

**Report of the IWC Workshop on Future
SOWER Cruises, 1-4 October 2004,
Tokyo**

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1. OPENING REMARKS

The Convenor, Kato, welcomed the participants to this important Workshop.

J. Morishita, Deputy Director, Far Seas Fisheries Division, Fisheries Agency of Japan, welcomed participants to the Workshop on behalf of the Government of Japan. He noted that the Southern Ocean Whale Ecosystem Research (SOWER) programme is a flagship of the International Whaling Commission (IWC) and a good example of international co-operation of nations within the Commission. He noted the good spirit of co-operation at the last Commission meeting and expected that this would continue at this Workshop. He looked forward to the positive and constructive outcomes of the Workshop and identified that there is a need for a vision for future SOWER cruises and that this Workshop was a good opportunity to make some progress towards this.

A list of participants is given in Annex A.

2. APPOINTMENT OF CHAIR AND RAPORTEURS

Kato was elected Chair and Childerhouse agreed to act as rapporteur. Donovan carried out the final editing.

3. ORGANISATION OF THE WORKSHOP

The Workshop was held at the Institute of Cetacean Research, Tokyo, 1-4 October 2004.

4. ADOPTION OF AGENDA

The Agenda is given as Annex B. It was noted that additional sub-agenda items may be required for Items 7-9.

5. TERMS OF REFERENCE

The following general terms of reference were **agreed** for the Workshop:

- (1) determine and specify priorities/sub-objectives;
- (2) determine appropriate methods to achieve these;
- (3) establish a timeline for this work;
- (4) produce an initial proposal.

In response to a question over possible support for future cruises, Morishita summarised the position of the Japanese Government. He stated that no decision has yet been made to support any future programme and that any such a decision would take into account the future objectives of the programme. He also confirmed that if it was agreed to support a future programme, the level of resources provided

would probably not exceed the present level of assistance. It was **agreed** that for the practical purposes of discussion at this Workshop, it would be assumed that the Japanese Government would continue to provide vessels and assistance at the present level, even though it was recognised that no decision had been taken and that this represents a major investment from the Japanese Government.

6. GENERAL OBJECTIVE

The general objective for any future programme, as **agreed** by the Committee at SC/56 (IWC, 2005), is:

To provide information to allow determination of the status of populations of large whales that feed in Antarctic waters. The programme will primarily contribute information on abundance and trends in abundance (including of minke whales), learning from both the successes of past IDCR/SOWER cruises and the difficulties encountered in interpreting previous results.

It was **agreed** that this should be the general objective for this Workshop.

7. PRIORITY/SUB-OBJECTIVE

7.1 'Brainstorming session' on general ideas for sub-objectives

It was agreed to begin the Workshop by having a general 'brainstorming session' of potential 'lofty and noble ideas' in order to help provide some guidance in the development of priorities and sub-objectives. Several different approaches were suggested and the approaches described below were not intended to be considered as mutually exclusive ideas or proposals, but rather to provide a general discussion of issues that could be considered for future SOWER cruises.

7.1.1 *The perturbed ecosystem approach*

This approach was based on the idea that the Antarctic ecosystem is one of the most perturbed ecosystems on earth and that since blue and fin whales were the species most affected by commercial whaling, they should be the priority species for any future work. In particular, studies should focus on investigating what has happened to them since protection. Potential methods that could be used should not only focus on abundance estimation but also on applying a broader range of techniques including satellite tagging (for movements and stock structure), acoustics (for distribution and abundance) and the identification of individuals from photo-identification and biopsy sampling. It was suggested that any such integrated programme would benefit from having a pre-determined statistical framework for the various forms of data (e.g. acoustic and visual line transect data) to maximise the potential information collected. In

¹ Presented to the meeting as SC/57/Rep1.

addition, it was suggested that there should be an ecosystem rather than a species-specific focus as there is a need to examine a suite of species to understand ecosystems. It was suggested that the clear difference between species-specific and ecosystem research programmes needs to be clearly identified and elucidated.

7.1.2 The guild of krill eaters approach

This approach focused around the idea that it is important to monitor what is happening in the guild of krill-eating whales in the Antarctic ecosystem. This would include blue, fin, humpback and minke whales and some right and sei whales that are sympatric with them. Methods such as biopsy, photo-identification and satellite tagging should be used. In addition, there should be an extension in survey effort north of 60°S and further work should be undertaken on stock structure, especially links between feeding and breeding grounds. With regard to the latter two points, it was suggested that during transits to and from the Antarctic, research time should be dedicated to studies on the breeding grounds as well as dedicated research effort within 50-60°S. It was suggested that it would be important to collect information on the migration of individuals to and from the Antarctic within a single season.

7.1.3 The explanatory variable approach

This approach was based on the premise that an understanding of trends in abundance requires an understanding of general biology and ecology; this would require, in particular, the collection of information on explanatory variables in addition to standard sighting survey information. Collection of such information could be undertaken by SOWER vessels and be facilitated by collaborations with other research programmes. In addition to data on abundance via line-transect data, a key element would be the investigation of stock structure. Methods such as spatial modelling would be used to provide information about why whales are where they are and what are plausible explanations for apparent trends. It was suggested that continued collaboration with an ice-breaker to investigate how whales use the ice would be extremely useful.

7.1.4 The Revised Management Procedure (RMP) approach

This approach had the primary aim of obtaining sighting data to estimate abundance of baleen whales for use in the RMP. In general, survey methods would continue to have both a circumpolar (CP) focus and a focus of survey effort south of 60°S. It would follow the survey methodological guidelines laid out in Hammond and Donovan (2004). Broadly, therefore, this would be a continuation of surveys along the lines of the previous CPII and CPIII surveys. It was highlighted that there have been 26 IDCR/SOWER cruises and that this is a very important dataset. It is critical to have consistency between this dataset and any future research to avoid a break or end to the series.

7.1.5 The explanatory approach

This approach suggested that future research could focus on methods that would provide further information on differences between CPII and CPIII surveys, although the methods to be used were not specified.

7.1.6 The criteria approach

This approach outlined some criteria that could be used to identify priorities for a future research programme. It has already been agreed that the focus should be on large whales (see Item 6). One criterion could be that if more than one

species is to be considered for research, then the species should have the same general distribution. This would allow for the optimisation of tracklines such that information on two (or more) species could be collected simultaneously. Another criterion could be that the number of species being considered should be small. As information on abundance and trends are required (as identified in the general objective) in addition to information required to understand these (e.g. explanatory variables), it is not realistic to collect such a wide range of information for many species. Another criterion could be that any future research should build upon research already conducted, thus enabling the maximum value to be obtained from both existing and future research. It was suggested that the species most consistent with these criteria are minke and blue whales. Future research priorities that could be considered include movements and stock structure for these species. This would include the use of genetics, satellite tagging and perhaps surveys at low latitudes. Another potential criterion that should be considered was the length of time required to complete a CP survey.

7.1.7 Other ideas

It was noted that there is a need to try to collect information pertinent to VPA catch-at-age analysis as age distributions may differ between areas. Future research could focus on obtaining accurate data on the length of individuals to provide additional information from areas outside the JARPA programme. This would require development and application of methodologies for the estimation of length (e.g. work by Pitman on estimating length of killer whales from helicopter; photographic techniques by Gordon etc.).

In terms of limiting the scope of the programme, it was suggested that sperm whales should be excluded from consideration as they are difficult to study (e.g. have long dive times) and only a small proportion of the population is found in the Antarctic area.

7.1.8 General discussion

Some participants believed that while the concept of defining criteria was useful, it was too early in the discussion to restrict thoughts; it may be sensible for example that cruises in any future programme go to new areas, that may vary year by year. Others pointed out that if the goal is to understand trends, it is inefficient to collect data over short time periods for a small number of species and then switch to another species. It would be better to have longer term studies that consider multiple species, which would allow better precision in detecting trends. Given the problems in interpreting trends from CPII and CPIII, it did not seem appropriate to merely continue the present approach. It was also suggested that future studies should not be considered in isolation, but should try and integrate IWC research programmes with other international programmes to maximise the benefits of data sharing and collaboration.

Overall, it was **agreed** that many aspects of the approaches raised above could be integrated into a larger research programme which could include sighting surveys, photo-identification and biopsy studies, use of telemetry, use and further development of new statistical techniques and the collection of appropriate environmental data.

7.2 Consideration of factors from SOWER

In considering potential priorities and sub-objectives for future SOWER cruises, it is useful to learn from past experiences with IDCR/SOWER cruises. In particular, it is

important to focus on factors that have been identified as potentially affecting both absolute abundance estimates and trend information for minke whales such as the hypotheses that may explain differences between CPII and CPIII (IWC, 2003, table 1). Such considerations can be useful in identifying issues that may or may not be addressed in future surveys. The Workshop reviewed the aforementioned table 1 in this context. It was noted that while the issues and important factors to consider had been developed with respect to Antarctic minke whales, they may also be relevant for other species. It was **agreed** that when considering potential factors, the two questions below should be used in evaluation.

- (1) What needs to be done to establish if a factor is likely to have a large effect on estimating absolute abundance?
- (2) If the work that is done or planned does suggest that there is a large effect, are there ways to address the problems, including the use of methods other than sighting surveys (e.g. telemetry, specific experiments)? If not, then this should not be listed as a high priority for future research.

Based on a review of the table (IWC, 2003, table 1), a list of factors that have previously been identified to influence the abundance of Antarctic minke whales were identified (Table 1). Table 1 identified the level of influence on the absolute abundance estimate (Column 2) and on the estimation of trends (Column 3) and on what species were likely to be influenced (Column 4). It also identified how each factor could be addressed in the future using either analytical or field methods (Columns 5 and 6).

The Workshop finally evaluated the priority and ease of conducting each of the proposed field studies (Columns 7 and 8). It should be noted that factors at the bottom of the table (Stock Structure and below) were more general issues and so were considered in a slightly different manner.

In summary, a range of factors/issues were identified as high priority for future work (i.e. scored either a 1 or 2). In some cases, these factors/issues were only relevant to a single species or a specific method. Overall, the high priority items included (in no particular order): (a) animals within sea ice; (b) survey timing in respect to migration; (c) g(0) considerations; (d) observer experience; (e) changes in longitudinal distribution of individuals between years; (f) stock structure issues; (g) sea ice boundary moving within the survey period; and (h) use of acoustics in abundance estimation.

It was **agreed** that all of these factors/issues should be considered in the development of a future SOWER research programme.

7.3 Sub-objectives

Based on the brainstorming session (Item 7.1) and the investigation of factors identified by SOWER (Item 7.2) the Workshop **agreed** that the sub-objectives given in Fig. 1 should form the basis for the future research programme. These fall under four major interrelated areas: methodological developments and improvements in abundance estimation and interpretation of those; stock structure; abundance estimates; and trend in abundance. The figure also indicates short-, medium- and long-term sub-objectives.

7.4 Short and long term priorities

It was **agreed** that the long term goal for a future programme is to provide CP estimates of abundance and trends in abundance for large whales that feed in Antarctic

waters. It was also **agreed** that the short term goal for a future programme is to undertake research on priority species including to:

- (a) undertake experimental surveys to provide information useful in developing optimal survey design and methodology and addressing problems with previous IDCR/SOWER surveys; and
- (b) provide estimates of abundance for smaller areas (in conjunction with stock structure studies), which will be potentially useful in investigating long term trends.

The estimation of CP abundance for priority species will be a long term project. It will not be possible to get such a CP estimate in the short term, however it will potentially be possible to get abundance estimates for smaller areas for priority species. Such estimates can still provide useful information on trends in species in Antarctic waters if methods that include techniques for the estimation of additional variance are utilised.

7.5 Species priorities

The Workshop noted that the general objective for the programme (see Item 6) referred to: 'the determination of the status of the populations of large whales that feed in Antarctic waters'. It **agreed** therefore that the long-term goal of the programme was to consider all species found south of the Antarctic convergence. However, this clearly is an enormous task and it **recommended** that the following species priorities should be assigned in order from highest to lowest: (1) Antarctic minke and blue whales; (2) fin whales; (3) humpback whales; (4) sei and right whales; and (5) sperm whales.

Blue and Antarctic minke whales were considered to be the highest priority because they have similar latitudinal distributions (the great majority occurring south of around 60°S during the austral summer) thus allowing a common primary research area. In addition, the Commission has also assigned them priority in the past via Resolutions. Fin whales were assigned the next priority since they represent the species for which the highest cumulative catches occurred in the past. Their latitudinal distribution is south of around 50°S with most being found between 50°-65°S although some are found slightly further south. Humpback whales show a similar latitudinal distribution to fin whales although they are generally found slightly further south. They have been given slightly lower priority than fin whales since their abundance can also be estimated by studies in their breeding grounds. Sei and right whales were given the next priority since they are found both north and south of the Antarctic convergence during the austral summer (sei ~40°-50°S; right ~40°-60°S). Sperm whales were given the lowest priority as only large males feed in Antarctic waters and there are considerable methodological difficulties in estimating their abundance. They are not considered further in this report.

The Workshop **agreed** that the assignment of these priorities did not mean that work on lower priority species could not be carried out incidental to work on the highest priority species. It was noted that while other species were not considered priorities, information should be collected on them whenever possible.

7.6 Review of information on past and present whale distributions

The Workshop considered the issue of appropriate research areas. The Workshop **agreed** that the long-term goal was to obtain abundance and trend information for all species that feed in the Antarctic.

Table 1
Evaluation of issues arising out of previous SOWER cruises.

Factor/objective	Influence on population (5=large)			Proposed method		Future field work	
	Abundance	Trend	Species	Analytical	Field*	Priority (1=high)	Ease (1='easy')
Animals within sea ice	4	3	Minke-blue	None	SS Tag	1 3	3 4
Survey time WRT migration	4	2	All All Humpback Some	Little	SS Tag Photo-ID Acoustic	2 3 5 2	2 4 3 1
School size	2	4	Minke	Yes	SS experiment	4	2
Reaction to vessel	2	1	All	Yes	SS experiment	3	2
Proportion of like-minke	2	2	Minke	None	SS experiment	4	2
g(0)	4	5	All	Yes	SS experiment	1	2
Using closing mode	3	3	All	Yes	SS	4	1
Observer experience	2	4	All	Yes	SS experiment	2	2
Longitudinal distribution changes over years	3	4	All	Yes	Tag Acoustics External sources SS	1 3 2 3	3 3 1 1
Multi-years → 1 'point' estimate	4	3	All	Yes	SS	3	4
Survey design	4	?	All	Yes	SS experiment	1	2
Stock structure	5	4	All	Yes	Biopsy Tag Acoustic Photo-ID	2 1 4 3	2 3 4 3
Age-structure WRT density gradient	2	3	Minke	Yes	SS experiment	4	3
Alternative to SS	4	?	All	Yes	SS experiment	1	2
Sea ice boundary moving	3	2	Minke-blue	Yes	Tag SS	2 3	4 2
Use of acoustics in abundance	5 1 3	? ? ?	Blue Minke Fin	Yes Yes Yes	SS, photo-ID None SS	1 NA 3	3 NA 3

*SS = sighting surveys; SS experiment = one time sighting survey experiment; tag = telemetry studies using VHF or satellite tags; acoustic = acoustic studies using pop-ups or passive acoustic arrays; biopsy = biopsy studies; photo-ID = photo-identification; external = utilising data from external sources such as satellite chlorophyll data or results from other research programmes, e.g. krill distribution from CCAMLR studies; WRT = with respect to.

There was some consideration of future research areas. Very coarse plots of concentrations of past and present distribution for the top four priority species (minke, blue, fin, sei) were examined (see Annex C). It was noted that these could be refined if necessary but it was felt that they were probably sufficient for the present purposes. It was noted that there were at least three areas in the Antarctic where all four species occur within close/overlapping proximity and high abundance. These encompassed the following approximate areas: (a) 10-40°E; (b) 170°E-170°W; and (c) 80-100°E.

The latter area was not identified as a hot spot for minke whales, but they are still known to be there in reasonable numbers.

It was noted that under Item 7.1, it had been agreed that initial work in the short term would be to undertake research to provide information to develop optimal survey design/methods and to address problems associated with interpreting results from previous surveys. Given this, the Workshop **agreed** that the most appropriate way to determine appropriate research areas was to consider the priority sub-objectives and methods to address them discussed under Item 7.2 and then determine which area or areas were most likely to lead to particular sub-objectives being achieved most efficiently.

8. PRIORITY ITEMS FOR SHORT TERM RESEARCH

A range of factors that could influence estimates of abundance and trends was identified under Item 7.2. Associated with these factors were potential methods that could be used to investigate their influence. The following research issues were considered as equally high priority for short term research based on their ranking on the future field work column and from related discussions:

- (1) determining the proportion of whales in the ice (if this proves feasible – see this year's ice-breaker experience);
- (2) determining the best way of estimating g(0) and school size; and
- (3) collecting data necessary to understand stock structure.

The additional research items were identified as lower priority, but still important:

- (4) development of satellite tags and attachment mechanisms;
- (5) development of new methods for analysis and design of surveys; and
- (6) development of methods to integrate acoustics with sighting surveys.

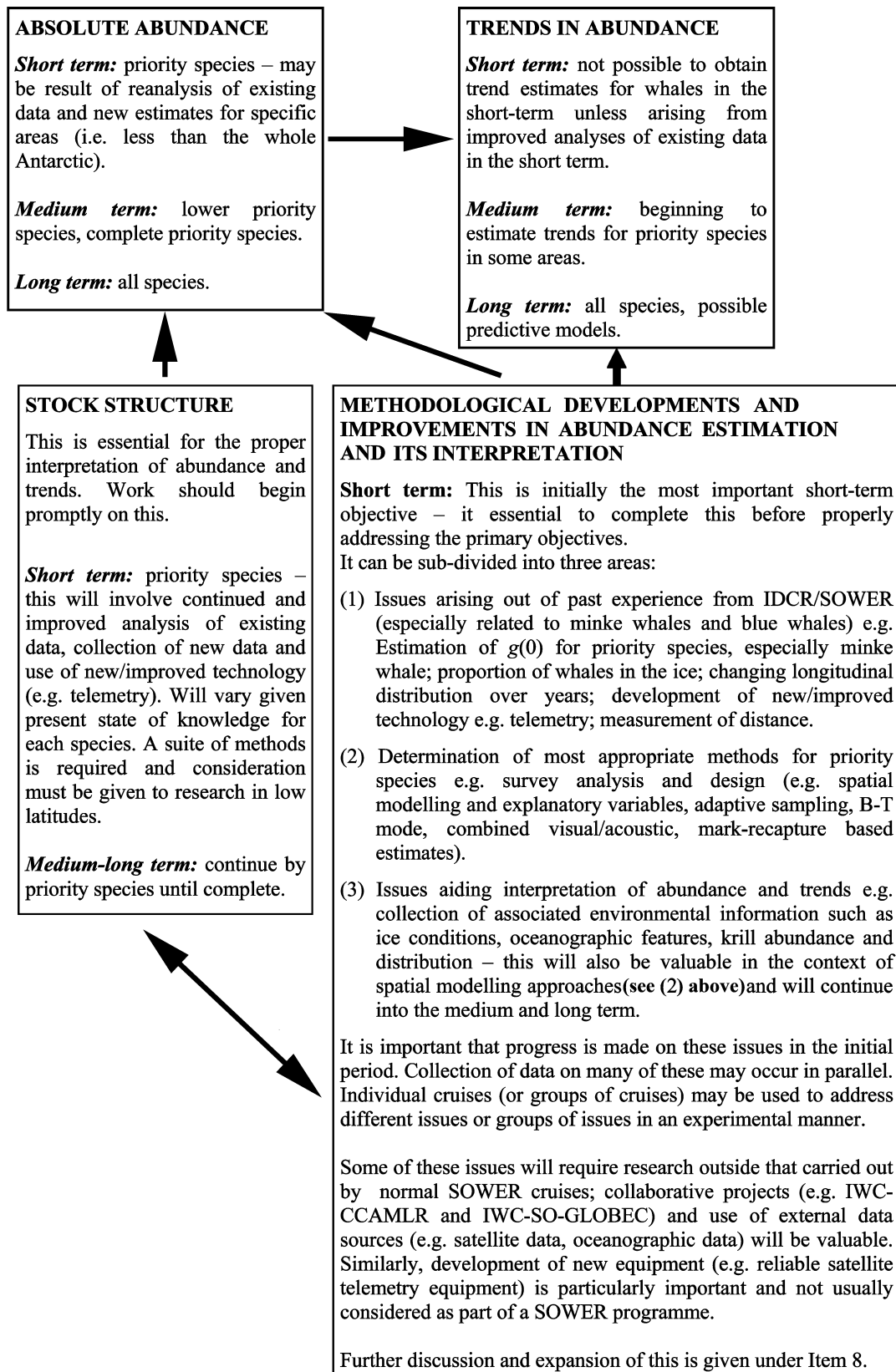


Fig. 1. Schematic representation of the link between the various sub-objectives and short-, medium- and long-term priorities.

A general discussion followed. It was noted that stock structure information is critical for the understanding and interpretation of abundance and that there is no single method that will be able to address the issue of stock structure. A suite of methods should be considered to adequately elucidate stock structure. Biopsy sampling should be considered as a high priority for blue and fin

whales, but less so for minke whales as there appears to be a smaller genetic effect size. For minke whales, satellite tagging studies may be a more appropriate method.

In addition, it was noted that biopsy samples are needed from low latitude areas to provide information on stock structure as there may be considerably mixing on the higher latitude feeding grounds. This mixing will make

determination of stock structure from sampling only on the feeding grounds difficult or impossible. This may prove difficult as the locations of the breeding areas for the rorquals are not well known. This issue could potentially be addressed by satellite tagging studies.

It was agreed that it would be advantageous to collaborate with other research programmes (e.g. CCALMR) where appropriate since this would expand both the Antarctic areas that can be covered by surveys and would improve the collection of data on additional variables (both biotic and abiotic). The value of investigating the use of acoustic techniques (e.g. pop ups), particularly for fin whales was suggested.

9. METHODS TO ACHIEVE THE PROPOSAL

Items under this item were considered under Items 7.2 and 7.7.

10. TIMEFRAME

It was **agreed** that a detailed discussion of timeframes for any future work should await the development of an initial proposal which is likely to occur at the next full Scientific Committee (SC) meeting.

11. INITIAL PROPOSAL

It was **agreed** that an initial proposal should not be developed at this Workshop, as it was an issue for the full SC to consider. It was suggested that initial draft proposals should be submitted to the next meeting of the SC. Such proposals should take into account the guidelines developed at this Workshop and described under Item 7.3. It would also be appropriate to consider results from the 2004/05 SOWER survey in developing a future survey.

12. RECOMMENDATIONS

The Workshop **recommended** that:

- (1) the SC should consider the report of this Workshop as a set of guidelines for the development of an initial proposal;
- (2) that an initial proposal be developed during SC/57, with appropriate time allocated for a full discussion;
- (3) that SC members provide background papers to SC/57 to allow for efficient progress to be made on the development of a proposal; and
- (4) an intersessional email discussion group (consisting of the participants of the Workshop) continue to discuss issues related to the development of an initial proposal.

13. ADOPTION OF REPORT

The report was adopted by email.

REFERENCES

- Hammond, P.S. and Donovan, G.P. 2004. Suggestions for updating the 'Requirements and guidelines for conducting surveys and analysing data within the Revised Management Scheme'. Paper SC/56/RMP4 presented to the IWC Scientific Committee, July 2004, Sorrento, Italy (unpublished). 13pp. [Paper available from the Office of this Journal].
- International Whaling Commission. 2003. Report of the Scientific Committee. Annex G. Report of the Sub-Committee on the comprehensive assessment of whale stocks – in-depth assessments. Appendix 10. Hypotheses that may explain why the estimates of abundance for the third circumpolar set of surveys (CP) using the 'standard methods' are appreciably lower than estimates for the second CP. *J. Cetacean Res. Manage. (Suppl.)* 5:286-90.
- International Whaling Commission. 2005. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 7:1-62.

Annex A

List of Participants

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Annex B

Agenda

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| <ol style="list-style-type: none"> 1. Opening remarks 2. Appointment of Chair and rapporteurs 3. Organisation of the workshop 4. Adoption of Agenda 5. Terms of reference 6. General objective 7. Priority/sub-objective <ol style="list-style-type: none"> 7.1 'Brainstorming session' on general ideas for sub-objectives <ol style="list-style-type: none"> 7.1.1 The perturbed ecosystem approach 7.1.2 The guild of krill eaters approach 7.1.3 The explanatory variable approach 7.1.4 The Revised Management Procedure (RMP) approach 7.1.5 The explanatory approach | <ol style="list-style-type: none"> 7.1.6 The criteria approach 7.1.7 Other ideas 7.1.8 General discussion 7.2 Consideration of factors from SOWER 7.3 Sub-objectives 7.4 Short and long term priorities 7.5 Species priorities 7.6 Review of information on past and present whale distribution 8. Priority items for short term research 9. Methods to achieve the proposal 10. Timeframe 11. Initial proposal 12. Recommendations 13. Adoption of report |
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Annex C

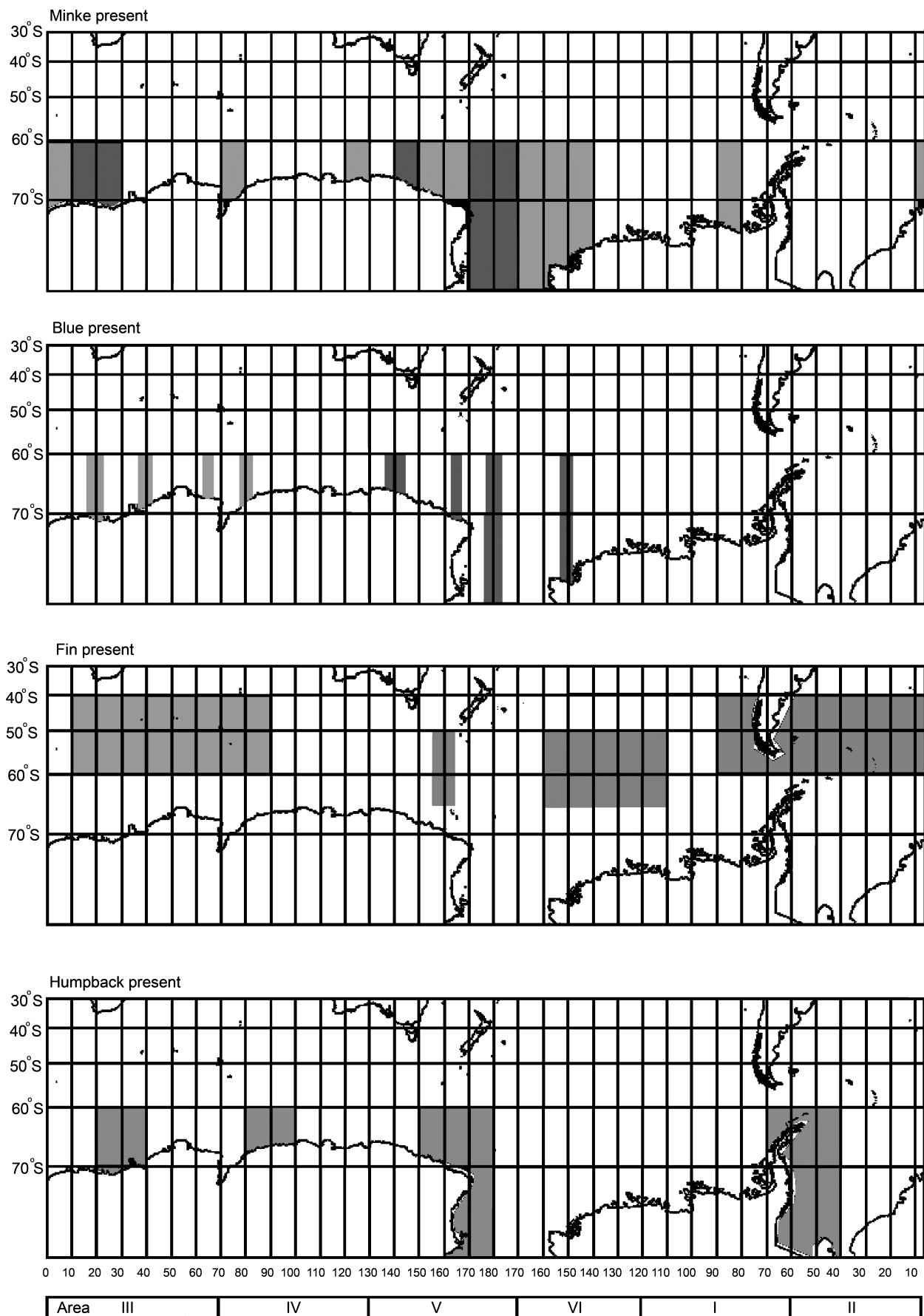
Baleen Species in Antarctica

The original figures in this Annex are in colour and colour copies can be requested from the Secretariat.

N.B. The absence of shading does not imply that there are no or very few whales present – it merely means that the

highest relative concentrations for each species are where the shading is. The latitudinal areas covered are not meant to imply equal concentrations in any band – just the broad range.

[Figures on following pages]

(A) Crude present main concentrations of main baleen species

(B) Crude comparison of present distribution and past catches

