INTERNATIONAL COURT OF JUSTICE

WHALING IN THE ANTARCTIC
(AUSTRALIA v. JAPAN)

STATEMENT BY DR NICK GALES BVMS PhD

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15 APRIL 2013

1. INTRODUCTION

1.1. In this statement I draw on my direct experience as: an active member of the International Whaling Commission's Scientific Committee (**Scientific Committee**) over the past decade; a senior member of the international marine mammal science community for more than 30 years; and a leader of a major national science program. A copy of my curriculum vitae is attached to the notification of expert evidence provided to the Court under letter dated 24 January 2013.

1.2. The Scientific Committee is of considerable importance to the successful functioning of the International Whaling Commission (**IWC**). I will demonstrate that the clear separation of the processes of science and policy between the Scientific Committee and the IWC have been a prerequisite to the Scientific Committee achieving its excellent

track record in the delivery of a range of world-leading science outputs: see **Section 2** of this statement below, "The Scientific Committee".

1.3. In stark contrast, the *Japanese Whale Research Program Under Special Permit in the Antarctic* (**JARPA**) and the *Second Stage of the Japanese Whale Research Program Under Special Permit in the Antarctic* (**JARPA II**) have been the most divisive components of the Scientific Committee's activities since their inception: see **Section 3** below, "The Scientific Committee and Special Permit Whaling".

1.4. My experience at the Scientific Committee indicates that the difficulties with JARPA and JARPA II have been caused by the programs' ongoing and indefinite nature and lack of clear objectives, along with the inability to engage the proponents of the programs in an evidence-based dialogue and the resultant lack of influence the Scientific Committee has on the content and structure of JARPA and JARPA II. These factors have prevented any real progress in the Scientific Committee's attempts to conduct its mandated scientific role of review and advice on these special permit whaling programs.

1.5. In its Counter-Memorial, Japan asserts that the Scientific Committee has not been critical of JARPA and JARPA II and that it has recognised the value of the programs to the Scientific Committee's work: see, for example, Japan's Counter-Memorial at footnote 629 and paragraphs 34, 11.2–11.3, 4.16, 4.33, 5.16, 5.142, 9.27–9.28. I will assess these assertions and demonstrate that the nature of the debate on JARPA and JARPA II precludes the Scientific Committee providing the IWC with constructive, consensus advice on these programs: see **Section 4** below, "Japan's Counter-Memorial".

1.6. On the very few occasions when consensus has been achieved on a summary statement on the Japanese programs, they refer to little more than an unrealised *potential relevance* to an element of the work of the Scientific Committee. That potential remains unrealised after more than 25 years of the application of lethal methods, with those methods remaining in essence the same as when the programs commenced.

1.7. The technical engagement of the Scientific Committee with data resulting from JARPA has been limited to a few methodological issues that arise from the analysis of data that have complex properties, such as bias, resulting from their collection as part of a

whaling operation rather than within a framework of a carefully designed experiment with clear objectives and appropriate methods. These examples will be discussed in the statement.

1.8. I will demonstrate that the contribution of Japan's Southern Ocean special permit whaling programs to our knowledge on Antarctic minke whales, particularly in relation to their conservation and management, is negligible: see **Section 5** below, "Has JARPA and JARPA II contributed important knowledge on Antarctic minke whales?"

1.9. Finally, I will outline an existing, collaborative and highly successful research framework, operating with the endorsement and cooperation of the Scientific Committee, that provides an alternative mechanism to Japan's unilaterally determined JARPA and JARPA II programs and which can deliver on the important questions relating to the conservation and management of minke whales without the need to kill the whales: see **Section 6** below, "The Southern Ocean Research Partnership: A new model for collaborative, non-lethal science in the Southern Ocean".

2. THE SCIENTIFIC COMMITTEE

2.1. The Scientific Committee of the IWC is widely recognised as a world-leading scientific body on matters associated with the conservation and management of whales. As with all successful science bodies charged with responsibilities to review, undertake research and provide advice on matters of practical management relevance, a prerequisite to achieving these mandates is to isolate its technical functions from debate on policy questions.

2.2. In **Annexure 2** to this statement, I provide a general description of the governance and working practices of the Scientific Committee and present three relevant examples of its world-leading science. Several of these science outcomes were only possible to achieve due to the Scientific Committee being able to apply its scientific processes in a complete and proper manner.

2.3. In one of these examples, the development of an agreed method to calculate catch limits for commercial whaling – the Revised Management Procedure (**RMP**) – I explain that a key element of this success was that its framework was explicitly designed to ensure that any policy decisions were provided via instruction from the IWC. Thus, the

Scientific Committee limited its deliberations to matters of technical consequence which responded to the conservation objectives, or policy, determined by the IWC.

2.4. The RMP was developed after the moratorium on commercial whaling was imposed. This break from the annual business of agreeing catch limits acted as a "circuit breaker" for both the Scientific Committee and the IWC. It allowed time for reflection on the reasons for the failure of earlier management to conserve whales adequately.

2.5. A key feature of the manner in which the IWC functioned prior to the moratorium was a blurring of responsibilities between the Scientific Committee and the IWC on matters of science and matters of policy and management. The failed predecessor of the RMP – the New Management Procedure (**NMP**) – required the Scientific Committee to make determinations on the classification of whale populations that defined if those populations could be subject to whaling. The failure in the technical process by which this classification was supposed to occur exposed the Scientific Committee to undue policy influence: see also Annexure 2.

2.6. Thus, it can be said that the Scientific Committee has only truly managed to functionally quarantine its scientific processes from policy considerations since the introduction of the moratorium on commercial whaling. This self-correction within the IWC allowed the Scientific Committee to apply the well-proven, evidence-based norms of scientific research and to leave difficult policy debates on whaling to the IWC – but with the important exception of its consideration of special permit whaling: see Section 3 below.

3. THE SCIENTIFIC COMMITTEE AND SPECIAL PERMIT WHALING

3.1. The difficulty of the Scientific Committee to manage effectively its roles of review and advice in relation to JARPA and JARPA II stand in stark contrast to almost all other aspects of the Committee's business.

3.2. In many ways, the nature and debates on JARPA and JARPA II represent a continuation of the problematic manner in which the Scientific Committee operated prior to the moratorium. This link with past practice is clearest in two regards:

(i) There is an almost entire emphasis in JARPA and JARPA II on the collection of lethally acquired data for the assessment of biological parameters; and

(ii) The ability of the Scientific Committee to provide evidence based advice to the IWC regarding JARPA and JARPA II is compromised.

3.3. I will examine these two features to explore the degree to which they have evolved or changed in the 26 years since JARPA commenced, and in particular the degree to which they remain an issue in JARPA II.

Emphasis on lethal data and the use of biological parameters

3.4. The premise that data derived from whaling operations can be used for the suitably precise estimation of biological parameters required for the determination of catch limits was the flawed basis of the failed NMP. On that basis, the need for such data was expressly avoided in the RMP: see Kirkwood 1992; IWC 1994.

3.5. After more than 25 years of ongoing work within the Scientific Committee on the RMP, during which time it has been revised in several regards, data from JARPA and JARPA II have not been relevant to those revisions.

3.6. It is notable that in its use of Aboriginal Subsistence Whaling Management Procedures to set catch limits for subsistence hunters, biological parameters estimated from lethally acquired data are not used by the Scientific Committee. This is despite the samples being readily available as a part of whaling operations.

3.7. Despite these factors and the extraordinary evolution and availability of powerful, non-lethal research techniques over the past 25 years (including those addressed in Section 6 below) and the great success that the application of these tools has achieved, JARPA II, and JARPA before it, remain programs that are centred almost exclusively on the use of lethal research. The lethal methods adopted have remained in essence unchanged throughout that time.

The ability of the Scientific Committee to review and provide evidence-based advice on JARPA and JARPA II

3.8. Paragraph 30 of the Schedule to the *International Convention for the Regulation of Whaling 1946*, specifies the role of the Scientific Committee in reviewing special permits issued by any country. A key part of that review, *inter alia*, is to provide advice on the objectives of the research.

3.9. In principle the challenge of the review and advice function for special permit whaling should be the same as the challenge the Scientific Committee faces for the full range of scientific issues within its remit. In the cases described in Annexure 2, all competing views were tested for their scientific merit through intense debate and discussion. Of key importance, the Scientific Committee determined the next steps in their workplan to resolve the uncertainties around the issues, and thus genuinely worked its way through the often polarised debate. In other words, the Scientific Committee had a genuine scientific role to fulfil and was able to apply the normal scientific process of review and structured analyses to successfully complete its role. Good science prevailed.

3.10. As I have noted, this has not been the case for the Scientific Committee in its role of reviewing and providing advice on special permit whaling, and more particularly on JARPA and JARPA II. A normal scientific approach to undertaking a review would be flexible around the particular issues that may arise in a proposal, but essentially includes a two-stage process, which involves:

(i) Review of the *scientific merit* of the overall proposal (are the objectives/hypotheses of the proposal scientifically meaningful and do they address important or relevant scientific questions?); and

(ii) Review of the *proposed methods* described (how likely is it that the questions being asked can be answered with the proposed data collection and analytical methods and timelines proposed?).

3.11. In the case where animals are to be used in an experiment, particularly if the methods are invasive or lethal, then a review would invariably assess if the objectives can be achieved with non-lethal, or less invasive tools, and to determine whether the proposed number of animals to be used in an experiment is no larger than appropriate to acquire informative results and will not harm the populations from which animals are taken (for international standards on these ethical and welfare issues, see Gales et al. 2009).

3.12. In the normal course of resolving a dispute where scientific views are polarised, the Scientific Committee would evaluate the evidence-base of each view. Thus, a simple expression of a contrary view would not in itself be sufficient to block the Scientific

Committee from forming a view unless the contrary view is able to be scientifically supported.

3.13. The Scientific Committee attempted to utilise this process when Japan first proposed its JARPA program. A range of papers was presented to the Scientific Committee, and indeed published in the open literature, which provided legitimate and objective scientific views that the objectives of the program were ill-defined and were not achievable, particularly in relation to age specific mortality rates with the proposed methods: see Cooke 1987, de la Mare 1987, 1989, 1990, Goodman 1988, Goodman and Chapman 1988, Holt 1987. Japan disagreed with the views (see IWC 1988), but despite a later attempt (see Sakuramoto and Tanaka 1989) they were unable to refute them. The concerns raised by Cooke and others were ultimately agreed (see Tanaka 1990) and Japan adjusted the methods of analysing data in JARPA, but notably no change was made to the method of collecting data in the program, and in particular their use of lethal methods and self-imposed catch limits. In summary, the prospective analyses of JARPA within the Scientific Committee demonstrated that no usable estimates of age-dependent mortality would be obtained (see de la Mare 1990a, 1990b), which was eventually confirmed after 18 years of JARPA.

3.14. The Scientific Committee and the IWC have attempted on a number of occasions to redefine a process for reviewing special permit programs that would facilitate an effective outcome. The most recent version of these defined review procedures – "Process for the Review of Special Permit Proposals and Research Results from Existing and Completed Permits", also known as "Annex P" (see IWC 2009a) – outlines the areas on which the Scientific Committee may comment on new special permit programs, annual reports and mid-term reviews from existing programs or final reviews of completed programs. "Annex P" includes a review component that includes some external scientists, but the fundamental review responsibility remains with the Scientific Committee.

3.15. It is important to note that progress on the issue of reviewing special permit whaling programs has not foundered in the Scientific Committee simply because whales are being killed, or because strongly opposing views have been expressed. These same challenges exist for many scientific issues that the Scientific Committee deals with, including some of those discussed in Annexure 2. In the normal scientific process, the

debate critically evaluates the evidence base of all of the presented information and views, determines a workplan and iterates towards an agreed conclusion. Indeed, in my view, a proposal under special permit whaling that asked relevant scientific questions, proposed methods that were demonstrably the best scientific solution and was subject to genuine scientific review, would not founder in the Scientific Committee in the manner that JARPA and JARPA II have.

3.16. The core problems the Scientific Committee has encountered in the review of JARPA and JARPA II are as follows:

(i) A lack of clear and achievable objectives in JARPA and JARPA II, thereby not providing the scientific framework by which a review can proceed;

(ii) The ongoing and indefinite nature of JARPA II;

(iii) A lack of engagement by the proponents in an evidence-based dialogue that can be assessed by the Scientific Committee; and

(iv) A consequential lack of influence, and hence practical purpose, of the review process in changing the JARPA or JARPA II programs.

3.17. Resolution of all four issues would be required in order to provide for a proper review by the Scientific Committee of JARPA and JARPA II. I examine each of these criteria below.

3.18. **A lack of clear and achievable objectives:** As explained by Professor Mangel, whose statement I have read, a research program that is for "purposes of scientific research" requires objectives or hypotheses to be clear, meaningful and achievable using the tools available to a scientist. Once framed in such a manner, it is possible to provide an objective assessment of: (i) the relevance and importance of the research question the objective addresses; and (ii) the likelihood that, and degree to which, the proposed scientific methods can inform the question. Without the guiding framework of clear and achievable objectives, the remaining review steps are not possible.

3.19. The view of the Scientific Committee clearly aligns with that of Professor Mangel, as can be seen in "Annex P". In this document the Scientific Committee notes that objectives should, *inter alia*, be quantified to the extent possible, and provide a statement of their value to the conservation and management of whale stocks or other

marine living resources. Further, the Scientific Committee requests statements as to the degree to which the objectives address a range of issues including past recommendations of the Scientific Committee and the work of the Scientific Committee in relation to things such as the RMP.

3.20. In relation to JARPA II (and to a large extent JARPA), this fundamental scientific structure of clear and achievable objectives is lacking. Professor Mangel has provided an examination of these objectives against the expected norms of scientific research. I concur with his views and will not expand on them here, except to draw particular attention to the first of the JARPA II objectives. I do this as the subject matter Japan purports to examine under Objective 1 – the Southern Ocean ecosystem – is central to my role as the Chief Scientist of Australia's Antarctic Program. Understanding the Southern Ocean, its ecosystems and their influence on, and vulnerability to, global climate processes is the largest element of our, and most other, national Antarctic Programs. Consequently, through the Australian Antarctic Program, I am fully aware of, and participate directly in, most of the global initiatives that aim to improve our understanding of the Antarctic ecosystem.

3.21. Unless set within the framework of a testable scientific question, the first objective of JARPA II, "Monitoring of the Antarctic ecosystem", in itself cannot be treated as "scientific research". The Antarctic ecosystem, which ranges from viruses to whales, and includes complex and ill-understood interactions and processes between the physical and biological components of the system, is immense in scale. There is a wide range of very large, multi-national initiatives that aim to improve our knowledge on specified elements of the Antarctic ecosystem that have been shown to be relevant to particular questions. These initiatives run over defined timelines. Each of these specify which components of the ecosystem they intend to study (e.g. ocean productivity in a specified area and its relationship to the Antarctic circumpolar current), which field methods will inform such an interaction (generally based on models which build on existing knowledge), and the timeline by which their specified objectives can be achieved. The vague JARPA II objective of "Monitoring of the Antarctic ecosystem" lacks any of these required characteristics and is immutable to any form of practical review.

3.22. By contrast to JARPA II, Japan's National Institute of Polar Research (NIPR) is an important contributor to scientific knowledge in the Southern Ocean and on the Antarctic continent. Australia has a particularly close relationship with NIPR as both nations operate in East Antarctica. In common with the Australian Antarctic Program, NIPR tests the scientific quality and relevance of its research projects through international peer review before embarking on its research expeditions. Along with its other characteristics of international engagement and regular reporting of the progress of its research, NIPR is an example of an organisation with a proper scientific research program.

3.23. The JARPA II program operates in complete isolation and without any reference to the scientific research of NIPR. The work of NIPR and the many international programs on Southern Ocean science that Japan and its scientists engage in receive no reference in the JARPA II proposal. Given NIPR's focus on research that aims to improve our understanding of Antarctic ecosystems, such non-alignment between a genuine ecosystem scale program in the work undertaken by NIPR and a purported one in JARPA II is hard to understand from a scientific perspective. If JARPA II was genuinely a program for "purposes of scientific research" it would be expected to be connected with the broader scientific initiatives of Japan in the Southern Ocean. It is not.

3.24. Japan did initiate one collaboration during the final season of the 18 year JARPA program. During the IWC review of JARPA, Japan presented results from a joint survey in 2004/05 between JARPA and a vessel from Japan's National Research Institute of Far Seas Fisheries: see Naganobu et al. 2006. The survey focused on interactions in the Ross Sea area between oceanography, krill and baleen whales. The JARPA review workshop welcomed the multi-disciplinary approach presented in the papers and was complimentary on the value of the data. The authors of an associated paper that reported on the use of scientific echo-sounders in JARPA (Murase et al. 2006) concluded that multi-disciplinary studies such as these can reveal ecological relationships between krill and baleen whales. These results have recently been published in the peer-reviewed literature: see Murase et al. 2013. Critically, only non-lethal data was collected during the joint surveys and subsequently analysed and reported in any of these papers. No such joint surveys have occurred during JARPA II

and no data comparable to that collected by the joint survey have been presented to the Scientific Committee.

3.25. **The ongoing and indefinite nature of JARPA II:** Leaving aside the lack of clear and testable objectives, an important element of review of scientific research is a defined timeline, and a demonstration of how the timeline was determined. A proper review will test the claims made in a program and provide advice on their likelihood of success. Without a timeline such tests have no scale to assess against. An absence of a timeline also means that the determination of appropriate sample sizes becomes confounded.

3.26. Additionally, an important feature of long-term programs is the definition of milestones; that is, what level of knowledge will have been achieved within a defined time period. It is common to link these milestones with stopping rules that ensure that if a program is not progressing as planned, then work will stop until an improved approach is developed. JARPA II lacks timelines, milestones and stopping rules leaving the review process without a context in which practical advice on progress against objectives can be provided. It appears to be entirely open-ended.

3.27. **A lack of engagement by the proponents in an evidence-based dialogue:** Differences in scientific opinion are an important and common element in advancing scientific knowledge and understanding. Within the Scientific Committee such differences are encountered in addressing almost all complex problems. Different scientists present their scientific perspectives backed up with evidence. The role of the Scientific Committee is to examine the evidence base of all perspectives and to work through a process (often with a specified work plan) towards resolving the differences by weight of the scientific evidence. As noted above, the Scientific Committee has managed this role with success on many scientific issues: see particular examples in Annexure 2.

3.28. This has not been the case in reviewing JARPA or JARPA II due to Japan's apparent position that it need not provide a serious response to scientific criticism from the members of the Scientific Committee, nor provide and debate the scientific basis for its own views. Rather, Japan's responses are characterised by noting disagreement with a particular view and reiterating their own. Such resistance is not a part of scientific

debate. All aspects of JARPA (and JARPA II since then), including the program's objectives, and all aspects of the methods and analyses have remained virtually immutable in the face of valid criticism. The proponents of JARPA and JARPA II, and indeed all special permit programs, provide reports and participate in reviews, but do not answer legitimate scientific concerns, or modify their proposals on the basis of the scientific debate, including contrary views that are put to them.

3.29. This lack of proper engagement by proponents of special permit programs greatly hampered the ability of the Scientific Committee to provide constructive consensus advice to the IWC. On matters that go to the heart of reviewing the program's objectives and the utility of the proposed methods, the process ends with little more than a brief statement of opposing views. Such statements ("some said this, while others said that") are a feature of the annual reports of the Scientific Committee, including each of the reports since the introduction of JARPA II: for example, see IWC 2006, 2007, 2008, 2009b, 2010a, 2011a, 2012a. These opposing statements are usually appended in their entirety to the Scientific Committee's report, and often simply refer to statements made during previous meetings.

3.30. While the Scientific Committee can be said to have achieved balance in informing the IWC of the opposing views, the lack of arbitration over the validity and evidence base of either view has resulted in each view being presented with apparently equal scientific merit.

3.31. While it is certainly true, as Japan attests, that "there are instances where irreconcilable differences persist among [the scientists]" (see Japan's Counter-Memorial at paragraph 2.53) and these views are presented to the IWC, such a point should only be reached after some scientific process of assessment of the validity of the competing views. The matters at the heart of the criticisms and defence of JARPA and JARPA II are well within the competence of the Scientific Committee to make an objective and scientifically weighted determination of the validity of each view.

3.32. **A lack of influence, and hence practical purpose, of the review process in changing the JARPA or JARPA II programs:** A review function lacks practical purpose unless it exerts some influence over the program subject to review. While final reviews aim to provide an objective assessment of the degree to which a project has managed to

complete its stated objectives, initial and mid-term reviews are of particular importance in providing guidance on whether a program is still worth proceeding with and/or how a program may be modified in order to improve its performance. Without this practical outcome there is little purpose to the review.

3.33. The importance of this point is exemplified in the process by which the Scientific Committee attempted to review the JARPA II proposal, and the influence the review of JARPA has had on JARPA II.

3.34. Japan presented its proposal for JARPA II to the Scientific Committee during its annual meeting in 2005: see IWC 2006. It proposed to commence JARPA II in the 2005/06 Antarctic summer season with an expansion in its lethal take from a maximum of 440 Antarctic minke whales per season in JARPA to 935 (a 112% increase) as well as an expansion of the species it would take to include 50 humpback whales and 50 fin whales each season. JARPA had concluded during the 2004/05 season and the Scientific Committee was planning a review of the JARPA program which was to take place late in 2006. The timing of the Scientific Committee review was to ensure that Japan had sufficient time to complete the analysis of all data collected during the 18 year program, including the data collected in 2004/05.

3.35. While the objectives of JARPA II varied in some areas from JARPA, the field program itself was virtually unaltered: the core of the program required the killing of whales (indeed a greatly increased number) and the collection of an almost identical suite of measurements from the dead whales.

3.36. Any review of the plan for JARPA II could logically not proceed in the absence of a review of JARPA, the program's first phase, in which an assessment could be made of the degree to which the methods common to both phases of the research had achieved the stated objectives. Indeed, the JARPA II proposal argued that the research contained in that proposal addresses questions that cannot be answered by analysis of existing data, which in the case of JARPA, consisted of data collected from almost 7,000 dead whales.

3.37. Japan had conducted its own review of its JARPA program in January 2005. However, the Scientific Committee had decided that this was not an IWC-sponsored workshop: see IWC 2005. Some members of the Scientific Committee had noted that such a self-

review – where 27 of the 39 participants were from Japan's own Institute of Cetacean Research (17), or the Japanese Government's fisheries agencies (10) – would not provide an objective review of the program: see IWC 2006. The report from the Japanese review received little comment in the 2005 Scientific Committee meeting and was not submitted or considered as part of the Scientific Committee's review in 2006.

3.38. At the 2005 Scientific Committee meeting, at which Japan presented its JARPA II proposal, an unprecedented 63 members of the Scientific Committee, which included 47 delegates from 16 national delegations (of a total of 31) and 16 Invited Participants, presented a paper in which they stated that they felt "unable to engage in a scientifically defensible process of review of the JARPA II proposal". They further stated that "this proposal can be addressed by the SC only when the JARPA review is complete": see Childerhouse et al. 2006. A response from five members of the Japanese delegation rebutted this statement and argued the Scientific Committee was compelled to review the JARPA II proposal under paragraph 30 of the Schedule of the Convention: see IWC 2006.

3.39. The Scientific Committee then continued, without the 63 authors who had raised important concerns that go to the core of scientific process. Given the scale and open-ended nature of JARPA II, the brief discussion within a small and non-representative portion of the Scientific Committee (IWC 2006) and in the absence of any legitimate review of the first phase of the JARPA program, the Scientific Committee cannot be seen to have been able to acquit its responsibilities under paragraph 30 or under any other scientific criteria.

3.40. The IWC JARPA review workshop took place in Japan in December 2006 and the report was presented at the 2007 annual meeting of the Scientific Committee: see IWC 2008. It should be noted that the JARPA review included the full participation of the Japanese scientists who conducted the work. This included their involvement in defending their own program and in agreeing the language of the report. In a normal scientific review process the proponents of the research participate only to the extent necessary to present the work and answer questions of clarification.

3.41. Despite the fact that JARPA had run for 18 years and been subject to a mid-term review almost a decade earlier, none of the stated objectives had been achieved. Major issues

were identified against each of the objectives, and a wide range of recommendations for future work was provided.

3.42. Critically, none of the recommendations from the JARPA review workshop suggested a need for future lethal data to inform any of the JARPA objectives. Nor did they include any suggestions that a greater sample size might be required.

3.43. Many of these issues raised at the review workshop went to the heart of the need to kill whales for the collection of data. These include particular recommendations on non-lethal techniques that would provide superior results. For example the Workshop recognised the following (see IWC 2008):

> [S]amples from the breeding areas (e.g. as could be obtained through a combination of satellite tracking and biopsy sampling) would greatly facilitate [stock structure] analyses, and are likely to be required to resolve issues relevant to stock structure and mixing within the JARPA research area.

3.44. In its Counter-Memorial at paragraph 5.40, Japan responds to this recommendation in a cursory manner, stating:

> It must be noted however that the locations of breeding grounds of the Antarctic minke whales are unknown, except in waters off Brazil. In any case, research under the JARPA demonstrated that the analyses of samples in the feeding grounds are informative of the stock structure of Antarctic minke whale.

3.45. Major issues were also raised in relation to the analysis of samples such as ear plugs and stomach contents.

3.46. In the case of ear plugs, the JARPA II proposal makes no reference to, or methodological change as a result of, the issue of the failure of nearly 7000 ear plug samples from dead whales in JARPA to add anything to the precision of our estimates of mortality rates for Antarctic minke whales, nor to the more general issues of the use of the age data for other purposes (e.g. age at maturity).

3.47. Japan asserts that the collection of ear plugs for age analysis is a key rationale for JARPA and JARPA II (for example, see IWC 2006), but ignores the multiple issues identified by the Scientific Committee relating to the use of ear plugs to estimate age at maturity (i.e. through the use of a 'transition layer'): see also paragraph 5.9 below.

3.48. In relation to the measurement of stomach contents, the JARPA review raised a wide range of concerns in relation to the analysis and interpretation of the data. Indeed it

was noted during the workshop that the research merely confirmed the two species of krill that Antarctic minke whales were known to eat and provided daily intake estimates that were no more precise than estimates published prior to the start of JARPA: see IWC 2008. These significant concerns raised in the JARPA workshop did not give rise to changes in the approach in JARPA II.

3.49. To my observation and knowledge in attending the meetings of the Scientific Committee, the JARPA review has had no practical impact on the core aspects of JARPA II that entailed killing whales. To that extent, the review of the first phase of JARPA had no practical purpose in informing the second, greatly expanded phase of JARPA II.

3.50. In summary, the fundamental debate in relation to the scientific propriety of the objectives and methods proposed in JARPA and JARPA II remains unresolved within the Scientific Committee. The original lethal methods proposed in JARPA have remained substantially unchanged over the past 26 years. The scientific concerns raised in relation to the ill-defined nature of the objectives, the unlikelihood of the methods to resolve the stated objectives, and the more appropriate application of alternative non-lethal methods remain unanswered. The inability of the Scientific Committee to influence the methods and analyses applied each year by the proponents of the program, arising directly from the proponents' failure to properly engage in and respond to the review process, has essentially resulted in a deadlock. This has led to the disengagement of many of the Scientific Committee's scientists. Very few scientists engage in the annual review and discussion process concerning JARPA II. Those that do commonly refer back to statements made in previous years, rather than use the valuable time of the Scientific Committee to reiterate a view for which progress in discussions has proved impossible.

4. JAPAN'S COUNTER-MEMORIAL

4.1. In its Counter-Memorial, Japan makes multiple assertions claiming various levels of support for JARPA and JARPA II from the Scientific Committee. The main claims made by Japan in this context are that:

- The Scientific Committee approved JARPA and JARPA II as legitimate scientific programs: see Japan's Counter-Memorial at paragraph 60;

- Non-lethal alternatives to methods in JARPA and JARPA II are considered by the Scientific Committee as being impractical or too imprecise, and that some data could only be acquired lethally: for example, see Japan's Counter-Memorial at paragraphs 4.13, 4.61;
- The process by which the Scientific Committee review submitted papers represents peer review: for example, see Japan's Counter-Memorial at paragraph 4.108; and
- The Scientific Committee endorsed the value of data from JARPA and JARPA II in a number of contexts of its business: for example, see Japan's Counter-Memorial at paragraphs II.2 and II.3.

4.2. Many of these assertions are made without authority or references. Those that include attribution refer primarily to the report of the Scientific Committee's final review of JARPA.

4.3. As I have described above, the advice of the Scientific Committee to the IWC on JARPA and JARPA II is characterised by its polarity and its lack of assessment of the scientific weight of the issues raised by members of the Scientific Committee. As a result, it is rare that consensus is reached on any statement that provides a substantive judgement on the programs. The most common paragraph referenced by Japan is one that appeared in both the mid-term review of JARPA and the final review (see IWC 2008):

> The results from the JARPA programme, while not required for management under the RMP, have the potential to improve management of minke whales in the Southern Hemisphere in the following ways....

4.4. The quote goes on to discuss the manner in which these data *could* be relevant to aspects of the RMP, such as implementation simulation trials. The other Scientific Committee statements for which Japan provides references in its Counter-Memorial refer to similar statements of the *potential* utility of data in a range of ongoing analyses.

4.5. It is noteworthy that the statement was repeated in both the mid-term and final review of JARPA, but that the intervening decade and indeed the years since have failed to see a realisation of this potential.

4.6. On their face, it can be seen that none of the statements referenced by Japan can be interpreted as an endorsement by the Scientific Committee of the actual JARPA and JARPA II programs. As has been discussed earlier, JARPA and JARPA II are programs of data collection which operate outside of the normal processes of scientific research. Such programs will, by their nature, generate data. As the Scientific Committee considers questions to do with the conservation and management of whales, it will quite appropriately consider all available data that might contribute to its research and assessments. However, even though the Scientific Committee may have considered the data, two important points in this regard are that: (i) it has not endorsed JARPA or JARPA II as the appropriate scientific method of obtaining such data; and (ii) as elaborated below, it has not requested further data that can only be obtained using lethal means.

4.7. The most conspicuous aspect of the data that has been collected in JARPA and JARPA II is that, with the potential exception of data on stock structure (see paragraph 4.8 below), it has yet to realise any of the stated *potential* utility in research outputs from the Scientific Committee that are relevant to the conservation and management of whales. The Scientific Committee makes many recommendations during its annual meetings on research and data needs to answer key scientific questions. What is absent from Japan's Counter-Memorial are *any statements at all* from the Scientific Committee that suggest a need for any further *lethal* data from Southern Ocean whales in order to complement any aspect of its research needs. Such statements are entirely absent from the Scientific Committee's records.

4.8. In relation to stock structure, it is true that analyses of the genetic data from JARPA have provided some additional support for the view that there are at least two populations of minke whales in the JARPA whaling area, and that there is a wide boundary of mixing between these populations to the south of Australia. However, two factors significantly detract from the apparent utility of this outcome. First, evidence for this population structure was already identified before the JARPA program: see Wada and Numachi 1979. Whilst JARPA provided additional evidence for the structure, it did not find anything new. Second, it is important to note that the Scientific Committee, the final JARPA review and even Japan's own review of its JARPA program make reference to the fact that information on stock structure and mixing

would be better addressed with non-lethal sampling on the breeding grounds and with satellite tag data to look at animal movements: see IWC 2008, Japan 2005. It is also incontrovertible that genetic samples from any species of whale can be acquired non-lethally with biopsy darts. As such, Japan's purported revelation on stock structure from JARPA could have been achieved equally, and in my opinion better, by using non-lethal techniques.

4.9. Japan's Counter-Memorial also makes several assertions on the value of data from JARPA and JARPA II to the understanding of the interactions between minke whales and their environment. It is certainly true that the Scientific Committee regards issues around the way whales interact with their environment as important to its work. Indeed, the topic is sufficiently important that in 2008 the Scientific Committee held a joint workshop with the Scientific Committee of the Commission for the Conservation of Antarctic Marine Living Resources (**CCAMLR**). At the time, I was the convenor of the Scientific Committee's Working Group on ecosystem modelling, and was a joint convenor of this workshop. The workshop enjoyed strong representation from both organisations' Scientific Committees.

4.10. The workshop had an explicit purpose of reviewing input data required for ecosystem models being developed to provide management and conservation advice on krill predators (which includes whales) in the Antarctic marine ecosystem that might be relevant to IWC and CCAMLR. After determining the data required for ecosystem models and reviewing what data was available, the workshop was asked to identify and prioritise gaps in knowledge and the types of research programs needed to reduce important uncertainties in ecosystem models.

4.11. A report from the workshop was presented to the Scientific Committee meeting in 2009: see IWC 2010b. Many useful recommendations on the prioritised knowledge gaps were presented in the report. Importantly, there were no recommendations and no ranked data needs that would be serviced in any manner from any aspect of the JARPA II program, or from lethal take generally. This is despite the fact that a major stated objective of this program is in relation to the manner in which Antarctic whales interact with krill and the broader environment.

4.12. Japan also asserts in its Counter-Memorial that the process by which the Scientific Committee review submitted papers represents peer review (for example, see Japan's Counter-Memorial at paragraph 4.108). As has been discussed earlier, this is clearly not the case given the manner in which discussions on JARPA and JARPA II occur in the Scientific Committee. Peer review is the independent, and usually anonymous, assessment of a paper by appropriately qualified scientific peers. The papers' authors have a right of reply to the review, but play no role in the review itself. The peer review and the response of the authors are then assessed through an independent third party (usually in the form of the editor of a journal) and a determination is made of the validity and quality of the paper and whether it merits publication in the scientific literature. The polarised discussions in the Scientific Committee on JARPA and JARPA II in no way represent a form of credible peer review.

4.13. In summary, in its Counter-Memorial and in its discussions in the Scientific Committee, Japan makes regular reference to statements from a wide range of sources that support some aspect of the potential relevance of the data they collect to particular analyses or assessments. However, it is clear that none of these references amount to the Scientific Committee giving any sort of endorsement to the need for, or the objectives or methods adopted by, JARPA or JARPA II. Furthermore, the Scientific Committee has in fact been critical of Japan's programs. While Japan may argue that it has followed the advice of the Scientific Committee on some particular analyses, what has been entirely absent is any evidence that Japan is willing to modify its program in any way that impacts on its self-determined lethal take of whales. It is the clear lack of scientific need for this lethal sampling that underlies by far the greatest amount of criticism by many members of the Scientific Committee and for which they have seen no adjustment in Japan's programs.

5. HAS JARPA/JARPA II CONTRIBUTED IMPORTANT KNOWLEDGE ON ANTARCTIC MINKE WHALES?

5.1. As the populations of great whales in the Southern Ocean collapsed, and began to be protected by the IWC, the focus of the whaling nations turned increasingly to the much smaller (but relatively abundant) Antarctic minke whales.

5.2. Global concern over the status of whale populations was rising and culminated, in 1972, with the call for a moratorium on commercial whaling by the UN Conference on

the Human Environment. The IWC responded in two ways. The Scientific Committee argued that a blanket ban on whaling was not scientifically justified and that management of whales "requires regulation of the stocks individually" (IWC 1973). This led to the work on the NMP. The Scientific Committee also stated that "instead of a moratorium, support should be sought for a decade of intensified research on cetaceans". This second recommendation led to the International Decade of Cetacean Research (IDCR) surveys. Work commenced in 1975 and surveys began in late 1978.

5.3. At the time the IDCR surveys commenced, 6,000-9,000 Antarctic minke whales were taken each year as part of a commercial hunt, predominately by the USSR and Japan. There was substantial disagreement in the IWC about the method of setting the catch limits. At the time this was determined from an estimation of the number of whales that could be killed in a population such that the population remained stable. In other words, the number of whales born would be equal to the number of whales killed by whaling, plus those that died of natural causes. These "annual replacement rate" estimates ranged from 0.5% to 7% of the population (that is, you can kill between 0.5% and 7% of the abundance estimate of a population of whales each year and the population will remain the same size). For Antarctic minke whales, the IWC negotiated a replacement rate of 3.5%, but debate in the Scientific Committee continued on both the replacement rate and abundance estimates.

5.4. The minke whale component of the IDCR surveys responded to these issues of debate in the Scientific Committee and set about focusing efforts on abundance estimates and animal movement patterns. The former was addressed with non-lethal sighting surveys, and the latter through the use of "Discovery marks". Discovery marks were the best available technique at the time for a pelagic whale species. The system involved firing a metal cylinder with a unique identifier engraved on it into a whale, recording the location of the whale when it was 'marked' and recording the location of any whales taken in the commercial whaling operations that had a tag in their tissues. Thus, it can be said that the primary issues the IWC believed should be addressed through these surveys were questions of abundance and animal movements on the feeding grounds. Additional scientific information on minke whales was recorded from a proportion of whales taken in commercial whaling operations, including certain biological data that was thought at that time might allow calculation of replacement rates. At this time the

IWC was applying the NMP which was explicitly reliant on these biological data. As discussed in Annexure 2, the NMP failed exactly because the estimation of the required biological parameters from whaling data proved to be manifestly unattainable at the level of precision required and their use in a management context was proved to be of no practical utility.

5.5. By the Antarctic summer of 1985/86, when the moratorium on commercial whaling came into effect, the Scientific Committee had concluded that the IDCR sighting surveys required modification. This was subsequently done and led to the conduct of two circumpolar survey series over the next two decades – the IDCR and Southern Ocean Whale and Ecosystem Research (**SOWER**) programs – which have provided an invaluable foundation of what we know today about Antarctic minke whales. In simple terms, the surveys provided new information on Antarctic minke whales relevant to conservation and management that has enabled the Scientific Committee to:

- estimate the absolute abundance of Antarctic minke whales by sector and around the whole of the Southern Ocean;
- potentially estimate trends in Antarctic minke whale abundance by sector and around the whole of the Southern Ocean;
- characterise some aspects of Antarctic minke whale habitat north of the ice edge;
- compare habitat distribution of Antarctic minke whales with other whale species; and
- improve our understanding of some aspects of minke whale behaviour, e.g. group size.

5.6. The IDCR/SOWER programs also provided many novel insights and information on other great whale species in the Southern Ocean.

5.7. For much of the same period that Japan participated in and supported the collaborative IDCR/SOWER program, it also unilaterally ran its JARPA/JARPA II programs.

5.8. In 1987, when Japan commenced its JARPA program, the salient knowledge relevant to the conservation and management of Southern hemisphere minke whales can be summarised as follows:

- The estimates of abundance of minke whales that relied on the notoriously problematic techniques of using measures of catch per unit of effort had been discarded in favour of the direct estimates from sightings surveys. The number of breeding populations, required for the application of the NMP, was unknown. Based on some early genetic analysis, there was evidence that there were at least two breeding populations with a possible boundary somewhere in IWC Areas IV and V (roughly 130°E): see Wada and Numachi 1979. The positions of other boundaries (of which there must be at least one) were unknown. The locations of breeding grounds were unknown, although one was suspected off the coast of Brazil. Discovery marks showed that whales tended to be recaptured in later seasons often close to where they were originally marked.

- It had become clear that biological information derived from animals taken in commercial whaling operations were confounded through the issue that the killed whales did not represent a true cross-section, or "random sample", of the whole population. Pregnancy rates were known to be high, with the corrected estimate of 0.78 per year (that is, almost eight out of every 10 adult females killed were pregnant). Natural mortality rate was unknown, but thought to be in the range of 0 to 0.1 (that is somewhere between 0 and 10% of the population died each year), with natural mortality considered to depend on an animal's age.

- Estimates of maximum sustainable yield rate (**MSYR**) and replacement yield from the analysis of biological parameters covered a broad range, and were much less precise than required for the application of the NMP. Methodological studies provided strong evidence that only very broad estimates of MSYR and replacement yield would ever be obtainable: see de la Mare 1990a, 1990b. That is, it was very likely that we would never be able to ascertain MSYR sufficiently accurately for use in a management regime.

- Minke whales were known to feed almost exclusively on Antarctic krill. On the basis of theoretical relationships between body mass and food consumption in mammals, minke whales were estimated to consume about 4% of their body mass each day. These daily estimates could not be converted into the more informative estimate of total annual food consumption per whale because the dates of arrival and departure of whales to the feeding grounds were unknown

and believed to depend on the age, sex and reproductive state of individual animals.

5.9. The contribution of information from more than 25 years of JARPA/JARPA II to the state of knowledge relevant to conservation and management of minke whales is negligible. In this context, key aspects of the current state of knowledge and associated elements of the work of the Scientific Committee can be summarised as follows:

- The recent abundance estimates for Antarctic minke whales have been derived exclusively from the non-lethal IDCR/SOWER program. Abundance surveys of JARPA were reviewed and found to be seriously compromised in multiple aspects of the methodology, including their close association with the whaling operations: see IWC 2008.
- The number of breeding populations remains unknown and little has been added to the earlier evidence for at least two populations with a boundary somewhere around 135°E. The positions of other boundaries (of which there must be at least one) remain unknown. With the exception of the already recognised putative breeding population off Brazil, locations of breeding grounds remain unknown. This is despite the fact that the location of these breeding grounds, and genetic sampling of animals from those areas, would be the most informative genetic approach to understanding population mixing on the feeding grounds.
- This lack of information about population structure in minke whales was anticipated in the design of the RMP. Simulation tests of the RMP showed that setting catch limits for each 10° of longitude was robust to uncertainty in the number of populations, location of stock boundaries, the variability in the ranges and overlap of possible multiple breeding populations on the feeding grounds. JARPA/JARPA II have not added to the knowledge of the range of movements of individual whales, which is information that might allow a less cautious application of the RMP's multi-stock rules. The most efficient means for studying whale movements are non-lethal such as satellite tagging or identifying individual animals through genetic "fingerprints" (obtained from biopsies) or natural markings (from photo identification). The recent success in tagging and collecting biopsies from Antarctic minke whales in the Ross Sea

and the Western Antarctic Peninsula demonstrate both the practicality and scientific returns of such an approach (see discussion below in paragraph 6.14).

- A major objective of JARPA was to provide estimates of natural mortality by age, i.e. what proportion of each age class died each year. This objective was abandoned after a few years and replaced with the amended objective of deriving an average estimate over all ages. When the JARPA program was reviewed by the IWC in December 2006, it was concluded that the uncertainty around the derived estimate from the sampling taken from almost 7,000 whales meant that the parameter remained "effectively unknown": see IWC 2008. Japan's assertion at paragraph 4.124 of its Counter-Memorial that the problems identified with its age estimates from JARPA have now been solved such that "the precision of the estimates of natural mortality rates ... has now been accepted", is not correct. Japan incorrectly equates the resolution of one problem identified by the Scientific Committee – variations encountered when different people 'read' the age data – with resolution of all of the identified problems. It remains the case that JARPA estimates of natural mortality are so imprecise that our state of knowledge on mortality estimates remains essentially as it was at the start of JARPA.

- Analyses associated with the determination of age of animals killed in JARPA remain as confounded as those from the commercial whaling era. There have been no new insights on Antarctic minke whales agreed by the Scientific Committee that are based on these data.

- Pregnancy rates are known to be high, with the pre-JARPA estimate of 0.78 per year remaining the accepted value. It is worth noting that pregnancy can be determined through non-lethal means from biopsy samples (St. Aubin 2001).

- In 2009, the Scientific Committee's Working Group on MSYR classified the estimates of minke whale MSYR based on JARPA as being of low reliability because of difficulties relating to possible changes in the carrying capacity of the Southern Ocean (i.e. the number of whales an area of ocean can support in terms of available prey and other environmental factors) and problems in interpretation of the catch-at-age data (IWC 2010c). These findings by the

Working Group reiterated the earlier realisation that MSYR could not be estimated sufficiently reliably for direct use in management.

- Estimates of daily food consumption from JARPA have not provided any improvement in precision from those established using general energetic principles. The problem remains in converting daily consumption into total food consumption because the dates of arrival and departure of whales to and from the feeding grounds remains unknown and is likely to depend on the age, sex and reproductive state of individual animals. JARPA/JARPA II lethal research cannot address this problem since it would require tracking the movement of live animals – a research technique that has been avoided in JARPA/JARPA II.

- Japanese scientists have published a range of papers from the JARPA and JARPA II programs, although the number and relevance (to the conservation and management of whales) of these papers for such a large and heavily funded program is notably small. Given the very large number of whales killed, sampled and measured in these programs, the amount of the resultant data must be assumed to be substantial. Thus it is not surprising that some papers will result from a range of exploratory and opportunistic analyses which are largely not relevant to the program's objectives. For example, the two peer-reviewed papers cited by Japan as arising from JARPA II (see Japan's Counter-Memorial at paragraph 5.99 and footnote 774) discuss microscopic morphology of minke whale hearts and changes in minke whale ovaries.

- Nor is it surprising to have statements that the analysis of these data *might* be relevant to various issues. The main feature evident in the pattern of published outputs (which is the usual measure by which science is judged) is the near absence of papers that address the actual objectives of these two programs. Given the difficulty that the programs have had in framing and addressing objectives from their inception, a normal science process would have expected to be self-correcting and to have developed modified objectives and methods to ensure that important questions were being posed and that the methods were capable of answering them.

5.10. While not related to issues of commercial whaling and its management by the IWC, a great deal remains to be learnt about how Antarctic minke whales interact with their environment. Like its predecessor, the lethal components of JARPA II have contributed nothing to that knowledge, and on its own terms plainly cannot do so. Addressing these important questions requires research efforts that are collaborative and are linked to integrated programs that consider aspects of the Southern Ocean system as a whole. Major multi-million dollar, collaborative programs are currently being conducted throughout the Southern Ocean via national polar programs. These are typically coordinated through international organisations such as the Scientific Committee for Antarctic Research (**SCAR**), the Scientific Committee for Oceanic Research (**SCOR**), CCAMLR and indeed the IWC. All IWC members participating in Southern Ocean research, including Japan, work within these collaborative frameworks. The results from this work have been at the cutting edge of our understanding of all elements of the Southern Ocean (including whales). It is notable that while Australia and Japan enjoy an extremely productive and close collaborative relationship in Antarctic and Southern Ocean research through several of these bodies, Japan's Institute of Cetacean Research and its JARPA and JARPA II programs operate in isolation from these mechanisms. The Southern Ocean Research Partnership in the IWC provides an existing non-lethal and collaborative scientific process through which future work on Antarctic minke whales and other whale species is occurring and linking to other relevant international science frameworks: see Section 6 below. This Partnership has a designed flexibility to include new research priorities and design additional projects to address them collaboratively. It has already demonstrated the benefits of this approach through novel science outputs relevant to priority conservation and management needs. This includes the demonstration that satellite tagging and biopsy sampling of Antarctic minke whales is readily achievable.

5.11. The cessation of unilateral and non-productive programs like JARPA II and a redirection into a partnership framework would assist in resolving the Scientific Committee's impasse with special permit whaling, and allow for a proper scientific process on which to build future knowledge.

6. THE SOUTHERN OCEAN RESEARCH PARTNERSHIP: A NEW MODEL FOR COLLABORATIVE, NON-LETHAL SCIENCE IN THE SOUTHERN OCEAN

6.1. In 2009, the Australian Government proposed the establishment of a new structured approach to conducting regional, collaborative and non-lethal whale research in the IWC: the Southern Ocean Research Partnership (**SORP**): see Australia 2008. Australia noted that the Scientific Committee is generally highly successful at reviewing information on whale populations and identifying the priority research issues that require attention. What was lacking, however, was a mechanism by which countries can develop collaborative research specifically aimed at addressing the priority research gaps.

6.2. The Scientific Committee endorsed the proposed approach of conducting regional, collaborative research, in this case, in the Southern Ocean. The first stage in the genesis of the SORP projects was to review the scientific questions and objectives previously identified by the Scientific Committee through its research recommendations in its annual reports, and prioritise these against the perceived need for the information and the ability to address the scientific question within a reasonable timeframe. After broad ranging, collaborative and highly consultative meetings of international experts reviewing all previously identified priorities, five research projects were identified by SORP. Each project uses non-lethal research techniques and directly benefits from a regional collaborative approach. SORP also proposed a workshop on the development of non-lethal research techniques. The Scientific Committee reviewed and endorsed the projects and the workshop.

6.3. The following is a list of the five SORP projects:

(i) Antarctic Blue Whale Project: towards an improved circumpolar abundance estimate (see paragraph 6.8 below);

(ii) Acoustic trends in abundance, distribution and seasonal presence of Antarctic blue whales and fin whales in the Southern Ocean;

(iii) What is the distribution and extent of mixing of Southern Hemisphere humpback whale populations around Antarctica?;

(iv) Foraging ecology and predator-prey interactions between baleen whales and krill: a multi-scale comparative study across Antarctic regions (see paragraphs 6.14-6.17 below); and

(v) Distribution, relative abundance, migration patterns and foraging ecology of three ecotypes of killer whales in the Southern Ocean.

6.4. The workshop, *Living Whales in the Southern Ocean; Advances in methods for non-lethal cetacean research*, was held in Chile in March 2012. It was attended by 124 participants from 16 countries and was live streamed to a further 1500 viewers. A one day open-symposium which showcased new non-lethal research methods for whales was followed by two days of workshops on health assessment of live cetaceans, advances in long term satellite tagging techniques for cetaceans, population dynamics and environmental variability, and estimation of diet and consumption rates from non-lethal methods. The full report of the workshop is available at: http://www.simposioballenas.cl/wp-content/uploads/SC_64_O14_Report-of-the-SORP-Living-Whale-Symposium_Rev1.pdf.

6.5. It is worth noting that all of the Scientific Committee's research priorities published in its annual reports for at least the past five years, and which required collection of data from Southern Ocean cetaceans, could be addressed most effectively with non-lethal tools: see Anonymous 2009. As a result, the fact that SORP would only consider non-lethal research techniques did not discount any of the Scientific Committee's research priorities identified in the exercise mentioned in paragraph 6.2 above.

6.6. Further, in its consideration and discussion of SORP, the Scientific Committee has not recommended that any lethal techniques be included in these projects. Indeed, from my knowledge and involvement in the Scientific Committee's work, the Committee, including Japan for this purpose, has not recommended any research areas which either in terms or through an understanding of their likely scope would call for the use of lethal methods.

6.7. Countries participating in the work of SORP include Australia, Argentina, Brazil, Chile, France, Germany, New Zealand, Norway, South Africa, United Kingdom and United States of America. Despite a number of invitations and expressions of interest in the work by Japanese scientists, Japan has declined to join SORP. Nevertheless as a

member of the Scientific Committee Japan has been free to seek to formulate and recommend research priorities for SORP or other work of the Scientific Committee, but to my knowledge and observation has not suggested that there are any research priorities that require lethal methods outside what it seeks to achieve through special permit whaling.

Antarctic Blue Whale Project

6.8. The development, planning and implementation of the SORP projects follow a thorough scientific process, such as that presented by Professor Mangel. The Antarctic Blue Whale Project, which is noted above and is the flagship project of SORP, is a good example.

6.9. This project concerns the Antarctic blue whale, the largest animal to ever live on earth, and one that was perilously close to extinction some decades ago. The project has several specific objectives including addressing the hypotheses that the population has continued to recover since that last abundance estimate in 1998 and that the Antarctic blue whale is represented by a single population around Antarctica.

6.10. The SORP recognised that this was an ambitious project given the relative scarcity of blue whales, the logistical difficulties of operating in Antarctic waters and the associated costs. As such the first step in the detailed planning of this project was to establish an appropriately qualified project team and to review the most suitable methods to acquire a new abundance estimate for Antarctic blue whales and assess whether it would be feasible logistically. This step alone has taken two years as it required the review of all the available sightings and catch data to contribute to an analysis that assessed the relative power of different techniques (in particular line transect or mark-recapture) for estimating abundance with a specified level of precision. Throughout this period papers were presented to the Scientific Committee to seek direction (see Childerhouse 2010, Childerhouse 2011a, Kelly et al. 2011, Kelly et al. 2012, Miller et al. 2012, Miller 2012, Wadley et al. 2012, Bell 2012, Baker et al. 2012), and each time the project responded directly to this feedback through changing the nature of the analyses and exploring the issues further. These analyses suggested that a technique known as mark-recapture (using DNA "fingerprints" from non-lethal biopsy sampling and the comparison of natural markings from photo-identification) had

significant potential, but only if the encounter rate with blue whales could be increased above the level expected using normal sighting surveys.

6.11. It was collectively agreed through consultation and endorsement by the Scientific Committee that the project's next step should be the assessment of passive acoustic techniques for locating and increasing the encounter rates with blue whales. A pilot study was conducted off eastern Australia in 2012 using pygmy blue whales as a surrogate for Antarctic blue whales. This internationally collaborative study of two three week voyages allowed the testing and refinement of equipment, decision rules as well as the first assessment of the utility of the approach: see Miller et al. 2012. This in turn led to a six week Antarctic voyage in 2013 that tested the equipment and the approach in Antarctica with Antarctic blue whales: see Wadley et al. 2012. The voyage was highly successful showing that blue whales could be detected acoustically from distances of hundreds of kilometres and subsequently found by the ship. Once within sighting distance of the blue whales, small boats were launched from the ship when weather conditions allowed (generally on about two out of three days) and the ship and small boats were used to obtain photographic and biopsy data required not only for the mark-recapture analyses but also the assessment of population structure. The small boats also were used to deploy satellite tags that enable the animal to be tracked in the ensuing weeks and months.

6.12. A total of 84 blue whales were seen on the voyage in 39 different groups. Fifty seven of these were photographed at a quality sufficient for individual identification, 23 biopsies were collected and two whales had satellite tags deployed on them (see photos and video at: http://www.antarctica.gov.au/media/news/2013/australias-successful-antarctic-blue-whale-voyage. The encounter rate and success in data collection were well beyond expectations. Indeed the 57 photo-identified blue whales collected on this one voyage approaches the total of 63 photo-identified blue whales collected all around Antarctica in 30 years of IDCR/SOWER voyages. The data from this voyage will be reported to the Scientific Committee in June 2013 and will be used to provide an estimate of the likely scale of increase in encounter rate provided by passive acoustics.

6.13. The project is now at the stage where it can make very clear research recommendations for the consideration of the Scientific Committee on the most appropriate techniques to address the project's objectives and the ship-based effort required to achieve the

objective within a specified timeframe. Although the preparatory phase of the project has taken several years the extensive reviews, preparatory analyses, pilot studies and the repeated presentations to and feedback from the Scientific Committee and other international experts have led to the development of a defensible research project with clear protocols, timeframe and degree of effort required to achieve its well-articulated and specified objectives.

Interactions between baleen whales and krill

6.14. Another SORP project, *Foraging ecology and predator-prey interactions between baleen whales and krill: a multi-scale comparative study across Antarctic regions*, directly addresses questions about Antarctic minke whale feeding behaviour and its ecological relationships with other species. This subject matter is also purportedly explored by Japan under JARPA II. However, the SORP project takes a fundamentally different approach to that adopted by Japan. For instance, the SORP project has clear and testable hypotheses, including asking: (i) do humpback whales and Antarctic minke whales compete for krill in the same ecological habitats?; and (ii) do humpback whales and Antarctic minke whales use similar feeding strategies in different Antarctic regions? See Childerhouse 2011b. The SORP project also adopts effective non-lethal techniques.

6.15. Under this project, during the 2012/13 Antarctic summer season a joint USA-Australia research voyage and a USA research effort in the Ross Sea successfully collected the first ever data on Antarctic minke whale foraging behaviour, including diving, movement data, measurements of krill in the area and comparative data from humpback whales that feed in similar habitats. This approach uses a sophisticated and integrated suite of the latest available non-lethal research tools, many of which were also applied in the Antarctic blue whale project. These techniques include collection of biopsies, photo-identification, measurements of krill using scientific echo-sounders and the deployment of a range of different animal-borne tags. The tags range from short term (hours to days) tags which provide data on full three dimensional movements (including lunge feeding behaviour) to long term (days to months) tags which provide data on movements and in some cases dive depths. Photos and videos of the application of these techniques can be seen at:

http://www.antarctica.gov.au/media/news/2013/significant-advances-in-non-lethal-research-on-antarctic-minke-whales.

6.16. The success of this recent research on Antarctic minke whales demonstrates that a ship equipped with small boats and appropriately trained scientists can apply the same suite of non-lethal research tools that have been used on many other whale species to Antarctic minke whales. This is in contrast to the claims by Japan that such techniques are impractical for Antarctic minke whales (see Japan's Counter-Memorial at paragraphs 4.62, 4.75, 4.79, 4.82, 5.49–5.50).

6.17. An important lesson that is already evident from the SORP projects, and which has been demonstrated in other successful, large, collaborative non-lethal whale projects, is that the power in non-lethal techniques is most effectively delivered when they are combined and used in concert to address particular research questions.

North Pacific Ocean

6.18. The SORP model for collaborative research towards agreed IWC priorities, which perhaps began in concept with the IDCR/SOWER voyages, is also achieving uptake in the IWC in other regions. For the past few years the IWC has been developing the IWC-North Pacific Ocean Whale and Ecosystem Research program (**IWC-POWER**). This program seeks to determine the status of North Pacific whale populations and provide the necessary scientific background for appropriate conservation and management actions. Japan, Korea and USA are key partners and Australia has played an active role in the survey designs. The project only applies non-lethal tools.

General observations on collaborative research initiatives

6.19. The contrast between these IWC-endorsed, international collaborative programs (including SORP), which achieve their well demonstrated success through the application of a normal scientific process, and the unilateral programs of JARPA and JARPA II conducted under special permit is stark. Japan itself has provided much of the resourcing and has been a critical player in the IDCR/SOWER and the IWC-POWER programs and has seen the scientific benefits that these collaborations are delivering.

6.20. These collaborative programs represent the appropriate alternatives to the unnecessary and unscientific approaches adopted in JARPA and JARPA II. As such, Japan has an alternative to continuing JARPA II available to it right now, being the ongoing SORP program, which incorporates cutting edge technologies and techniques to meet all relevant scientific research needs for the conservation and management of whales. However, Japan has not to date chosen to utilise this alternative approach.

Annexure 1: References cited in the statement

Anonymous. 2009. 'Report of the Planning Workshop of the Southern Ocean Research Partnership (SORP), Sydney, Australia 23-26 March 2009'. Paper SC/61/O16 presented to the 2009 Scientific Committee Meeting (available from: http://iwc.int/sc61docs).

Australia. 2008. 'Regional Non-Lethal Research Partnerships: a proposal for the Southern Ocean'. Paper IWC/60/16 presented to the 60th Annual Meeting of the International Whaling Commission, June 2008 (available from: http://iwc.int/iwc60docs).

Baker, C.S., Galletti, B., Childerhouse, S., Brownell Jr, R.L., Friedlaender, A., Gales, N., Hall, A., Jackson, J., Leaper, R., Perryman, W., Steel, D., Valenzuela, L. and Zerbini, A. 2012. 'Report of the Symposium and Workshop on Living Whales in the Southern Ocean: Puerto Varas, Chile 27-29 March 2012'. Paper SC/64/O14 presented to the 2012 Scientific Committee Meeting (available from: http://iwc.int/sc64docs).

Bell, E.M. 2012. 'Annual Report of the Southern Ocean Research Partnership (SORP) 2011/12'. Paper SC/64/O13 presented to the 2012 Scientific Committee Meeting (available from: http://iwc.int/sc64docs).

Childerhouse, S. et al. (62 other authors). 2006. 'Comments on the Government of Japan's proposal for a second phase of special permit whaling in Antarctica (JARPA II)'. Appendix 2 of Annex O1. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 8:260-261.

Childerhouse, S. 2010. 'Southern Ocean Research Partnership project plans (seven projects)'. Paper SC/62/O10 presented to the 2010 Scientific Committee Meeting (available from: http://iwc.int/sc62docs).

Childerhouse, S. 2011a. 'Annual Report of the Southern Ocean Research Partnership 2010/11'. Paper SC/63/O12 presented to the 2011 Scientific Committee Meeting (available from: http://iwc.int/sc63docs).

Childerhouse, S. 2011b. 'Revised Project outlines for the Southern Ocean Research'. Paper SC/63/O13 presented to the 2011 Scientific Committee Meeting (available from: http://iwc.int/sc63docs).

Cooke, J.G. 1987. 'Comments submitted by J.G. Cooke (Invited Participant) on the research plan for the feasibility study on 'The program for research on the Southern Hemisphere minke whale and for preliminary research on the marine ecosystem in the Antarctic' by the Government of Japan'. Paper SC/D87/37 presented to the IWC Scientific Committee Special Meeting to Consider the Japanese research Permit (Feasibility Study), Cambridge, December 1987 (unpublished).

de la Mare, W.K. 1987. 'Comments on the program for research of the Southern Hemisphere minke whale and for preliminary research on the marine ecosystem in the Antarctic'. Paper SC/39/O 24 presented to the IWC Scientific Committee, June 1987 (unpublished). 16pp.

de la Mare, W. K. 1989. 'On the simultaneous estimation of natural mortality rate and population trend from catch-at-age data'. *Rep. int. Whal. Commn* 39:355-62.

de la Mare, W. K. 1990. 'A further note on the simultaneous estimation of natural mortality rate and population trend from catch-at-age data'. *Rep. int. Whal. Commn* 40:489-92.

de la Mare, W. K. 1990a. 'Problems of 'scientific' whaling'. *Nature* 345:71

de la Mare W. K. 1990b. 'Inferring net recruitment rates from changes in demographic parameters: a sensitivity analysis'. *Rep. Int. Whal. Commn* 40:525-9.

Gales, N.J., Bowen, W.D., Johnston, D.W., Kovacs, K.M., Littnan, C.L., Perrin, W.F., Reynolds III, J.F. and Thompson, P.M. 2009. 'Guidelines for the treatment of marine mammals in field research'. *Marine Mammal Science* 25:725-736

Goodman, D. 1988, 'R7. Systematic evaluation of scientific research permit requests: application to the Southern Hemisphere minke whale'. *Rep int. Whal. Commn* 38:147-8.

Goodman D. and Chapman D. G. 1988. 'R5. Comments on Annex R2 "A preliminary consideration on a method for estimating age-dependent mortality from age-composition obtained from random sampling"'. *Rep int. Whal. Commn* 38:144-5.

Holt, S. J. 1987. 'Comments on Japanese proposal to catch Southern Hemisphere minke whales under special permit'. Paper SC/39/Mi10 presented to the IWC Scientific Committee, June 1987 (unpublished). 12pp.

IWC. 1973. 'Report of the Scientific Committee'. *Rep. int. Whal. Commn* 23:28-238.

IWC. 1988. 'R8. The view of the Japanese scientists in response to annexes E5, R5, R6, and R7, SC/39/Mi10, SC/39/O2, SC/39/O24, and comments by some members of the sub-Committee regarding SC/39/O4'. *Rep int. Whal. Commn* 38:148-9.

IWC. 1994. 'Report of the Scientific Committee (Annex H): the revised management procedure (RMP) for baleen whales'. *Rep. int. Whal. Commn* 44:145-52.

IWC. 2005. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 7:44-49.

IWC. 2006. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 8:46-53.

IWC. 2007. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 9:57-63.

IWC. 2008. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 10:58-61.

IWC. 2009a. 'Annex P. Process for the Review of Special Permit Proposals and Research Results from Existing and Completed Permits'. *Journal of Cetacean Research and Management* 11:398-401.

IWC. 2009b. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 11:61-64.

IWC. 2010a. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 12:73-80.

IWC. 2010b. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 12:300-306.

IWC. 2010c. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 12:180-198.

IWC. 2011a. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 13:56-58.

IWC. 2012a. 'Report of the Scientific Committee'. *Journal of Cetacean Research and Management* 14:53-57.

Japan. 2005. 'Report of the Review Meeting of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA) called by the Government of Japan, Tokyo, 18–20 January 2005'. (Reproduced as Annex 102 to the Japanese Counter-Memorial).

Kelly, N., Double, M., Peel, D., Bravington, M. and Gales, N. 2011. 'Strategies to obtain a new abundance estimate for Antarctic blue whales: a feasibility study'. Paper SC/63/SH3 presented to the 2011 Scientific Committee Meeting (available from: http://iwc.int/sc63docs).

Kelly, N., Miller, B., Peel, D., Double, M., de la Mare, W. and Gales, N. 2012. 'Strategies to obtain a new circumpolar abundance estimate for Antarctic blue whales: survey design and sampling protocols'. Paper SC/64/SH10 presented to the 2012 Scientific Committee Meeting (available from: http://iwc.int/sc64docs).

Kirkwood, G. P. 1992. 'Background to the development of revised management procedures'. Annex I, *Rep. int. Whal. Commn* 42:236-43.

Miller, B.S. 2012. 'Real-time tracking of blue whales using DIFAR sonobouys'. Paper SC/64/SH12 presented to the 2012 Scientific Committee Meeting (available from: http://iwc.int/sc64docs).

Miller, B., Kelly, N., Double, M., Childerhouse, S., Laverick, S. and Gales, N. 2012. 'Cruise report on SORP 2012 blue whale voyages: Development of acoustic methods'. Paper SC/64/SH11 presented to the 2012 Scientific Committee Meeting (available from: http://iwc.int/sc64docs).

Murase, H., Kiwada, H., Matsuoka, K. and Nishiwaki, S. 2006. 'Results of the cetacean prey survey using echo sounder in JARPA from 1998/99 to 2004/2005'. Cited in Report of the Scientific Committee. *Journal of Cetacean Research and Management* 10:438-439.

Murase, J., Kitakado, T., Hakamada, T., Matsuoka, K., Nishiwaki, S., and Naganobu, M. 2013. 'Spatial distribution of Antarctic minke whales (Balaenoptera bonaerensis) in relation to spatial distributions of krill in the Ross Sea, Antarctica'. *Fisheries Oceanography* 22:154-173.

Naganobu, M., Nishiwaki, S., Yasuma, H., Watanabe, Y., Yabuki, T., Yoda, Y., Noiri, Y., Kuga, M., Yoshikawa, K., Kokubun, N., Murase, H., Matsuoka, K., and Ito, K. 2006. 'Interactions between oceanography, krill and baleen whales in the Ross Sea and Adjacent

Waters: An overview of Kaiyo Maru-JARPA joint survey in 2004/05'. Cited in Report of the Scientific Committee. *Journal of Cetacean Research and Management* 10:438-439.

Sakuramoto, K. and Tanaka, S. 1989. 'On the estimation of age dependent natural mortality'. *Rep. int. Whal. Commn* 39:371-3.

St. Aubin. D. 2001. Endocrinology. In L.A. Dierauf and F.M.D. Gulland (eds), CRC Handbook of Marine Mammal Medicine, 2nd edn. CRC Press, London.

Tanaka, S. 1990. 'Estimation of natural mortality coefficient of whales obtained from the estimates of abundance and age composition data obtained from research catches'. *Rep. Int. Whal. Commn* 40:531-36.

Wadley, V., Lindsay, M., Kelly, N., Miller, B., Gales, N., de la Mare, W. and Double, M. 2012. 'Preliminary voyage plan for the 2013 austral summer SORP Antarctic Blue Whale Project.' Paper SC/64/SH13 presented to the 2012 Scientific Committee Meeting (available from: http://iwc.int/sc64docs).

Wada, S. and Numachi, K. 1979. 'External and biochemical characters as an approach to stock identification for Antarctic minke whales'. *Rep. int. Whal. Comm* 29:421-432.

Annexure 2: Governance and working practices of the Scientific Committee

1. The International Whaling Commission (IWC) established its Scientific Committee to provide scientific advice to the IWC on issues of cetacean conservation and management. The Scientific Committee meets annually as well as conducting a range of separate workshops to advance work on specific priority issues.

2. Membership of the Scientific Committee is made up of around 200 scientists, including many global leaders in cetacean science. The membership includes national delegates from member countries and invited participants with particular expertise relevant to the work of the Scientific Committee.

3. The Scientific Committee is led by a Chair elected from its membership of delegates. The Chair takes advice from the Scientific Committee as well as from a leadership group constituted from the convenors of the various sub-committees and working groups of the Scientific Committee.

4. The agenda and workplan of the Scientific Committee are developed on the basis of the priorities and instructions of the IWC. The IWC approves the workplan and provides a budget to support the activities of the Scientific Committee.

5. Each year the Scientific Committee considers and discusses a great number of papers submitted by the membership, typically about 200 each year. Some of these papers are simply noted by the Scientific Committee, while others are discussed more thoroughly and may give rise to additional working papers during that process. In all cases the Chair of the Scientific Committee presses for a consensus view from the Scientific Committee. Given the complexity of some of the issues the Scientific Committee faces, a consensus view is not always achieved and a range of views will be transmitted to the IWC, most commonly in association with a suggested workplan to resolve the uncertainties and differences of view. Generally, this robust scientific process has served the Scientific Committee and the IWC well and resulted in the resolution of many key scientific issues that impact directly on the conservation and management of whales. This scientific progress has often been achieved through the development of novel and world-leading techniques with application in the wider scientific community.

6. The effective and global-leading work of the Scientific Committee on scientific issues is exemplified in the following three examples:

The development of the Revised Management Procedure

7. The failure of regulation of commercial whaling and the collapse of global whale populations is well known; but the underlying reasons for this failure are less recognised. Through much of the twentieth century the primary mechanism for determining catch quotas took place in the IWC where whaling nations bartered among themselves for the highest catches they could obtain. Despite the fact the Scientific Committee met annually, there was no clear separation between an independent science procedure – the business of the Scientific Committee – and matters of policy and management – the business of the IWC. Consequently the Scientific Committee had a far less influential role in affecting the decisions on catches. In 1960, as the dire status of the whale populations became impossible to ignore, the IWC appointed a group of three outside scientists specialising in population dynamics to provide advice on catches. In large part, it was advice from this group which led the IWC to cease all whaling on the highly depleted blue whale and humpback whale populations. However, the advice failed to deliver a sufficiently influential science case to divert the IWC's continued

allocation of unsustainable catches for fin whales and other species. Nevertheless, it can be said that the decisions to protect some species demonstrated, at least in part, the benefits of decisions that are primarily informed by the best available science.

8. In 1972 the United Nation's Conference on the Human Environment (the fore-runner to the United Nations' Environment Program) endorsed a proposal for a global moratorium on commercial whaling as the most effective and necessary measure to arrest continued declines in whale populations. The US supported the UN's approach and proposed a ten year moratorium on commercial whaling to the IWC; a proposal that was rejected in favour of an Australian proposal for the New Management Procedure (the NMP). The NMP, it was argued, would provide the safeguard to ensure sustainability in catches through a sound scientific process. The scientific principle behind the NMP of designing a scientific framework through which to construct advice was sound, but it failed on two key counts. Firstly, the idea that estimates of the magnitude and trend of a few biological parameters could be derived with sufficient precision and accuracy to be reliable in the required management context proved to be flawed. Secondly, because the NMP did not deal with the uncertainty about a range of scientific parameters that determined catch limits, nor the rules for classifying populations that determined if they could be considered for whaling, a strong policy influence was introduced that undermined efforts to conduct an appropriate, independent scientific evaluation. In effect the NMP required the Scientific Committee to make policy determinations that are the proper business of the IWC.

9. Thus, a lack of agreed policy and science-based management rules and a failure to separate and isolate the functions of the Scientific Committee and the IWC again failed to constrain the commercial drive for continued exploitation. Ultimately the IWC abandoned the NMP and in 1982 adopted a moratorium on commercial whaling which came into place during the 1985/86 Antarctic season.

10. The moratorium on commercial whaling acted as a circuit breaker from the annual debates on catch limits and allowed time for the Scientific Committee to undertake the challenge of revising management procedures to account for the failures of the previous management procedure. Importantly, the Scientific Committee focused on ensuring that the scientific elements that would underpin a new management approach would be feasible to collect (abundance estimates and catch data) and that the elements that required a policy decision, such as the degree to which a whale population might be exploited, would be made in the IWC.

11. While debate within the IWC continued to reflect opposing policy positions on the future of commercial whaling, the Scientific Committee prioritised its work and ultimately developed what we know today as the Revised Management Procedure (RMP). The science process was challenging as it had to be designed more or less from the ground up. Different scientists developed competing models for components of the RMP and these were tested using agreed processes and models and thoroughly debated during the many meetings and workshops of the Scientific Committee. The RMP is built within a simulation framework where assumptions and inputs into the models can be tested in a virtual world of whaling scenarios; in other words, it explicitly dealt with uncertainty.

12. Ultimately the RMP itself represented a new paradigm of fishery-type models in that it established a management strategy that could be tested via simulation, included catch limits that were scaled to the quality of the input data and embedded feedback and evaluation methods to restore populations to safe abundance levels and maintain them there with high certainty. This type of management strategy evaluation has now become increasingly embedded in modern regional approaches to fishery management.

13. The RMP was designed to eliminate reliance on the biological parameters that led to intractable and unresolvable difference in management advice that was a feature of the NMP. Indeed, the RMP relies entirely on data that can be acquired non-lethally. This feature was not a product of design against a non-lethal criterion, but rather an outcome of assessing which parameters can be measured reliably and are key to the management decisions – ultimately the abundance of the populations. In fact, the RMP is capable of operating with just two inputs—abundance estimates and information on past catch levels (to account for removals from the population). Additional informative, although not indispensable, inputs are information about stock structure and the level of mixing of different stocks in the relevant area or areas that will be subject to whaling.

14. The RMP is designed to operate with different levels of knowledge. In scenarios where knowledge is good (precise abundance estimates and a good understanding of population mixing) catch limits need not be highly cautious and may, as a result, be higher. In contrast, where knowledge is less certain, more caution is exercised in setting catch limits, and so they are generally lower. Given that whale abundance is subject to change through natural and human causes, the RMP will reduce catch limits if estimates of abundance are not updated and, if an agreed abundance estimate had not been obtained in the last ten year period, then catches would be reduced to zero.

15. These (estimates of abundance and past catches) are the only inputs required for the RMP. As noted above, the RMP is designed to eliminate reliance on biological parameters. Rather than requiring knowledge of the various biological characteristics of whales in the real world (knowledge which the Scientific Committee's experience with the NMP showed was manifestly unattainable), the RMP sets up simulations which account for (and test) the plausible range and variations in biological characteristics and the environmental features that drive them. The ultimate result is an outcome that is robust to the uncertainty in these biological and environmental characteristics.

16. The Scientific Committee presented the IWC with three options for the level of managed depletion for a population (referred to as tuning levels), from which a policy decision could be made on the degree to which a whale population might be depleted through a commercial whaling operation. The options provided by the Scientific Committee allowed the IWC to determine if whale populations subject to the RMP should be managed down to levels of 60, 66 or 72% of the estimated size the population would reach if it was not subject to whaling. The IWC chose the most conservative of these tuning level options, 72%.

17. If instructed by the IWC, the Scientific Committee can apply the RMP to any whale population and provide advice, based on clear and agreed science rules, on catch limits. Indeed, with the exception of the final step of the RMP, which is the calculation of catch limits, the RMP has been applied to many whale populations, including Antarctic minke whales, since its development. The full application of the RMP, including the determination of catch limits, would normally only occur when a catch limit was required for a commercial whaling operation managed by the IWC. While management measures such as the moratorium and the Southern Ocean Sanctuary (both of which explicitly set commercial whaling catches to zero) remain in place, and until such time as a Revised Management Scheme (see below) is agreed, it is unlikely the Scientific Committee will be requested to undertake this step.

18. An important feature of the RMP is that its elements and assumptions can be subject to review and enhancements. For the scientific elements, a review could be triggered by presenting the Scientific Committee with analyses that demonstrated a change could enhance one or more aspects of the performance of the Procedure. Such reviews have been a feature

of the work of the Scientific Committee since the RMP was developed and have led to agreed changes in the science rules. It is relevant to note that such a review has not been triggered by any outputs from JARPA and JARPA II, nor have data from these operations been a feature of the RMP reviews triggered by other analyses. Similarly, the IWC can, at its will, vary the policy decisions built into the RMP process, such as instructing the Scientific Committee to evaluate an RMP at a different tuning level.

19. Before commercial whaling could resume the IWC would need to develop and adopt what is referred to as the Revised Management Scheme (RMS), under which any whaling operation would operate. An RMS would include rules on independent observation and inspection of whaling operations, full catch documentation and verification and any other management data that may be required to regulate the industry. An RMS has never been agreed by the IWC.

20. The development of the RMP is a demonstration that when limited to issues of science the Scientific Committee can successfully deliver scientific tools and advice even within a highly polarised policy environment.

21. The legitimate policy debate on whether or not commercial whaling should be resumed remains the responsibility of the IWC.

The Management of Aboriginal Subsistence Whaling; the Bering-Chukchi-Beaufort Seas Bowhead whales

22. An important component of the work of the Scientific Committee is to provide advice to the IWC on the management of subsistence whaling by indigenous communities around the world. As with other forms of whaling the conduct of subsistence whaling is controversial within the IWC, although sustainable aboriginal subsistence whaling operations by member nations have been managed by the IWC for some decades and all such catches are regulated under a range of IWC mechanisms.

23. The scientific models developed by the Scientific Committee account for the technical aspects of whale population structure, size and trend. The IWC determines a desired catch limit from a given whale population on the basis of a statement of need from an indigenous community and this is tested for sustainability within the model developed by the Scientific Committee. These Aboriginal Subsistence Whaling Management Procedures (ASWMPs) balance the conservation objectives for the whale population against the need statement of the whaling communities.

24. Indigenous communities in Alaska have a long history of hunting Bowhead whales. Unfortunately, the Bowhead population was severely depleted by commercial whaling in the 19th Century, but since the 1970s a series of surveys have shown that Bowhead numbers have been recovering. The catch limits (defined as the number of animals struck by a harpoon) is determined using an ASWMP specifically developed by the IWC for this particular hunt. The population of bowhead whales they hunt is referred to as the Bering-Chukchi-Beaufort Sea (BCB) population which was believed to represent a single, growing population of whales. In 2005 Norwegian scientists reported genetic evidence that the whales killed by the Alaskan hunters might instead come from two populations. As there is a risk of depleting one population disproportionately to the other, such a finding could affect the output of the ASWMP and could lead to a decrease in catch limits.

25. The Scientific Committee was tasked with resolving the uncertainty around the number of whale populations being hunted. The ensuing research involved genetic analysis of material collected and archived as part of previous hunts. These analyses were run at several

international laboratories and were among the most thorough conducted for any population of mammals. The results led to consensus advice to the IWC that a single population of whales was being hunted and that the current management procedure was appropriate. This collaborative research led to a novel analytical framework for population genetic analyses of animals sampled on migratory routes which was subsequently published in the open scientific literature: see Jorde et al. 2007.

26. Once again, while the Scientific Committee's advice on this issue had potentially potent political implications for some member countries, the science process was able to progress appropriately and concluded with defendable consensus advice to the IWC.

Determining the abundance of Antarctic minke whales

27. A key function of the Scientific Committee is to provide advice to the IWC on the status of global whale populations. Interest in these abundance estimates are for manifold reasons including the determination of levels of recovery from exploitation and, for some countries, interest in possible future whaling.

28. Each year the Scientific Committee reviews papers reporting population abundance estimates and determines if the techniques and conclusions are sufficiently robust for the Scientific Committee to endorse an estimate. In most cases the estimates are for populations of whales which migrate through coastal waters and thus are relatively available for surveys. Such populations include humpback whales, right whales and grey whales.

29. A much greater challenge is estimating the population size of species which spend almost all of their lives in remote offshore habitats. Examples of these species include the Antarctic minke whale, the Antarctic blue whale and the fin whale.

30. The techniques used to estimate these populations usually rely on structured non-lethal sightings surveys that count whales within a sub-set of the area in which they are believed to live. While simple in concept the methods and analyses (referred to as distance sampling) are complex because not all whales are seen in the sub-areas searched. The chances of seeing a whale varies with distance, sighting conditions, habitat type, group size, animal behaviour and animal size. Moreover whales are not always available to be seen because of the time they spend beneath the surface and are known to distribute themselves unevenly and unpredictably in their habitats.

31. For three decades the Scientific Committee conducted ship-based surveys around Antarctica with a primary aim of estimating the abundance of Antarctic minke whales. These surveys (initially part of the International Decade of Cetacean Research; IDCR, and continued as the Southern Ocean Whales and Ecosystem Research Program; SOWER) represent a powerful and successful model of how such research can be conducted through the IWC. The Government of Japan provided the ships (usually two survey ships per year) and Russia provided one ship during the first six years. A steering committee of the Scientific Committee made up of appropriate experts designed the surveys, and selected international scientists led and participated in the surveys. Members of this steering committee conducted the analyses of results, with several groups developing their own methods. These surveys were under the control of the Scientific Committee and completely independent of, and structurally different to, the surveys carried out by Japan as part of JARPA and JARPA II. Scientists from many countries, including Australia, participated in this steering committee and the ensuing analyses. Each year analyses from these surveys were presented and discussed.

32. This process led to a consensus that the first series of these surveys (1978-1984; known as circumpolar 1, or CPI) were inadequately designed such that the analyses of the results could not correct for important effects that bias the abundance estimates. The second two series of surveys conducted 1985-1991 (CPII), and 1991-2004 (CPIII) had improved designs and the methods of analysis were continuously improved. However, issues of how best to analyse the data remained.

33. Recently, re-analyses of abundance estimates have been led by a group from Japan and a group from Australia and the United Kingdom. Each group have developed their own statistical models, tested the performance of their models against a simulated, identical data series developed by the Scientific Committee, and then applied the models to the survey data. Differences in the model output were examined and intensely debated, and in 2012 the best elements of each model were merged and abundance estimates for minke whales at two periods in the time series of surveys (CPII:1985-1991, and CPIII:1991-2004) were agreed by consensus. In deriving these agreed abundance estimates the scientists have led the international field of distance sampling, particularly in the application of spatial statistics. The tools developed to count Antarctic minke whales will increasingly be applied to other species for which similar scientific challenges apply.

34. While the point estimates (that is, the middle of the statistically plausible range of each estimate) of the two circumpolar surveys appear quite different (515,000 for CPIII and 720,000 for CPII), there is actually no statistically significant difference between the two estimates. This is because the statistically plausible range of each estimate overlaps substantially (361,000–733,000 for CPIII and 512,000–1,012,000 for CPII). That is, it is statistically plausible that there is no difference between the two estimates. Nevertheless, the difference between the two estimates is close to being statistically significant and the Scientific Committee is exploring plausible explanations – including one of no difference. Other possible explanations include a real decline in overall abundance, a decline in abundance in the survey area driven by change in minke whale distribution between the surveys (that is, the whales have moved location between the surveys, particularly into unsurveyed areas such as the pack ice), or technical issues with the survey techniques that lead to an erroneous suggestion of difference.

35. The Scientific Committee has already drawn on a wide range of potentially relevant data to inform this work, including satellite telemetry of ice, knowledge of minke whale movements in ice, trends in abundance of other krill eating predators and reported changes in the Antarctic environment. It has recently been suggested that catch at age data derived from JARPA and JARPA II may be relevant to this work. Notwithstanding that such a possibility cannot, by definition, be tested until a proper review has been undertaken, it seems likely that the major problems that have confounded interpretation of these data for the past two decades will limit their utility against this question and that other more robust data series will be more directly informative.

36. The IDCR/SOWER surveys are exemplars for how the Scientific Committee can plan, coordinate and execute research efforts that respond to priority science questions within the IWC. The surveys concluded in 2010.

Conclusion

37. The examples listed above demonstrate the capacity of the IWC's Scientific Committee to work through complex scientific issues and resolve them within the normal process of the advancement of science. The Scientific Committee's approach to each issue was resolved

despite the polarised policy debate on whaling and led to the delivery of world class science advice to the IWC.

Reference cited in Annex 2

Jorde, P.E., Schweder, T., Bickham, J.W., Givens, G.H., Suydam, R., Hunter, D., Stenseth, N.C., 2007. 'Detecting genetic structure in migrating bowhead whales off the coast of Barrow, Alaska'. *Molecular Ecology* 16, 1993-2004.