INTERNATIONAL COURT OF JUSTICE

WHALING IN THE ANTARCTIC
(AUSTRALIA v. JAPAN: NEW ZEALAND INTERVENING)

STATEMENT BY DR NICK GALES IN RESPONSE TO THE EXPERT STATEMENT BY PROFESSOR LARS WALLØE

Chief Scientist, Australian Antarctic Program

31 MAY 2013

1. INTRODUCTION

1.1. This statement is prepared in response to aspects of the statement of Professor Lars Walløe of 9 April 2013. In this present statement I set out my views in response to a number of specific issues raised by Professor Walløe that touch on issues raised in my original Expert Statement dated 15 April 2013. As such, I do not address every issue raised by Professor Walløe in this present statement, and absence of comment by me on a particular assertion of Professor Walløe should not be taken as agreement. This present statement should be read in conjunction with my original Expert Statement.

1.2. The major issues that I address are in relation to:

- The feasibility of biopsy sampling Antarctic minke whales;
- The utility of JARPA data to improve management procedures; and
- Professor Walløe's concerns with non-lethal alternative methods.

2. FEASIBILITY OF BIOPSY SAMPLING ANTARCTIC MINKE WHALES

2.1. Professor Walløe asserts that genetic research requires lethal sampling because the non-lethal alternative is infeasible. He states "it is only feasible to obtain a sufficiently large number of genetic samples from minke whales by lethal sampling" (Section 2, page 11, paragraph 6). His conclusion is based on his view that non-lethal genetic samples cannot be collected effectively or efficiently from the JARPA/JARPA II fleet because the shooting distance for biopsies is too short compared with harpoons, and, consequently, not enough samples could be collected.

2.2. Professor Walløe is incorrect in his view; direct evidence from Japanese and other scientists show that biopsy sampling is not only feasible, but it is in fact almost certain to be more effective and efficient than lethal sampling. In my view, the non-lethal collection of biopsy samples is capable of obtaining sufficient genetic samples to analyse stock structure, such that there is no need to kill whales for this purpose.

2.3. Before I discuss this evidence, I believe it is helpful for the Court to better understand the process by which biopsies are collected. In so doing I rely in large part on Japan's own experience in this matter by using biopsy collection results from the IDCR/SOWER voyages. The IDCR (**International Decade of Cetacean Research**) and SOWER (**Southern Ocean Whales and Ecosystem Research**) programs were multi-national, collaborative research efforts undertaken under the auspices of the IWC. IDCR ran from 1978 to 1997, and SOWER ran from 1997 to 2010. Japan provided vessels for these surveys and managed their operation, including the collection of biopsy samples from most species of Southern Ocean whales.

Biopsy collection technique

2.4. Whale biopsy samples collected as a part of IDCR and SOWER utilised compound crossbows and two types of rifles (Paxarms and Larsen) (e.g. see Ensor et al. 2006). The principles of operation of each system are essentially the same; the main difference being the range of the projectile biopsy dart. As the Larsen gun is the most powerful of the systems available and was the routine method of biopsy collection in SOWER, I will describe this method in some detail. This modified firearm uses blank ammunition to provide an explosive force which fires a biopsy dart from the gun's barrel. The force used to fire the projectile can be varied by venting some of the

explosion away from the barrel; this allows adjustments to be made to the force (velocity) of the dart to allow for the distance to the target (the whale). The guns are equipped with a "red dot" sight which allows for reasonably accurate firing over its operating range (see paragraphs 2.7 – 2.11 below). The biopsy dart for each of the systems is designed to impact the surface of the whale, with a circular cutting tube penetrating up to a few centimetres into the skin and retaining a sample of skin and underlying tissue. The dart bounces off the whale and floats at the water surface until retrieved. The force of firing the biopsy dart from a Larsen gun precludes the use of a tether.

2.5. The normal routine for the collection of a biopsy is that a whale is selected for biopsy sampling, the ship closes on the whale until it is within firing range (dependent upon the system used), a biopsy dart is fired at the whale, and then retrieved by the ship. This general technique is a standard and widely practiced procedure in whale and dolphin research all around the world (see reviews in Chivers et al. 2000, Noren and Mocklin 2012). Indeed, the Institute of Cetacean Research in Japan has developed and successfully tested its own biopsy system. In their paper entitled "Development of biopsy skin sampling system for fast swimming whales in pelagic waters", Kasamatsu et al. (1991) describe the development and testing of an air powered system with which they successfully biopsied four minke whales, and one each of blue, fin, sei and humpback whales while testing the system on an IWC-SOWER voyage. They reported "[t]he effective firing distance was found to be less than 30m at vessel speeds of 12-15 knots and no substantial problems were encountered".

2.6. The technique of collecting biopsy samples explained in the preceding paragraphs can and has been used for many whale species, including in the Southern Ocean (as exhibited in the IDCR and SOWER programs) and for Antarctic minke whales (as exhibited in feasibility studies under SOWER and in recent work under the Southern Ocean Research Partnership – see below). The practicability of collecting biopsy samples in the Southern Ocean is further elaborated in the following subsections, in which I discuss the shooting distances and collection times for such work.

Shooting distances for biopsies and harpoons

2.7. Professor Walløe reports harpoon shooting distances for Japanese whalers is a minimum of 20m and a maximum of 60m. He reports shooting distances for biopsies

being restricted to less than 20m. His assessment of harpoon shooting distance is consistent with our understanding, but he is not correct with regards to the achievable shot distances for biopsy collection with the widely used biopsy sampling systems available and already used by Japan and others as a part of IDCR/SOWER.

2.8. During the SOWER voyages the annual cruise plans generally involved the provision of some specified amount of ship time to collect biopsies from different species of whales. The amount of time to collect a biopsy is taken as the time at which the ship starts to close on the whale for the purpose of collecting a biopsy, to the time when the biopsy dart is retrieved. This will vary with the behaviour of the species of whale, the individual whale itself (which is affected by such things as group size) and other issues such as weather. Records of biopsy collections from SOWER cruises between 2000 and 2008 are presented in the following table:

	Antarctic minke whales[1]	Antarctic blue whales[2]	Fin whales[2]	Humpback whales[2]	Southern right whales[2]	Killer whales[2]
Sample size	12	165	45	173	11	10
Time per sample (minutes)	24min	65	34	25	40	71
Average distance of shot (m)	28m (range: 15 -40)	35-40, max 50-70.*				

[1]IWC-SOWER cruise report 2000-2001 (Ensor et al. 2001)

[2]IWC-SOWER cruise reports 2001-2002 to 2007-2008 (Ensor et al. 2002, Ensor et al. 2003, Ensor et al. 2004, Ensor et al. 2005, Ensor et al. 2006, Ensor et al. 2007, Ensor et al. 2008)

*P. Ensor, personal communication (see Appendix 1 to this statement, highlighted passage)

2.9. The distance of the shot to collect a biopsy is not routinely reported for species other than minke whales as the procedure is considered to be routine and established. Paul Ensor, the cruise leader for all of the SOWER voyages during this period, reports that for blue whales the average distance of shots is 35-40m, but that shots as long as 70m have resulted in a biopsy being collected (see Appendix 1 to this statement, highlighted passage). As the same system is used to collect biopsies it is reasonable to assume that

similar shot distances are used on the other species for which data in the table are missing.

2.10. Biopsy sampling for Antarctic minke whales was not a priority for IDCR/SOWER, but two trials have been conducted – in the summer of 2001-2002 (Ensor et al. 2002) and 2007-2008 (Ensor et al. 2008) – to test the feasibility of collecting biopsy samples from this species. For the 12 biopsy samples collected in 2001-2002, the distance of a successful shot ranged from 15-40m. The authors of the cruise report noted that greater success in collecting biopsy samples from minke whales could be achieved by using two guns (they only used a single Larsen gun) and by sampling animals that came in close to the ship (they did not sample these animals).

2.11. These experiences from IDCR/SOWER clearly show that collecting biopsy samples in the Southern Ocean, including from Antarctic minke whales, is feasible at distances that are both practical and comparable to the distances used for harpoon shooting in JARPA and JARPA II. It follows that Professor Walløe's assertions that "the vessel needs to be much closer to a whale to obtain a biopsy than to fire a harpoon" (page 11, paragraph 5) and "it is only feasible to obtain a sufficiently large number of genetic samples from minke whales by lethal sampling" (page 11, paragraph 6) are simply not supported by the evidence.

Time needed to collect a biopsy compared to harpoon a whale

2.12. The time needed to collect a biopsy sample is routinely reported in the IDCR/SOWER cruise reports and varies from 24 -71min, depending on the species. This includes the time taken to close on the whale, shoot and retrieve the biopsy. The minke whales sampled in the 2001-2002 feasibility study had the shortest handling time per biopsy, which indicates that there is nothing inherently problematic about the biopsy of Antarctic minke whales. In the 2007-2008 trials a total of 1.83hrs of SOWER ship time was allocated to further test biopsy collection from Antarctic minke whales. The cruise report authors noted that conditions at the time were difficult as they only encountered solitary animals (which are harder to approach than animals in a group) and water clarity was poor (Ensor et al. 2008). Nevertheless, four whales were biopsied during this period, providing a similar average handling time of about 27min.

2.13. In addition to the demonstrated success of biopsy collection in IDCR/SOWER, experience gained as a part of two dedicated whale research voyages in the Southern Ocean Research Partnership, which used small boats launched from a ship, has shown that this combination of two vessels can lead to further efficiencies in biopsy collection from whales, including Antarctic minke whales (Gales 2010, see also my original Expert Statement at paragraphs 6.8-6.17).

2.14. Ohsumi (1979) reported the average times required during a Southern Ocean whaling season to chase, handle and tow a minke whale to the factory ship as being 59min. Given that handling times for biopsy sampling a minke whale are half of this, and that biopsy efficiency can almost certainly be improved with additional guns and experience, Professor Walløe's claim that the only feasible manner to collect a large number of genetic samples is by killing the whale is not supported by the evidence.

Why collect the biopsy samples and how many do you need?

2.15. Professor Walløe's arguments that focus on the collection of large numbers of genetic samples derived from killing whales on their feeding grounds are a diversion from the primary issue of determining the most effective and efficient approach to understanding Antarctic minke whale population structure. The Japanese JARPA review workshop (Annex 102, Japan Counter Memorial) and IWC-sponsored JARPA review workshop (Annexes 113, Japan Counter Memorial) have all pointed out that understanding the population structure of Antarctic minke whales requires finding where the lower latitude breeding grounds are and to obtaining genetic samples from animals at those sites. Indeed the IWC workshop concluded:

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

2.16. Despite this clear conclusion, JARPA II does not include any effort to acquire such samples from the breeding grounds. As samples collected from breeding grounds are more informative for stock structure analysis than those collected on the feeding grounds, it is highly likely that fewer samples would be required.

2.17. As such, provided that the appropriate approach to studying stock structure is adopted, Professor Walløe's question of whether it is possible to collect 850 biopsy samples in a year is not even the correct question to ask.

Summary

2.18. In his statement Professor Walløe asserts that the findings in JARPA on minke whale stock structure are "significant" and "important" (page 7) and required lethal sampling (page 11). The reality is that:

- Knowledge of a likely division between two minke populations from the Pacific and Indian Oceans existed prior to JARPA (Wada and Numachi, 1979).
- A study that focused on finding and sampling Antarctic minke whales on their breeding grounds – using non-lethal techniques of biopsy sampling and satellite tagging – would have provided better information on stock structure. As I noted in my original Expert Statement (at paragraph 4.8), this has been recognised by the Scientific Committee, as well as the Japanese and IWC-sponsored review workshops of JARPA.
- The genetic samples collected in JARPA and JARPA II could have been readily collected non-lethally with biopsy technology already used by Japan, and in all likelihood with less effort and less cost (a factory ship would not be needed) than that used to kill and sample whales (see paragraph 2.1 – 2.14 above).

3. UTILITY OF JARPA DATA TO IMPROVE MANAGEMENT PROCEDURES

3.1. Professor Walløe argues that data from JARPA II *may* be useful in improving the RMP in a number of ways. He argues that the RMP delivers "relatively low catch limits because of uncertainties about productivity levels of whale stocks" (page 12, paragraph 1). He further argues that the data on age (from ear plugs, also called "catch-at-age" data) (page 12, paragraph 2), and some parameters on reproduction which are only available lethally (page 12, paragraph 4), are required for population modelling relevant to the RMP.

3.2. I do not agree with Professor Walløe that the lethal data acquired through JARPA and JARPA II have, or are likely to, provide sufficiently reliable data to lead to improvements in our estimates of minke whale productivity or to whale management

through the RMP. Indeed, as I explain below under the following sub-headings ("*MSYR and catch limits*", and "*Age data and population modelling*"), the approach in JARPA and JARPA II has been shown to be flawed, and thus I do not believe there to be any scientific justification for killing whales on the basis of a non-specific objective of improving management procedures.

MSYR and catch limits

3.3. The key issue here is that there is an obvious relationship between how "productive" whale populations are (i.e. how fast a population can grow on the basis of how many new whales there are each year after all the births and deaths have been taken into account) and the number of whales that might be killed in whaling in a "sustainable" manner.

3.4. The IWC has shown that attempting to manage individual whale populations on the basis of biological data to estimate this "productivity" does not work (as demonstrated with the failure of the NMP), so the RMP instead uses a range of plausible "productivity rates" (what we call Maximum Sustainable Yield Rates; MSYR) for a generic baleen whale (representing all baleen whales that may be subject to commercial whaling). This range of MSYR estimates is 1% – 7% (in other words, the range assumes that you could sustainably catch somewhere between one and seven per cent of a whale population each year). This range is used in the simulations runs of the RMP (called the Implementation Simulation Trials) which is one of the steps that takes explicit account of the imperfect nature of our knowledge (e.g. the uncertainty around particular MSYR estimates).

3.5. Professor Walløe suggests (page 12, paragraph 1) that "if, for a specific stock, research results make it possible to raise this lower bound [i.e. the lower bound of the agreed range of plausible MSYR estimates for baleen whales], this would allow for larger catches without any perceived risk to the resource." He is wrong in this assertion. If a new single estimate of MSYR (in this case from Antarctic minke whales) could be estimated and proved to be reliable, it could either lie within the existing agreed range (and thus not change it) or sit outside the range and thus lead to an increase in the range (i.e. a lowering of the lower bound, or an increase in the upper bound). To raise the lower bound above 1% it would be necessary to demonstrate, through a formal review process, that it is implausibly low for baleen whales in general, not specifically for the

Antarctic minke whale. As noted above, the plausible range of MSYR used in the RMP covers all baleen whales, not just Antarctic minke whales.

3.6. The Scientific Committee are in the process of such a review and are considering if the current range of MSYR estimates is indeed appropriate for the RMP. A range of data from several species is being considered in this review. The review process is not yet complete, but it has already been agreed that **data from JARPA or JARPA II will not be used as they have been found to be of low reliability** for a range of reasons that remain unresolved (IWC 2010a). The relevant Scientific Committee workshop reported:

> Catch-at-age data [from JARPA and JARPA II] formed a key basis for estimates of MSYR for two stocks (minke whales in the Indian and Pacific Oceans); both of these estimates were assigned 'low' reliability.

And further that:

> The Workshop agreed that the changes in biological parameters [from JARPA and JARPA II] could not be used to define the range of values of MSYR for use in RMP simulation trials.

3.7. Thus, after more than 25 years of the collection of these data in JARPA and JARPA II, they have been found to be uninformative in relation to the Scientific Committee's review of the range of estimates of MSYR. Indeed, the data that have been used to inform this review have come from long-term, non-lethal research programs that track trends in a range of whale populations as well as the reproductive performance of individuals over time.

3.8. The assertions of Professor Walløe, and the JARPA II proposal itself, fail here on two key points. Firstly, they fail to establish a plausible case for how biological data from JARPA II – which the Scientific Committee has already determined to be of low reliability in relation to MSYR considerations – can lead to "improvements" in the RMP. Indeed, the evidence suggests that such data will not lead to improvements. Secondly, and more fundamentally, they fail to demonstrate what in the RMP requires review and improvement, and subsequently, what data or models might be required to achieve such improvements. The result is that biological data, including age, continues to be collected under JARPA II without any basis to show that the RMP requires improvement, or that the data collected will actually lead to that specified improvement.

Age data and population models

3.9. In addition to looking at productivity, Professor Walløe also asserts that population models, based on age and other lethal data from JARPA and JARPA II, are useful for looking at long-term changes in minke whale abundance (page 12, paragraph 2), how age structure in minke whales has changed over time (page 12, paragraph 3), and what this might tell us about environmental change (page 12, paragraph 3). I disagree with Professor Walløe's assertion for the reasons outlined below.

3.10. Here, Professor Walløe is referring primarily to the work of Butterworth, Punt and Polacheck who are – to put the point simply – attempting to compare: (i) Antarctic minke whale age structure during the era of commercial whaling (using ear plugs collected at that time); with (ii) current age structure (using samples collected more recently in JARPA and JARPA II). In addition to a wide range of technical issues to do with the accuracy of reading ear plugs and assumptions in the population models themselves, this analysis suffers a fundamental flaw due to the manner in which whales were selected by the commercial whalers. Their catches are known to be deliberately biased towards bigger (and thus more valuable) animals. As a result the commercial era "sample" cannot be said to represent the whale population at that time, and only commercial age data are available.

3.11. In order to overcome the missing data, the analysts are forced to make a range of assumptions in order to use the biased commercial sample to estimate what the true age structure of the population might have been. As there is no way in which these assumptions can be tested, the outcomes of the models are fundamentally uncertain. As Professor Walløe himself states, to give useful results the hunted sample must be a random sample (page 12, paragraph 5), and this simply is not achieved. Additional problems are also encountered as a result of JARPA and JARPA II catches themselves not being able to achieve random and thus representative sampling across the real age classes.

3.12. As a direct result of these problems, and despite many years of analysis and development of population models (since 1996), there are yet to be any agreed findings from the age related population models, and if such findings do eventuate, it is not clear that they would lead to reliable conclusions given their multiple analytical problems.

3.13. An additional important point here is that the lesson on the unreliability of the use of age data in estimating biological parameters should already have been learned from the failure of the NMP and JARPA. A key objective in JARPA was to determine age-specific mortality rates – a parameter that relies on the use of age data in a population model. This objective proved impossible and so Japan changed its objective to measure average mortality rates (which also relies on the use of age data in a population model). The JARPA review concluded that "the estimates of natural mortality estimated from the JARPA data alone spanned such a wide range that the parameter remains effectively unknown at present."

3.14. Professor Walløe's assertion that population models based on lethal data from JARPA and JARPA II might provide useful information on how whale populations have changed over time sits in complete contrast to the absence of any evidence of practical outcomes. The statistical issues that lead to the unreliability of the conclusions are largely unresolvable and thus any outcome is highly unlikely to have practical utility for management purposes. Again, it follows that there is no demonstrated need to kill whales for this purpose.

4. PROFESSOR WALLØE'S FURTHER CRITICISMS OF NON-LETHAL ALTERNATIVES

4.1. In section 4 (page 14) Professor Walløe defends the utility of a range of lethal methods, over non-lethal alternatives. I will respond specifically to Professor Walløe's comments regarding: (i) satellite tagging; (ii) feeding studies based on stomach contents; and (iii) studying the role of whales in the ecosystem based on blubber thickness. However, I will begin with some general observations regarding assumptions that information from certain lethal techniques is required in the first place.

Assumptions of utility

4.2. When Professor Walløe asks whether lethal techniques adopted by Japan have feasible, non-lethal alternatives (page 14, paragraph 2), he by-passes an important, initial question of whether that lethal technique is providing information that is actually required for anything. I will use Professor Walløe's reference to studying pollutants in whales as an example.

4.3. Sampling techniques (lethal or otherwise) that measure such things as pollutant loads in body tissues can only be defended if there is a clear rationale for the need for the information against a particular question. As Professor Mangel states, there needs to be a defined and achievable objective, and study of pollutant loads must be shown to be the appropriate means of achieving that objective. The scientific case for measuring pollutant loads in minke whale body tissues has never been made. Why are minke whales a good model for studies of pollutant loads and pathology? What is the question that is being addressed with such analyses? Without such a case, there is no reason to take any kind of sample to measure pollutants, whether by lethal or non-lethal techniques. In this context, the question of whether lethal or non-lethal techniques are the best approach simply does not arise. Professor Walløe's statement completely fails to address these core issues.

Satellite tagging

4.4. Professor Walløe states that satellite tagging has not been successful for minke whales, citing low success rates in attaching tags and attached tags not lasting long due to "strong drag on equipment attached to a fast swimming whale" (page 14, paragraph 2). I have already demonstrated in my original Expert Statement that satellite tagging of Antarctic minke whales is both achievable and yields powerful results (see my original Expert Statement, at paragraph 6.14–6.17). My earlier statement made reference (at paragraph 6.15) to video footage, which shows tagging of Antarctic minke whales taking place in the Southern Ocean. The video footage is available at: http://www.antarctica.gov.au/media/news/2013/significant-advances-in-non-lethal-research-on-antarctic-minke-whales (a copy of the transcript of this video is at Appendix 2 to this statement). These results from modest research effort clearly show that Professor Walløe's criticisms are misplaced and that satellite tagging of Antarctic minke whales is a viable technique for studying a range of issues including animal movement, behaviour and habitat preference.

Feeding studies

4.5. In JARPA and JARPA II, Japan uses a variety of lethal techniques, including measuring stomach contents of dead whales, in an attempt to estimate prey consumption of Antarctic minke whales. Professor Walløe argues that the use of non-lethal techniques to estimate prey consumption is "at best a hopeful guess of what

might be possible in the future" (page 14, paragraph 3). It is important to be clear here that all currently available methods – lethal and non-lethal – can only take measurements from which broad estimates of daily food consumption can be made. It is not possible to measure this parameter directly and accurately.

4.6. What Professor Walløe fails to do in his assertion is to firstly show why estimates of daily food consumption are relevant, and secondly, demonstrate that the estimates derived from lethal studies (measuring stomach contents) provide more accurate and/or precise estimates than those which use established non-lethal techniques.

4.7. In the case of the lethal technique used in JARPA and JARPA II, the approach taken by Japan is to kill a large number of whales and then identify and weigh the amount of food in their stomachs. In order to estimate daily food intake it is necessary to make a determination of how the food found in a whale's stomach relates to what it has eaten over a whole 24 hour period. There are a number of difficulties in determining total daily food intake based on the amount of food found in the stomach at the time the whale was killed. Whales are only "sampled" during the day, although feeding is not constrained to particular times. A range of assumptions, including the rate at which food passes through the stomach and feeding behaviour over a 24 hour period, are then necessary to calculate total daily food intake. Variables such as stomach emptying rate, meal size and feeding frequency change and interact with each other in relation to how their prey (Antarctic krill) are behaving and how motivated the whale is to feed. Thus, although the contents of a whale's stomach can be weighed, by the time that measurement is used to estimate total daily food intake a great deal of uncertainty has been introduced, and the final estimate may in itself be little better than a guess.

4.8. The simplest non-lethal alternative is to use a general equation based upon a mathematical relationship between the size of an animal and the amount of energy (food) that it requires to live (allometry). This too is an imprecise method and requires an estimate of animal size and the energy content of its food. Contrary to Professor Walløe's assertion that whale size cannot be measured non-lethally at sea, it is a standard practice to use photogrammetry to measure whale length (e.g. Gordon 1990, Gilpatrick and Perryman 2008). Energy content of prey can be measured directly from krill caught with trawl nets.

4.9. Thus, both lethal and non-lethal methods include uncertainty and are imprecise, but the main point is that no advantage is gained by killing the whale. The issues associated with these estimates were discussed at the JARPA review workshop (Annex 113, Japan Counter-Memorial) and later at the 2007 meeting of the Scientific Committee who reported (IWC 2008):

> Further discussion on the estimates of mean daily prey consumption by Antarctic minke whales in the Southern Ocean (SC/59/IA8; Tamura and Konishi (2006)) highlighted that estimates [from stomach content analysis] are particularly sensitive to assumptions about digestion rates for which data are not available. This, and other uncertainties associated with diurnal feeding behaviour resulted in feeding rates derived from the very large JARPA data set falling in a wide range which covers what might be considered the plausible range of values from other sources, including allometric comparisons of energy requirements. The Committee summarised the three issues that would need to be resolved before progress can be made: (1) the length of feeding season; (2) to what extent consumption rate is sensitive to digestion rate (which is largely unknown); and (3) the extent of feeding at night. **The Committee agrees that while these questions are being investigated it would be difficult to move beyond only broad estimates and that although it is important to look at temporal trends, there is still further work needed to determine whether the current trends suggested in the data are real, or an artefact of sampling or analysis** [emphasis added].

4.10. As can be seen, measuring stomach contents from nearly 7000 dead whales in JARPA has not improved the estimates of daily food consumption that were already available on the basis of the alternative, non-lethal method of allometry. Further, the Scientific Committee recommended future work that would be needed in order to make progress. Recommendations 1 (the length of the feeding season) and 3 (the extent of feeding at night) depend on the behaviour of whales and therefore are best answered with non-lethal tools such as satellite tags and dive recorders. Behaviour can only be studied non-lethally. Recent research referred to in my original Expert Statement (at paragraphs 6.14 – 6.17) has demonstrated the practical efficacy of these non-lethal approaches. Recommendation 2 (issues of digestion rate) is likely to be beyond the scope of any practical experiment (lethal or non-lethal) and will thus remain unknown. Importantly, the Scientific Committee concluded that while these uncertainties remained, it would be difficult to interpret any suggested trend in stomach content analyses. The JARPA II program has not addressed any of these uncertainties, but instead has simply continued to collect stomach contents.

Blubber thickness

4.11. Professor Walløe brings to the attention of the Court his view that a putative thinning of blubber thickness during the JARPA program reflects changes in the Antarctic ecosystem (page 7, paragraph 4). The study he refers to, of which he is an author, was published in Polar Biology (Konishi et al. 2008) and claimed that blubber thinned at an estimated rate of about 0.2mm per year during the JARPA period. However, since it was published the IWC Scientific Committee has concluded that the paper used inappropriate statistical methods and that the reported trend in blubber thickness may or may not be real (IWC 2012, IWC 2013). Since that time some reanalyses of the data have been underway, but the matter remains unresolved.

4.12. As a result, the purported observed trends in blubber thickness raised by Professor Walløe, and the conclusions he therefore draws about the Antarctic ecosystem, have not been shown to be statistically reliable, nor have proven relevant for interpreting broader ecological change. Unless the statistical issues can be appropriately addressed, the data collected lethally under JARPA and JARPA II will be of no use for drawing any conclusions about the role of whales in the Antarctic ecosystem.

4.13. Japan and Professor Walløe have made regular reference to data from JARPA and JARPA II to infer changes in the east Antarctic ecosystems, including these purported trends in blubber thickness. At this stage no trends in these biological parameters have been agreed by the Scientific Committee. Additionally, a case has not been made to suggest that studying lethally derived parameters, such as blubber thickness, are an informative means of exploring changes in the Antarctic ecosystem. Indeed, without measuring other key environmental variables such as prey availability, it is very difficult for Professor Walløe or Japan to show any linkage between parameters such as blubber thickness and broader environmental changes. As a consequence, the suggestion that the lethally derived data will provide anything useful in this regard is no more than mere assertion.

4.14. More importantly, if there is a genuine scientific desire to undertake research that investigates particular questions around changes in the Antarctic ecosystems, particularly in relation to whales, other predators and their prey, investigations would logically focus on the recommendations made in the joint IWC-CCAMLR workshop to

review input data for Antarctic marine ecosystem models (IWC 2010b) that focused on just this type of question. For example, that workshop recommended research focus on some existing key uncertainties such as fin whale abundance. In relation to issues of habitat utilisation by whales, the workshop highlighted the need for data on how whales use the whole water column (i.e. data derived from satellite tagging and dive recorders). None of the workshop recommendations could be used to argue that difficult to measure biological parameters from Antarctic minke whales are a defendable approach to such questions.

5. REFERENCES CITED IN THE STATEMENT

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Appendix 1

Personal communication with Paul Ensor regarding biopsy sampling during SOWER voyages

From: paulensor@xtra.co.nz [mailto:paulensor@xtra.co.nz]
Sent: Monday, 13 May 2013 2:23 PM
To: Nick Gales; Virginia Andrews-Goff
Subject: Fw: biopsy from SOWER-type vessel [SEC=UNCLASSIFIED]

Hi again Nick,

Realised I made a silly error in regard to fin whales; sorry
should read - Fin whale: Average duration for biopsy sampling of fin whales was 0.57 hrs per animal sampled (45 animals sampled 2005/2006 to 2007/2008).

Cheers, Paul

----- Original Message -----
From: paulensor@xtra.co.nz
To: Nick Gales
Cc: Virginia Andrews-Goff
Sent: Wednesday, May 08, 2013 9:02 PM
Subject: Fw: biopsy from SOWER-type vessel

Nick, I forgot to mention for the minke feasibility trials in 2000/2001 there was only one Larsen gun available on each vessel. Because of this, we didn't try on that cruise to sample more than one animal from each group, however, with multiple guns it should be possible. (In 2007/2008 when there were two guns available, most groups were solitary animals).

Cheers Paul

----- Original Message -----
From: paulensor@xtra.co.nz
To: Nick Gales
Cc: Virginia Andrews-Goff
Sent: Wednesday, May 08, 2013 8:16 PM
Subject: biopsy from SOWER-type vessel

Dear Nick,

Following is a summary of the efficacy of biopsy sampling of several species during recent IWC/SOWER cruises; included for Antarctic minke whales are extracts from the 2000/2001 and 2007/2008 cruise reports, outlining feasibility trials for this species. All of the following is based on the effort times provided in cruise reports 2001/2002 to 2007/2008; however if you wish to quote me I am happy with that also.

Regards, Paul

Antarctic blue whale:
For the IWC vessels the Average duration for biopsy sampling of Antarctic blue whales was 1.08 hrs per animal biopsy sampled (from a subset of 165 animals sampled 2001/2002 to 2007/2008, this includes the total duration of all biopsy chases, dart pick up and retreival, and includes all chases eg with misses and no chance for shooting). On SOWER the average

range is probably 35-40m and max usually 50m (though I have witnessed a max that we estimated as a ship length; 70m).

Fin whale: Average duration for biopsy sampling of fin whales was 0.44 hrs per animal sampled (subset of 66 animals sampled 2005/2006 to 2007/2008).

Humpback whale: Average duration for biopsy sampling of humpback whales was 0.42 hrs per animal sampled (subset of 173 animals 2005/2006 to 2007/2008).

Southern right whale: Average duration for biopsy sampling of Southern right whales was 0.67 hrs per animal sampled (subset of 11 animals 2005/2006 to 2007/2008).

Killer whale: Average duration for biopsy sampling of Southern right whales was 1.19 hrs per animal sampled (subset of 10 animals 2005/2006 to 2007/2008).

Antarctic minke whale:

Following is an extract from the 2000/2001 IWC-SOWER cruise report (Included in the Attachment is Table 8 from the 2000-2001 cruise report [table is reproduced below] - referred to in the following paragraph)

'Minke Whale Biopsy Sampling

Due to good weather and being ahead of schedule for much of the cruise, we were able to successfully conduct a feasibility study of biopsy sampling on minke whales this year. A total of 18 groups of minke whales were approached for sampling using the Larsen guns; the results are given in Table 8. Most trials were conducted later in the cruise and mainly from the *Shonan Maru No. 2,* due to the mechanical problems with the propeller on the *Shonan Maru.*

From the 18 trials, 8 resulted in a sample from a single shot fired; 1 resulted in a sample from two shots fired; 5 were misses; 3 were hits on the animal but no sample retained in the cutting head (one of the samples was apparently removed and eaten by a bird), and 1 trial resulted in no shots fired. One trial from the *Shonan Maru* was on a solitary animal which approached the vessel while drifting off-effort. The average time per trial (excluding Trial 18 which was conducted from drifting vessel) was 20.0 minutes, ranging from 7 to 33 min (includes dart retrieval time). It should be kept in mind though that the aim was not to obtain minke whale biopsy samples randomly, but to test the range and efficiency of the Larsen gun. For that reason, we deliberately chose groups with 2 or more animals present because in our experience groups tend to be more approachable and easier to track when they run; solitary animals are often very difficult to approach. During Trial 12, for example, there were several opportunities with animals very close to the bow that we did not take, and then once the animals started running we could not stay with them because of rough seas. We successfully took samples in wind speeds up to 20 kts (while chasing animals with the wind, and down swell). After high wind and seas, low light conditions posed the biggest constraint: during early morning/late evening hrs or under heavy overcast skies, it was very difficult to detect the animals just prior to their surfacing and this negatively impacted our sampling.

Our maximum successful range was estimated at 40 m, however it may be possible to collect samples from minke whales from greater ranges. Although minke whales often surfaced well within the range of the compound crossbow (and within the range of the Paxarms gun) surfacings were usually very rapid with often very little of the animal exposed. We feel that

the high velocity of the dart from Larsen gun results in greater accuracy and effective range under such circumstances, thus making it a more effective tool than any of the other systems currently available.

In the future, sampling success could be increased and sampling time decreased if 1) 2 Larsen guns are used at the same time, 2) animals that come in close to the boat are sampled, and 3) sample retention in the cutting heads is improved.'

Table 8. From 2000-2001 IWC-SOWER cruise report Results of the minke whale biopsy sampling trials.

Trial No.	Group Size	Experiment duration	Shots	Distance	Results
Shonan Maru No.2					
1	5	20 min	1	20 m	Miss
2	5	26 min	1	25 m	Sample
3	5	24 min	1	20 m	Sample
4	6	23 min	1	35 m	Sample
5	5	7 min	1	25 m	Sample
6	4	22 min	1	30 m	Hit - No Sample
7	4	21 min	1	35 m	Hit - No Sample
8	2	9 min	1	25 m	Miss
9	7	26 min	1	35 m	Miss
10	5	37 min	1	33 m	Sample
11	8	20 min	1	40 m	Sample
12	17	33 min	0	NA	No Shots Fired
13	6	24 min	1	27 m	Sample
14	19	20 min	1	15 m	Sample
15	18	12 min	1	55 m	Miss
16	9	16 min	1	28 m	Miss
Shonan Maru					
17	2	25 min	2	30m	Sample
18	1	0 min*	2	20m	2 Hits – No samples

* solitary animal approached vessel while drifting off-effort.

Following is an extract from the 2007/2008 IWC-SOWER cruise report (Included in the Attachment is Table 10 from the 2007-2008 cruise report [table is reproduced below] - referred to in the following paragraph)

'MINKE WHALE BIOPSY AND PHOTO-IDENTIFICATION STUDIES

A total of 14 groups of minke whales (comprising 16 animals) were approached for biopsy sampling and collection of photographs for individual identification during 2.45 hours of research time. Included in this is a total of 0.62 hours allocated to approaches to 4 solitary minke whales for photo-id without biopsy being attempted (close approaches to these groups for biopsy was not attempted because of the presence of too much ice).

A total of 6 biopsy samples were collected from 4 solitary Antarctic minke whales. The average time taken to sample an individual whale was 0.46 hours.

Photographs were obtained of 15 individual minke whales from 11 groups, including all the biopsied individuals (Tables 10 and 11). There was no opportunity to obtain photographs of the other 3 groups of minke whales approached for biopsy and photo-identification studies.

Conditions were difficult for biopsy sampling and photo-identification studies of minke whales during this cruise as most detections were of solitary animals. Tracking whales underwater was problematic due to poor water transparency and several of the groups were encountered near the pack ice where scattered ice often posed a further difficulty for approach.

Examination of digital images of the 15 individual minke whales photographed revealed no re-sightings.

MINKE WHALE TELEMETRY TRIAL APPROACH

There were few opportunities for telemetry trial approaches to minke whales on this cruise because there were few occasions when minke whale sightings coincided with reasonably good water clarity for tracking the whales underwater. One telemetry trial approach to a group comprising 3 Antarctic minke whales was conducted during 0.55 hours of research time on 9 February. The trial was judged as unsuccessful; although the whales were seen underwater very close to the bow they did not surface within 0.1 n.miles of the ship. Video was recorded of this approach for a total of 27min 31sec. During the trial approaches the video was recorded from the Top Barrel, instead of as instructed from the bow. This modification was made as it was thought it would provide better perspective and scale for the reviewer. Video was also recorded from the Top barrel for 3 approaches to minke whales during biopsy sampling attempts.'

Table 10. Results of biopsy sampling during SOWER 2008-09. All samples were collected with the Larsen system.

Species & date	Sight no.	Group size	Individual whale number	Sample number	Blubber	Comments
Minke						
26 January	054	001	01	09041001	Yes	
26 January	058	001	01	09041002	Yes	double hit: 2 skin samples, 1 blubber sample
26 January	062	001	01	09041003	Yes	double hit: 2 skin samples, 1 blubber sample
09 February	042	001	01	09041025	No	small sample
Total no. of whales sampled			4			

End

Appendix 2

Transcript of video, referenced in paragraph 4.4:

(Original video is available at: http://www.antarctica.gov.au/media/news/2013/significant-advances-in-non-lethal-research-on-antarctic-minke-whales)

Video transcript

Australian Antarctic Division Chief Scientist – Dr Nick Gales

This was a combined voyage with the United States Antarctic Program and its actually focusing on both humpbacks and minke whales. The idea is to work in a place in Antarctica where both animals are feeding and have a look at how they feed differently.

Went down to a place called the Gerlache Strait, which is a beautifully protected stretch of water in among the islands off the western side of the Antarctic Peninsula and worked in the Bays there. It's really productive, it's an area where a lot of Antarctic krill move through the whole area. Sort of size of prey/patches at different depth and we have no idea what those are. So this was actually for minke whales, our first real insight into the differences between these two key species.

So we are using a whole range of different tags that are giving us different information and at the same time we have tags on we have boats going round looking at the prey, the depths at it and what's in their environment.

So we go from the very short term tags, and we have to get these ones back, so you put a tag on the back of an animal, it's held on by suction cups and it will stay on there for hours to perhaps one day. And then it will just fall off naturally, the suction cups will give up and it will float to the surface and we will retrieve it. And it measures everything. So we can tell the number of tail fluke strokes on the way down to the prey, pitch and role and turning through the prey and everything, so we get incredibly dense information and at the same time we measure with echo sounds from a separate boat where the krill are.

And then another type that we stick on the animal that have to stay longer. So these are fired through the skin of the animal and then they just embed in the blubber and the underlying tissue just below the blubber and they stay on, well we hope, for months. They just give us location, but they give us the middle to large scale movements of the whales. So where they go from those summer feeding grounds, how they move around those summer feeding grounds and we hope they last long enough to tell us where they go for their winter breeding.

We had no idea how minke whales were going to act around the small boat. They are a much smaller whale than the type of whales that we have a lot of experience in tagging and they are much faster. So the boat driver sits alongside a group of minke whales and slowly comes in on the boat until we are just part of a school of whales and then they are surfacing around us. Then it's a matter of me on the bow, selecting a whale and then when that animal surfaces in the right range and the right distance from the boat shooting a tag onto the back of that whale. So it's quite tense, but it's really exciting when we successfully deploy the tags.

This summer is the very first time ever that these type of tags have been put on Antarctic minke whales, in fact any type of tag. So it's really exciting we are going to combine the data and really bring forward brand new information about this species.