observers. Applying the P_{3000} value obtained, the weighted mean of the two census results was 4,417 whales (95% confidence interval 2,613, 6,221); the Committee agreed that this was an improvement over estimates of current population size obtained last year.

However, the Committee **recommends** that four studies should be undertaken in the coming year to examine assumptions and uncertainties discussed this year; they are detailed in Annex H, Section 6.2.6.

Effects of industrial development

The Committee was informed that while some people still hold the view that industrial noise, e.g. from seismic operations, does not represent a threat to bowhead whales, the Eskimos strongly believe that seismic activity has led to changes in distribution during the autumn migration. They are particularly concerned with the effect on the whales' migration path, which would affect hunting strategies, and the whales' use of feeding areas.

Last year the Committee agreed that three studies were needed, to investigate (a) the reaction of whales to seismic noise, (b) the possible use of heart-rate monitoring to indicate stress effects, and (c) possible pathological effects on inner ear and other tissues. This year it was informed of some investigations carried out partially in respect of (a), but it **recommends** that since more precise distribution studies are needed to permit detection of possible deflections in the whales' migration path, relevant authorities should be urged to undertake such work. In respect of (b) the Committee was informed that no work had been undertaken. It welcomes new, realistic approaches to any behavioural or physiological monitoring of bowhead whales which might reveal effects of environmental disturbance. In respect of (c) it was informed that bowhead whales tend to avoid seismic activity at a range greatly in excess of that at which potential ear damage might occur. It looks forward to receiving the results of experiments being funded by the US National Science Foundation on seismic effects on marine mammal ear pathology.

Management advice

The Committee agreed that, using 95% confidence range for population size obtained at this meeting, and an initial population size of 14,000–20,000 animals (*Rep. int. Whal. Commn* 34: 134), the current stock is at about 13–44% of its initial level. Using the point estimate of 4,417 whales obtained for current population size, it would be 22–32% of its initial level. The Committee therefore **recommends** that the stock remains as a Protection Stock.

The Committee was unable to determine the minimum population size below which whales should not be taken (as required in terms of the Schedule), and therefore whether this stock was above or below it. The Committee noted that the current population size is well above the current size of some southern right whale populations, which may be increasing under protection (SC/35/Rep 2).

The Committee had no direct evidence of the trajectory of the population over the period 1915 to 1970 during which time there was an estimated average removal of 22 animals per year. A stock trajectory simulation (Breiwick, Eberhardt and Braham, 1984, *Can. J. Fish. Aquat. Sci.* 41: 484–96) using a reasonable range of biological parameter values showed minimum population sizes of 1,200–3,800 occurring from 1910 to 1915 and the population increasing between 1915 and 1970 with those removals.

In view of the uncertainties above, and the absence of any estimate of net recruitment rate, the Committee did not feel confident in predicting the likely effect of catches of the current magnitude on this stock. Furthermore, in view of the Aboriginal Whaling Scheme requirement for catch limits for such stocks to be set at levels which will allow them to move towards the MSY level, the Committee **recommends** that any catch limits should be set with caution.

In previous years the Committee has advised that any catch should be directed towards the smaller, immature (<13 m) individuals. It noted this year that a downward trend has occurred in the proportion mature in the catch recently (1983, 67% >13 m; 1984, 33%; 1985 (spring only), 20%). The Committee does not recommend any change this year, but advises that the question requires further consideration, to be explored fully at next year's meeting.

12.2 Eastern North Pacific stock of gray whales

Removals

In the 1984 Soviet aboriginal harvest off Chukotka 169 animals were killed, of which 168 (59 males, 109 females) were landed. The high proportion of females is due both to hunting preference for large animals and to segregation of the sexes. More immature animals (64% of the 31 males, 48% of the 60 females examined) were present in the 1984 catch, continuing a trend noted in 1983. Fewer mature females were pregnant than in any of the previous five years, possibly because of segregation of such animals offshore. Concentration of catching effort closer to the coast may also have led to the decrease in catch mean length, also continuing a recent trend (from 11.9 m in 1982 to 11.4 m in 1984). Information was also available to the Committee on other biological features of the catch and on five young animals (more than in recent years) found washed up on the shore.

There was no reported catch by Alaskan Eskimos in 1984. The Committee was informed that of 33 animals entangled in nets off the California coast between November 1980 and June 1985, 19 are known to have died.

Distribution

Information was available on shore based observations conducted for the first time off Chukotka (SC/37/PS5). The observations support earlier views of the animals' pattern of movement in spring. The presence of some animals in the area in November, together with a December sighting near St Lawrence Island (SC/37/PS7) suggests that not all animals migrate south to the breeding grounds but overwinter north of them.

The Committee was informed that Soviet and Mexican programmes had now begun in response to last year's request that photographs of the dorsal area of the landed catch be obtained for comparison with those photographed elsewhere, particularly in the breeding lagoons.

Two sightings of gray whales in deep water (4–5,000 m) at approximately 40°N, 155°E (SC/37/PS4) indicated that this species is not wholly restricted to the continental shelf on migration.

New census data

Last year the Committee recommended that the US and Mexican Governments be asked to provide, at the earliest opportunity, estimates of the current stock size, from both northern and southern migrations. In response, the Committee received a preliminary analysis of a southern migration census off Monterey, California (SC/37/PS25) and new information on occurrence and distribution in Mexican waters (SC/37/PS22).

The 1984/85 Monterey census used procedures similar to those of 1967/68–1979/80 and the analyses were undertaken using the same methodology as before. The 1984/85 preliminary population estimate obtained, 18,477, was not significantly different from that obtained from the last census in 1979/80. Preliminary radio-tagging results (SC/37/PS26) suggest that whales migrating past Monterey swim at similar speeds during day and night, an assumption that had been of previous concern to the Committee. Given the preliminary nature of the work it **recommends** that further similar work be undertaken.

The Committee recognised that the 1984/85 southern migration census and its preliminary analysis partially fulfilled last year's recommendation. It urges that the United States Government be asked to ensure that gray whale censuses continue. In particular, censuses should provide information to permit comparison with previous results and estimates of population size using improved procedures and analyses. Committee members are encouraged to submit comments to the US Marine Mammal Commission on ways of improving such methods for consideration at a forthcoming planning meeting.

The Committee welcomed the new information provided by Mexico which is given in SC/37/PS22 on abundance, reproduction and early mortality rates in Mexican waters, particularly the four main breeding lagoons. There was some discussion of the large difference between population estimates from the breeding grounds and along the migration route. The Committee noted that there may be some turnover in the population sizes obtained from those areas. The Committee therefore **recommends** that future research be carried out to attempt to determine the degree to which the assumption may be violated that mid-February counts represent the total lagoon breeding population and calf production, and to discover the distribution of animals not found in the breeding lagoons.

Modelling

Two papers (SC/37/PS21 and SC/37/PS31) gave results of modelling exercises; a third (SC/37/PS20) raised several questions with respect to the Monterey census results.

SC/37/PS21 applied an age-structured model to information on catch history and examined the sensitivity of the population trajectory to a wide variety of assumptions about population size, population parameters and density dependence. The authors found that in practically all the simulations the population decreased in recent years, unlike the results from shore counts.

There was some discussion of the catch data series used, with the Committee noting that the average annual values used might not reflect the normal pattern of whaling where higher catches might have been expected at the beginning of the series. Some members believed that it would have been more appropriate to back-calculate the population trajectory from the recent census estimates. This was in fact done in SC/37/PS31 where historical catch data were used to back-calculate the population assuming that recent annual rates of increase estimated from the Californian shore censuses are correct. Under all parameter combinations used, the 1846 population level was found to be lower than the current level. The author also concluded that the current net recruitment rate of this stock was not a useful guide to likely rates for other baleen whales.

The Committee noted that both modelling exercises suggested that conventional modelling of a density-dependent response of a whale population to exploitation was unable to explain the apparent increases in gray whales indicated by the shore counts. It agreed that before further conclusions can be drawn a full re-analysis of the earlier census data is required.

SC/37/PS31 also found evidence that a greater proportion of whales may pass by unseen by the observers than assumed in earlier analyses.

It was suggested that the appropriate procedure for estimating rates of stock change depends on the expectation of what point the stock has reached on its population growth curve; different assumptions lead to substantially different estimates. SC/37/PS20 noted that any calculation of sustainable yield is better related to estimates of population size obtained off Alaska than off California.

In view of the above, the Committee **recommends** that the re-analysis of sightings data from Monterey already agreed should take into account the main concerns raised in SC/37/PS20 and 31.

Management advice

The Committee noted that, as pointed out by Holt in SC/37/PS20, the stock has been classified as a Sustained Management Stock since 1978, based on the understanding that it had remained stable at about 11,000 whales over an 11 year period with approximately constant catches. The SMS classification has been carried over from year to year, with no formal reassessment of the stock's status. SC/37/PS20 considered that the original basis for the SMS recommendation was not valid since it had been agreed that the gray whale stock was increasing, and proposed that the stock should therefore be unclassified. However, the

Committee noted that, as discussed above, there is a need to reanalyse at least the Monterey sightings data before any recent trend in the gray whale population's size can be confirmed.

Some members concurred with the sub-committee's conclusion that there was insufficient information at the meeting on which to recommend a change in classification.

Others did not feel there was sufficient information to decide whether the stock was SMS or not. Their reasoning was as follows. If the stock had been increasing or constant recently, the remodelling analysis indicated that it was unlikely that the stock was responding in the density dependent manner envisaged by the New Management Procedure. Although there are alternative possibilities, for example that historical catches were significantly underestimated, these could not be assessed at the present. Accordingly, these members recommend that pending resolution of this problem the stock should be unclassified.

The Committee agreed to **recommend** that the present catch limit of 179 be retained but undertook to review the stock's classification and catch limits (including the effects of any indirect take) at next year's meeting.

12.3 Western North Atlantic stock of humpback whales

Removals

The 1984 catch off West Greenland was provisionally estimated at 15 (SC/37/ProgRep Denmark), six more than the Commission's agreed catch limit. Six animals were reported as having died from entrapment in fishing gear off eastern Canada (SC/37/O 18). No catches were reported in the 1984 St Vincent fishery (*Rep. int. Whal. Commn* 35: 413–20). Thus the estimated total 1984 removals from the western North Atlantic stock were 21, the same as in 1982 and 1983.

Stock identity

No new data were presented on this subject this year. Last year the Committee agreed that to provide more information on stock identity, four studies should be undertaken involving fluke photography and/or analysis of songs in certain areas. Action had been taken on one of the four studies, as reported in Annex H, Item 6.3.1. The Committee reiterates last year's view in **recommending** that those four studies be undertaken.

'Feeding aggregations'

The Committee noted that at least four separate 'feeding aggregations' are now accepted for the western North Atlantic—Nova Scotia/Gulf of Maine; Newfoundland/ Labrador; West Greenland; Iceland.

Four subadults were found to have moved from New England (Gulf of Maine) to the Gulf of St Lawrence (Newfoundland) within a season (Balcomb, *pers. comm.*). Adults have not been shown to move between feeding aggregations; the observations are in line with the well known phenomenon that juveniles of many species disperse further than adults.

Stock size

Re-examination of West Greenland fluke photograph data from 1981, 1982 and 1983 (SC/37/PS30) gave a population estimate for that feeding aggregation of 276 whales.

The Committee received the expected detailed review of the applicability of mark-recapture theory to photoidentification data in SC/37/PS27. Some of the points concerning possible violations of the assumptions used in estimating population size were reconsidered this year; the conclusions are detailed in Annex H, Item 6.3.3.

The Committee was informed that the probability that tail fluke markings change with time was being investigated; so far it seems that changes are limited to a small number of animals in the first few years of life. The extent to which recent examination of photographs may result in recognition of matches previously missed is also being examined; the effect would be to reduce the resulting population estimates slightly. The Committee agreed that the problem should continue to be examined. Some information on age at sexual maturity (4 years) and calving interval (2 years) was also being obtained from animals identified from fluke photographs.

3,219 individuals have been identified by fluke photographs obtained up to 1984. The Committee received an update and reanalysis of mark-recapture data from the breeding and feeding grounds undertaken in the light of the conclusions reached in the review of the methodology of the method referred to above. A revised population estimate of 5,561 (SE570) was obtained (Annex H, Appendix 5). A further analysis using a different method and data only from the breeding grounds gave clearly anomalous results which some members believed cast serious doubts on the estimate of 5,561. The Committee therefore agreed that further analysis should be carried out and noted that this was already planned.

Management advice

As last year, the Committee had no new information on the initial population size of this stock of humpback whales which had previously been conservatively assessed as at least 4,700. Given the uncertainties in the estimates of initial and current population sizes the Committee **recommends** that the stock be unclassified.

On the assumption that advice will be needed on an appropriate aboriginal take off West Greenland, the Committee noted that there was no new information to alter its view of last year that the animals there comprise a separate feeding aggregation of about 200–300 animals. The effect of such a take will thus obviously have a greater local impact than if the animals were drawn from the entire western North Atlantic, although it is unclear to what extent removals may be replaced from the breeding stock or by transfer of subadults between feeding grounds. In these circumstances the Committee **recommends**, as in previous years, that no catch should be permitted.

12.4 West Greenland stock of fin whales

Only 13 primary (seen from the track line) fin whale sightings were made during aerial surveys off central West Greenland in June and July 1984; the surveys were undertaken in adverse weather combined with severe ice conditions which delayed the arrival of whales into the area. No abundance estimation could be made (SC/37/O 19).

10 whales were reported as caught in 1984, four more than the catch limit. The 1984 catch was revised from seven to eight (SC/37/ProgRep Denmark). The Committee, as last year, had no evidence upon which to classify this stock or apply the provisions of the Aboriginal Whaling Scheme to it. It **recommends** that Denmark continue its attempts to obtain an abundance estimate for this stock.

13. SECOND INTERNATIONAL DECADE OF CETACEAN RESEARCH

13.1 Review of results from 1984–85

The only project sponsored by the Commission last year was the Southern Hemisphere minke whale assessment cruise. This is discussed in Annex E and SC/37/Rep 3.

13.2 Review of proposals for 1985–86

The Committee had the report of Gambell on the Consultative meeting held in March 1985 (IWC/37/16) and the UNEP observer, Nielsen, reported on the progress and current status of the Global Plan of Action for the Conservation, Management and Utilisation of Marine Mammals.

After the endorsement of the Plan by the UNEP Governing Council in May 1984 and the subsequent endorsement of the Plan's cetacean component by the IWC at its 36th Annual Meeting in June 1984, UNEP had approached all Governments for firm commitments to the Plan's implementation. A subsequent analysis of activities identified under the Plan revealed that more than 40% of these activities might be implemented in a regional rather than a global approach. Consequently, UNEP's Regional Seas and Living Marine Resources Programmes were combined in a new programme unit with responsibility for Oceans and Coastal Areas.

At the March 1985 Consultation, 47 projects were agreed for joint implementation. UNEP has recently agreed to co-sponsor eight of the proposed projects concerned with small cetaceans, pinnipeds and sirenians and is placing high priority on the determination of safe limits of catches of large cetaceans for scientific purposes in its 1986/87 budget. A large number of the other projects cannot be co-funded by UNEP due to the limitation of available resources. UNEP is urging the Scientific Committee to recommend to the Commission that some of the projects identified by the Geneva consultation should be implemented by the IWC in a Second IDCR as a contribution to achieve the goals of the Global Plan of Action for Marine Mammals.

Nielsen informed the Scientific Committee that a new consultation on the Plan was scheduled to take place in Gland, Switzerland, 28–30 October 1985 when joint activities for implementation in 1986/87 would be considered.

The Scientific Committee recognised that any research on large cetaceans will need to be initiated and funded by the IWC, and **recommends** that the Commission encourages Contracting Governments to support specific activities identified in the Plan, and to continue its own support in the context of the Second IDCR programme. It further **recommends** that the IWC should maintain close contact with UNEP in co-ordinating these activities, and that the Secretary should attend the Consultative Meeting scheduled for October 1985.

Upon reviewing the proposals for 1985/86, the Committee noted that two specific proposals had arisen from sub-committee discussions and that three unsolicited proposals had been received by the Secretariat; the latter had been subjected to the review procedure established by the Committee last year (Annex M, *Rep. int. Whal. Commn* 35: 146). The proposals are arranged in order of the priorities established by the Committee as follows:

(1) Proposals by sub-committees
   (a) SC/J85/S8, (Butterworth). To continue processing data from Southern Hemisphere IWC/IDCR minke whale assessment cruises (discussed in SC/37/Rep 3 and Annex E). Partial funding of £5,000 required.
   (b) To undertake a second IDCR minke whale assessment cruise in Area V (Annex E, Appendix 8). Partial funding of £55,000 required.

(2) Unsolicited Proposals
   (a) SC/37/RP2 (Balcomb). To examine the bias in mark-recapture photoidentification studies of humpback whales (discussed in Annex H, Item 9). Partial funding of £10,000 required.
   (b) SC/37/RP3 (Bloch, Desportes, Jean-Caurant, Lockyer and Waters). To examine the ecology of Faroese pilot whales (discussed in Annex I, Item 5.3 and Annex M, Item 5). Partial funding of £2,000 required.

The Committee **recommends** that the above proposals be endorsed and funded as indicated. The Committee noted that the above programme will cost some £72,000. The Secretary reported that about £50,000 was presently available in the research fund; thus an additional £22,000 is required to support the programme.

The Committee also had before it SC/37/RP1 (Collet, Boudou, Amiard-Triquet, Michel, Badie and Cosson—to examine the contamination of dolphins by micro-pollutants). Under the present financial circumstances the Committee is unable to recommend funding for this proposal, which it believes would not necessarily provide direct information for the management of large cetaceans. However, as discussed in Annex I (Item 5.3) and Annex M (Item 5), the Committee strongly endorses this proposal in principle.

14. WHALE HABITATS

The Commitee received the report of the working group which examined this item (Annex M). Last year the Committee had agreed that the subject of chemical pollutants and their effects on cetaceans should be covered at this meeting (*Rep. int. Whal. Commn* 35: 57) and discussion was limited to this item, although Annex H contained some discussion of noise pollution with respect to bowhead whales.

It was noted that monitoring, in the strict sense of global ocean pollution, is in most cases not feasible using cetaceans, although for pelagic species in particular, it is possible to obtain information on trends in pollutant levels over a period. In addition, in some areas of the Southern Hemisphere for example, pollutant levels are only detectable in top predators.

The Committee noted the need for studies on the effect of pollutants; there is little information on the effects of pollutants at either the individual or population level. The Committee therefore **recommends** that the Commission endorses and encourages this type of study. The importance of base-line studies was also stressed, as the existing data are inappropriate for comparison or determining the world distribution of pollutants in cetaceans. Such studies will provide reference data on pollution for the 1980s, and in conjunction with studies on effects on cetaceans in specific areas, will allow prediction of effects in other areas.

The value of a tissue bank for future pollution studies was discussed and the Committee **recommends** that the IWC:

(1) draws the attention of relevant bodies (e.g. ICES, who are holding a meeting on the effect of organochlorines on marine vertebrates this year—see Item 6.1) to this and the value of long-term pollution studies;
(2) encourages the organisation of a small workshop of biologists active in this field to examine the practicality of establishing a tissue bank.

The Committee noted the problem of interpreting pollutant levels found in stranded animals and **recommends** that if tissue from standard animals is collected, samples should be accompanied by a detailed description of the state of the animal (e.g. blubber layer thickness) and information on pathology.

The Committee **recommends** that at next year's meeting, the issues of marine debris and noise pollution be discussed in addition to chemical pollution.

15. DATA COLLECTION, STORAGE AND MANIPULATION

15.1 Progress on undertaking data entry and computing tasks

Data coding

Free reported on the progress of the data coding project.

(i) The principal task of coding the individual catch records from the North Pacific had been completed. The new dataset for sperm whales, covering the period 1949 to the present, is briefly described in Appendix 2 of Annex D.
(ii) All Southern Hemisphere catches from the 1979/80 season onwards had been made available in a final form, so that the Antarctic pelagic catch dataset was now virtually complete for the period 1931/32 to 1984/85.
(iii) All catch data from the most recent whaling season had been coded and summarised as part of the transfer of the administration of whaling statistics to the IWC Secretariat (*Rep. int. Whal. Commn* 34: 28).
(iv) Progress was especially good on coding the available catch data from the rest of the world, i.e. from pelagic operations and land stations outside the Antarctic and North Pacific. The time scales for the work presented at last year's meeting had been revised downwards to take account of the rate of work obtained in practice. In addition, consultations with Mr Vangstein at BIWS, Norway, indicated that the early (pre-1931/32) catch records are less complete than had been supposed. Consequently, it now appeared likely that essentially all the individual catch records extant in Norway could be coded in two to three years.
(v) No marking data had yet been coded, but the records from the International Marking Scheme were almost ready for data entry and it would be possible to begin work in the coming year. Ohsumi pointed out that other marking data under consideration had been obtained by the Japanese national programme and so would be subject to restrictions on access.
(vi) The first six years of IWC/IDCR Southern Hemisphere minke whale cruise data had been provided in a common format by Butterworth. Following a visit to the Secretariat by L. McQuaid the current validation programs were also available at Cambridge.

Free also reported that cataloguing of the files held by the Computing Facility was proceeding, but that progress had been slow because of practical difficulties.

Free pointed out that the data coding programme was subject to renewal annually and that continuation of the work for another full year would require further funding from the Commission. The Committee noted the substantial progress made and re-iterated its view that the project was providing fundamental sources of data essential to a comprehensive assessment of stocks. The Committee strongly **recommends** that the project should be continued.

The Committee discussed other sources of data for catches prior to the establishment of the BIWS recording schemes. It was suggested that reliability might be a problem with some of the early material. The Committee agreed to ask S. G. Brown if he would compile a list of possible sources as an extension of the consultancy work which he was undertaking for the Committee (*Rep. int. Whal. Commn* 35: 54).

Computing tasks

Free reported that validation studies had been conducted on the two programs incorporating the length-specific assessment technique for sperm whales and on the Sakuramoto-Tanaka model for Southern Hemisphere minke whales. The sperm whale programs had been further revised to translate them into the new standard for the FORTRAN language, FORTRAN 77. The validation exercise had been intended to verify that the programs correctly embodied the techniques and methods described in the relevant IWC publications and to ensure that the conventions and special features of the programming language had been met. Further details are given in Appendix 2 of Annex D. Problems that arose in attempts to use these programs are discussed under Item 11.1.1.2.

15.2 Bureau functions

The Committee noted that since its last meeting the functions of the Bureau of International Whaling Statistics had been transferred to the IWC Secretariat (*Rep. int. Whal. Commn* 34: 28 and 35: 22). The Committee discussed various practical questions concerning the presentation and distribution of the current statistics which had arisen since the transfer.

15.2.1 *Weekly catches during the season*

Tables of weekly catches in the Antarctic have in the past been distributed to all members of the Scientific Committee at monthly intervals. The Committee agreed that such frequent reporting is no longer necessary and requests that the Secretary provide a summary of the figures at the end of the season instead.

15.2.2 *Tables summarising catch and effort by 10° square*

The Secretary reported that the tables summarising catch and effort in the Antarctic and North Pacific by 10° square were currently circulated to only a small number of people before the Annual Meeting. He asked whether the present arrangements still met the needs of the Committee. Some members considered that an early distribution was useful and wished to continue to receive the tables. The Committee agreed that a new circulation list should be drawn up by correspondence in the coming year.

15.2.3 *Format for future output*
The Secretary reported that he intended to produce one more publication in the style established by BIWS, in order that there should be a consistent presentation up to the moratorium on commercial whaling. He suggested that a revised style would be appropriate for the following year (1985/86) and asked for the Committee's guidance on the information required and on a new format. The Committee established a Working Group comprising Best, Gambell, Horwood, Ivashin and Kasuya to provide suggestions to be discussed at next year's meeting.

15.3 Policy on access to IDCR Minke Whale Cruise data
Butterworth noted that certain South African funding agencies had contributed to the costs of the encoding and validation of the IWC/IDCR Southern Hemisphere minke whale cruise data. A general condition set by these bodies is that data resulting from supported projects should be submitted to a central national database, the South African Data Centre for Oceanography (SADCO). Butterworth pointed out that their structure allowed for limitations on access for some defined period, but did not permit indefinite restrictions. He asked the Committee to advise him on a suitable period of limitation.

It was agreed that the question was not addressed by the existing guidelines on data availability. Some members felt that there were wider implications both for access to existing data held by the IWC and for the joint funding of future research. The Committee believed that the matter needed further consideration and noting that SADCO did not require an immediate answer, agreed to discuss the matter further at its next meeting.

15.4 Computing needs
Three projects were assigned high priority by the Committee:

(i) complete coding of BIWS data;
(ii) complete validation of length-specific estimation programs for sperm whales by rectifying errors introduced in the previous validation process, thorough testing of the programs using simulated data with known parameter values, and testing of programs with actual western North Pacific data;
(iii) carry out sensitivity tests of validated length-specific estimation programs on western North Pacific data, using both the 160°W and the modified 'Cambridge' boundary, as outlined in section 7.3 and Appendix 3 of Annex D.

In respect of tasks (ii) and (iii), the Committee **recommends** that these projects be carried out in consultation with a working group with members Free, Harwood (Convenor), Kasuya and de la Mare. This working group is to correspond throughout the year and ensure that as much as possible of the necessary computing for a western North Pacific Stock assessment will have been completed in time for members to have received results prior to the 1986 meeting.

16. INITIAL AGENDA FOR 1986 MEETING

The Committee strongly **recommends** that the length of its annual meeting be restored to 13 days. This would facilitate its consideration of the following priority stocks:

(i) those subject to whaling under objection;
(ii) those subject to aboriginal/subsistence whaling;
(iii) those subject to a catch under scientific permit.

With regard to planning the comprehensive assessment, the Committee **recommends** that this be considered in the context of a special Scientific Committee meeting held during the intervening year (Item 9.5). However, if a lack of financial resources did not make this feasible, the Committee observed that this subject might be considered during the annual meeting if an extra three days were added for this purpose. It expressed the view that this was the minimum number of days required to undertake this planning and that the period would have to be dedicated solely for this purpose.

With regard to the workshop to consider sightings of species other than minke whales obtained during IDCR Southern Hemisphere cruises, the Committee agreed that this should be held for three days just before the annual meeting. The Committee welcomed Harwood's offer to host the meeting at the Sea Mammal Research Unit in Cambridge, UK.

During the meeting it was noted that detailed documentation had not been provided for several computer programs which had played a significant role in the Committee's deliberations. The Committee agreed to discuss this problem, and the provision of raw data used in analyses, at the next annual meeting, but asked authors to bear these concerns in mind when preparing their papers for next year.

It was agreed that the Chairman should consult with sub-committee convenors during the course of the year in accord with established procedures to develop the list of priority stocks and agenda for the next annual meeting. However, given uncertainties about future activities of the Commission and Committee at this time, it was further agreed that the Chairman should be accorded considerable flexibility in developing plans for the coming year.

17. PUBLICATIONS

The Committee agreed, in accordance with the procedure outlined in *Rep. int. Whal. Commn* 32: 63 that the editorial board should comprise Donovan, Bannister, Braham, Brownell, Harwood, Kirkwood, Shimadzu and Tillman.

18. ELECTION OF OFFICERS

Tillman informed the Committee that he would not be standing for re-election as Chairman. The Committee expressed both their regret at this decision and their warm appreciation for his outstanding service during the last three years.

In accordance with procedure agreed in 1983 (*Rep. int. Whal. Commn* 34: 61) Kirkwood and Brownell were elected Chairman and Vice-Chairman respectively.

19. OTHER BUSINESS

19.1 Information concerning non-priority stocks
New information concerning the following stocks was discussed by the sub-committee on protected species and aboriginal whaling (Annex H): the Northwestern Pacific stock of gray whales; the Okhotsk Sea and Eastern Arctic stock of bowhead whales; North Atlantic, North Pacific and Southern Hemisphere right whales. In discussing right whales off South Africa, Butterworth pointed out that the results of SC/37/PS28 and 29 were inconsistent with a model used in some sub-committees in the assessment of the other whale stocks, namely the Pella-Tomlinson model

with MSY level at 60% of carrying capacity under the assumption that super-compensation did not occur. He suggested that the Committee note this matter for attention at its next Meeting, and also that the Committee might wish to treat results of that model with caution in the meantime in view of this inconsistency. Some members did not accept that there was any such inconsistency.

New information on small cetaceans, including catches of small cetaceans off Sri Lanka; incidental catches in the eastern tropical Pacific; killer whales in Alaska; bottlenose dolphins in Florida; and narwhals and white whales in the Arctic; is given in Annex I. Following discussion of the vernacular name for *Phocoena sinus* in Annex I (Item 7.6), the Committee **recommends** that the name 'vaquita' replace 'cochito' in the IWC List of cetacean names (given in *Rep. int. Whal. Commn* 27: 30).

19.2 Icelandic Proposal for a Scientific Permit

Although aspects of the Icelandic proposal dealing with topics other than those related to the proposed scientific catch were not discussed in detail, some members of the Committee observed that some of the proposed activities could, in principle, advance the knowledge required for management of these stocks. Sightings surveys were particularly singled out as being most useful, and the Committee welcomed their undertaking.

19.3 Other

The Committee wished to record its appreciation of the long hours, hard work and cheerful service of the Secretariat during the meeting.

Annex A
List of Participants

AUSTRALIA
G. R. V. Anderson
J. L. Bannister
G. P. Kirkwood
W. K. de la Mare

BRAZIL
S. F. de A. Chaves
P. M. P. Coelho
J. A. de Oliveira
J. M. da Rocha

DENMARK
E. W. Born
F. Larsen

FEDERAL REPUBLIC OF GERMANY
W. Arntz
P. Deimer
J. Ploetz

ICELAND
T. Gunnlaugsson
J. Sigurjónsson

JAPAN
I. Ikeda
F. Kasamatsu
T. Kasuya
H. Kato
S. Misaki
T. Miyashita
F. Nagasaki
T. Nakamura
S. Ohsumi
K. Sakuramoto
K. Shima
Y. Shimadzu
S. Tanaka
K. Yamamura

REPUBLIC OF KOREA
Y. Gong

MEXICO
L. A. Fleischer
L. Rojas

NETHERLANDS
K. Lankester
P. J. H. Reijnders

NEW ZEALAND
M. W. Cawthorn

NORWAY
A. Bjørge
I. Christensen
E. O. Øen
N. Øien
T. Øritsland

ST LUCIA
J. P. Fortom Gouin

SEYCHELLES
S. J. Holt

SPAIN
A. Aguilar
L. Jover
S. Lens
H. Quiroga

SWEDEN
T. Lyrholm

USSR
R. G. Borodin
M. V. Ivashin
V. G. Makeyev

UK
P. S. Hammond
J. Harwood
J. W. Horwood
M. Klinowska
C. H. Lockyer
A. R. Martin

USA
T. Albert
H. W. Braham
J. M. Breiwick
G. C. Broadhead
R. L. Brownell
D. G. Chapman
C. W. Clark
W. T. Ellison
R. Elsner
W. E. Evans
J. C. George
L. L. Jones
G. G. Joyce
B. Krogman
M. K. Nerini
W. F. Perrin
M. F. Tillman
J. E. Zeh

INVITED PARTICIPANTS
E. D. Asper
K. C. Balcomb
P. B. Best
I. R. Bishop
D. S. Butterworth
A. Collet
J. G. Cooke
M. A. Fraker
E. F. Harding
J. S. Leatherwood
D. K. Ljungblad
B. Mate
D. J. Nicol
R. R. Reeves

INTERGOVERNMENTAL ORGANISATION OBSERVERS
J. R. Beddington (CCAMLR/IUCN)
J. Berney (CITES)
M. A. Hall (IATTC)
T. Øritsland (ICES)
B. H. Nielsen (UNEP)

IWC
C. Allison
G. P. Donovan
C. A. Free
R. Gambell