SC/66a/SP/1

Proponents' preliminary response to the Report of the Expert Panel to review the proposal for NEWREP-A

Government of Japan

INTERNATIONAL WHALING COMMISSION

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ABSTRACT

The International Whaling Commission's Scientific Committee (IWC SC) convened a workshop to review the Proposed Research Plan for New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A). An international Panel of Experts (Review Panel) carried out the review on the basis of the proposed research plan and nine papers prepared by IWC SC members and NEWREP-A scientists ('proponents'). The report of the Review Panel is presented in document SC/66a/Rep6. The present paper summarizes comments and responses of the proponents on the evaluation and recommendations on NEWREP-A made by the Review Panel. It will firstly present general comments in light of Annex P's terms of reference and then show comments and responses to conclusions and recommendations of the report of the Review Panel. Since the Review Panel report covers a wide range of research items and its recommendations require extensive scientific works, the comments and responses included in this document are still preliminary and not exhaustive, and additional analyses and information will be submitted to the IWC SC. Revisions and supplementary information to the proposed research plan for NEWREP-A at the moment are listed in document SC/66a/SP2 and submitted to the IWC SC separately from this document. A consolidated Revised Research Plan for NEWREP-A will be prepared after the forthcoming IWC SC annual meeting, taking account of the discussion at that meeting.

INTRODUCTION

Japan submitted a Proposed Research Plan for New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A) to the Chair of the IWC SC and the Secretary to the IWC in conformity with Paragraph 30 of the Schedule to the International Convention for the Regulation of Whaling (ICRW) and Annex P (IWC 2013) as a possible basis for issuing special permits in accordance with Article VIII, paragraph 1, of the ICRW. Subsequently, IWC SC has initiated a process for the specialist workshop for review of the proposal in conformity with Annex P.

The review followed the guidelines specified in the Annex P. An international Panel of experts ('Review Panel') carried out the review on the basis of the proposed research plan and nine papers prepared by IWC SC members and NEWREP-A scientists ('proponents'). The report of the Review Panel is presented in document SC/66a/Rep6.

The Terms of Reference of the review workshop were the followings as shown in Annex P:

(1) [The Workshop shall:] comment briefly on the perceived importance of the stated primary objectives from a scientific perspective and for the purposes of conservation and management, noting particularly its relevance to the work of the Scientific Committee;

(2) [P]rovide advice and suggestions on components of the programme that might be achieved using non-lethal methods, including, where appropriate, power analyses and time-frames;

(3) [D]etermine whether the proposed field and analytical methods are likely to achieve the stated quantified objectives within the proposed time-frame, where appropriate, commenting on sample size and time-frame considerations;

(4) [P]rovide advice on the likely effects of the catches on the stock or stocks involved under various scenarios of length of the programme – this will include inter alia examination of abundance

estimates provided and may involve a different analysis to that provided in the original proposal, including assumptions that short permit proposals may be projected further into the future;

(5) [R]eview the proposed intermediary targets and suggest when an intermediate review or reviews should take place.

In addition to the Terms of Reference for reviews of new proposals included in Annex P, the Review Panel also provided their advice on the issues included in the first operative paragraph of Resolution 2014-5 of the IWC which Japan voted against at the time of its adoption.

The Review Panel convened to review the NEWREP-A at the workshop in Tokyo from February 7 to 10, 2015. The draft report of the Review Panel was subsequently made available to the proponent on March 4, 2015. The proponents express sincere appreciation to the Chair and other members of the Review Panel for their dedicated work shown in the report.

The proponents have duly considered the findings and recommendations made by the Review Panel. Below are their preliminary responses to the report of the Review Panel that are shared at this juncture for further review at the forthcoming IWC SC annual meeting, and additional analyses and explanation will be presented in that meeting.

Revisions and supplementary information to the Proposed Research Plan at the moment are listed in document SC/66a/SP2 and submitted to the IWC SC separately from this document.

As the research plan for NEWREP-A has not been finalized yet, the proponents welcome further discussions and comments at the IWC SC annual meeting. Giving due regard to such comments in the course of examination after the forthcoming IWC SC annual meeting, a final research plan for NEWREP-A will be prepared as appropriate.

GENERAL COMMENTS IN LIGHT OF ANNEX P TERMS OF REFERENCE

The proponents recognize that the report of the Review Panel provides a number of useful advice to the proposal of the NEWREP-A, many of which specifically suggest further improvement to the plan. These recommendations are duly received and will be reflected to the proposal in an appropriate manner. While details of their concrete responses to the recommendations are explained in the following parts of this paper, the proponents consider it useful to, at first, confirm the common grounds that the Review Panel shared with the proponents. They will be demonstrated below in line with the structure of the Terms of Reference shown in Annex P. While the proponents are aware that the Review Panel also referred to the first operative paragraph of IWC Resolution 2014-5 which Japan voted against, specific areas referred to in the said paragraph are generally covered by the five items under the Terms of Reference.

(1) [The Workshop shall:] comment briefly on the perceived importance of the stated primary objectives from a scientific perspective and for the purposes of conservation and management, noting particularly its relevance to the work of the Scientific Committee;

a. In its report, the Review Panel acknowledges the reasonableness of both Main Objectives I and II as follows:

(i) 'The Panel **welcomes** the clearer identification of primary objectives and sub-objectives in NEWREP-A compared to previous proposals, partly in response to recommendations of previous expert review workshops' (Item 2.1.2 of SC/66a/Rep6, p6);
(ii) '[T]he Panel **agrees** that this objective [Main Objective I] and its component sub-objectives are important for conservation and management' (Item 8.1 of SC/66a/Rep6, p39); and
(iii) 'With respect to Primary Objective II […], the Panel **agrees** that this is an important area of research worldwide and that whales are important component of such work' (Item 8.1 of SC/66a/Rep6, p39).

b. While the Review Panel did not recommend any changes to the primary objectives and sub-objectives of the research plan, it made recommendation 1; see Table 1 in the context of the

stated objectives of the proposed NEWREP-A. The response of the proponents will be shown in 'Specific comments and responses to each recommendations' below.

(2) [P]rovide advice and suggestions on components of the programme that might be achieved using non-lethal methods, including, where appropriate, power analyses and time-frames;

a. The Review Panel shares the following understandings concerning the need for lethal sampling for both Main Objectives I and II of NEWREP-A:

(i) 'The Panel **agrees** that at present, the techniques commonly used for the determination of the biological parameters used in the SCAA model (see Item 3.3.4) require lethal sampling: i.e. earplugs for age determination (see Item 3.3) and animal length. In addition, the proposed version will require reproductive organs for sexual maturity.' (Item 3.4.3.1 of SC/66a/Rep6, p17) (Note: The SCAA model is closely associated with the Main Objective I of NEWREP-A.);

(ii) 'Two important inputs to multi-species modelling can potentially be obtained from lethal sampling; total consumption and prey preference' (Item 3.9.3.3 of SC/66a/Rep6, p25);

(iii) 'Total food consumption per predator is a key input to multi-species/ecosystem modelling in Objective II and it is thus important to obtain the best available estimates (and quantify uncertainty)' (Item 3.9.3.3 of SC/66a/Rep6, p26);

(iv) 'Lethal sampling will permit stomach content analyses that provide a high quality direct measure of the composition of the food ingested' (Item 3.9.3.3 of SC/66a/Rep6, p26); and

(v) 'Using lethal sampling, many of the same measurements that can go into estimating total consumption can also be used to compute a condition index. For example, a condition index can be obtained by combining blubber lipid with blubber mass corrected for total body mass or body length' (Item 3.9.3.3 of SC/66a/Rep6, p26).

b. The Review Panel made recommendations 4, 5, 8, 9, 10 and 24; see Table 1 in the context of non-lethal methods in its report. The response of the proponents will be shown in 'Specific comments and responses to each recommendations' below.

(3) [D]etermine whether the proposed field and analytical methods are likely to achieve the stated quantified objectives within the proposed time-frame, where appropriate, commenting on sample size and time-frame considerations;

a. The Review Panel also shares the following understandings concerning the proposed field and analytical methods and the time-frame:

(i) 'the Panel **agrees** that analytical calculations of the required sample size for each different purpose, with an overall integration of this information to determine the appropriate sample size for the complete programme, although desirable in principle, may not be possible in advance (Item 8.4.1 of SC/66a/Rep6, p41);

(ii) '[T]he broad approach taken with respect to ASM is not unreasonable' (Item 8.4.1 of SC/66a/Rep6, p41);

(iii) 'The Panel **welcomes** the efforts of the proponents to consider a more quantitative approach to examining sample size than in JARPA II' (Item 8.4.1 of SC/66a/Rep6, p41); and

(iv) 'The Panel **welcomes** the greater detail provided concerning timelines that was not present in the original proposal but that was presented by the proponents during the meeting' (Item 8.2 of SC/66a/Rep6, p39).

b. The Review Panel made recommendations 2, 3, 6, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25 and 26; see Table 1 in the context of the required sample size and time-frame in its report. The response of the proponents will be shown in 'Specific comments and responses to each recommendations' below.

(4) [P]rovide advice on the likely effects of the catches on the stock or stocks involved under various scenarios of length of the programme – this will include inter alia examination of abundance estimates provided and may involve a different analysis to that provided in the original proposal, including assumptions that short permit proposals may be projected further into the future;

a. The Review Panels shares the understanding that the NEWREP-A employs a robust analysis to conclude that catches will not harm the stocks:

(i) 'The proponents provided results based on one application of the *CLA* and by using program Fitter (de la Mare 1989) to conclude that catches of the order of 333 every second year in the two study areas will not harm the stocks. Given the estimated abundances of the stocks involved, the precautionary nature of the RMP and the nature of the sampling regime proposed following transect lines, the Panel **agrees** that this conclusion is very likely robust to whichever analytical method is applied.' (Item 8.5 of SC/66a/Rep6, p41).

b. The Review Panel made a recommendation 27 in the context of the likely effects of the catches on the stock or stocks in its report. The response of the proponents will be shown in 'Specific comments and responses to each recommendations' below.

(5) [R]eview the proposed intermediary targets and suggest when an intermediate review or reviews should take place.

The proponents note that the Review Panel did not make recommendation on the intermediary targets and the timing of intermediate review. This suggests that the Review Panel does not find the need of modification for the proposed plan of the NEWREP-A in the context of the intermediary targets and review.

COMMENTS AND RESPONSES TO CONCLUSIONS AND RECOMMENDATIONS

General Observations

The Review Panel makes 29 specific recommendations in relation to Item 8 of the report on field surveys and analytical methods (see Table 1 of SC/66a/Rep6, p36). A few general observations regarding these recommendations are noted below. Table 1 of the present paper shows the responses from the proponents to these 29 recommendations provided by the Review Panel, including the timeframe for the works. It follows the format of Table 1 of the Review Panel Report (SC/66a/Rep6).

First of all, it should be noted that while the report is considered to aim at 'review[ing] the proposal in the light of the stated objectives following the guidelines' as referred to in Annex P, these recommendations can be generally categorized into two in the context of the evaluation of the necessity of lethal sampling and/or reasonableness of the sample size under the proposed plan of the NEWREP-A: namely, recommendations that are relevant to 'a full evaluation of whether any new lethal sampling is required' and 'issues related to sample size (irrespective of method used to obtain data)', and the other recommendations that are not relevant to such issues. The former category of recommendations are those which are for the purpose of 'C' and/or 'D' in the 'Purpose' column in Table 1 of the report of the Review Panel (see SC/66a/Rep6, p36), namely, recommendations 1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 18, 22 and 26. The purpose of 'B' is not relevant in this context because it only 'evaluate[s] feasibility of particular techniques' while 'a full evaluation of whether any new lethal sampling is required' is addressed under 'C'. The latter category of recommendations are those that are not for purposes of 'C' or 'D', namely recommendations 5, 6, 7, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28 and 29. All recommendations are scientifically important for the better contribution of the proposed NEWREP-A to the cetacean studies and the proponents will sincerely tackle with all of them.

The proponents observe that while the Review Panel categorizes a number of recommendations under the only purposes of 'A', 'B' and/or 'E' as shown above that are not relevant to the need of lethal methods and reasonableness of the sample sizes, it at the same time states that '[t]he Panel therefore agrees that the recommendations in Table 1 should be completed and the results evaluated *before there is a final conclusion on lethal techniques and sample sizes*' (Item 8 of SC/66a/Rep6, p35; emphasis added). The proponents consider that the latter finding of the Review Panel is not necessarily compatible with the former observation and it is not necessary to address all the recommendations 'before there is a final conclusion on lethal techniques and sample sizes'.

Among the recommendations that are classified in the former category above, the proponents observe that those works in response to particular recommendations should be given the highest priority. They

are recommendations 1, 11, 12, 13 and 26 as they form an essential part of an assessment for the need of lethal method and reasonableness of the sample size under the proposed NEWREP-A. The proponents have already started the analyses on these recommendations. The proponents will submit additional analysis and information obtained from these analyses to the IWC SC in May. The proponents consider that this additional information will provide sufficient basis for the Scientific Committee to determine the reasonableness of the program design and implementation in order to achieve the two research objectives.

Before presenting their detailed response to each of the recommendations, the proponents would like to draw an attention of the Review Panel to their approach to an assessment to non-lethal methods. They note that the Review Panel attaches particular importance to the evaluation of the necessity of lethal sampling, as demonstrated in the following statement in its conclusion, i.e. 'with the information presented in the proposal, the Panel was not able to determine whether lethal sampling is necessary to achieve the two major objectives; therefore, the current proposal does not demonstrate the need for lethal sampling to achieve those objectives' (Item 8 of SC/66a/Rep6, p35). In this regard, the Review Panel recommended for several feasibility studies on non-lethal techniques.

In this respect, the proponents are of the view that the feasibility and practicability of non-lethal methods need to be evaluated in a systematic manner, as already explained in section 4 of the proposed research plan for NEWREP-A. In assessing the feasibility and practicability of any non-lethal method, the proponents will consider the following four major tests: (i) whether the same data sought (e.g. age) can be obtained by a non-lethal method; (ii) whether enough data can be obtained in terms of quantity for statistical analysis; (iii) whether it is of sufficient quality for analysis (e.g. accuracy); and (iv) whether the cost to obtain the data is realistic and reasonable. Tests (i) and (ii) concern technical evaluation, while test (iii) concerns analytical evaluation, and test (iv) concerns logistical evaluation. It is the proponents' view that, in order to conclude that a particular non-lethal method is feasible and practicable to the extent that it can practically replace a lethal sampling method, all of the four tests need to be satisfied.

In compiling the proposed research plan for NEWREP-A, the proponents conducted thorough analysis of the feasibility of non-lethal methods for obtaining one of the data items crucial for achieving the research objectives, namely age data, against the four tests listed above. The result of the assessment using the currently available non-lethal methods at their present stage of development is presented in section 3.2.1.1 of the NEWREP-A research plan and at the workshop of the Review Panel. In light of this assessment, the Review Panel recognizes that there are, at present, no established analytical methodologies to obtain age data (see Items 3.3.4 and 3.4.3.1 of SC/66a/Rep6, p15-16 and p17, respectively) as well as body length and information on sexual maturity status (see Item 3.4.3.1 of SC/66a/Rep6, p17). When potential for technical and analytical advancements are recognized, feasibility studies will be incorporated in the NEWREP-A research plan. The proposed NEWREP-A incorporates a review mechanism that allows it to continuously improve its performance throughout the program. Especially, the experience accumulated in the first six-year period will assist the elaboration of an improved research plan after the first half of the research period.

The Review Panel's recommendations appear to assume that the necessity of lethal sampling cannot be proven unless the feasibility studies of all the conceivable non-lethal research techniques, both current and future ones, are completed and the conclusion is reached that none of the non-lethal techniques is a feasible alternative to lethal sampling. The proponents have a different view as to the extent of the feasibility studies to be undertaken in order to prove the necessity of lethal sampling. In the proponents' view, the reasonable approach would be to determine the feasibility of non-lethal method based on the currently available scientific and technical knowledge, and if deemed unfeasible, to initiate lethal sampling in the meantime while continuing feasibility studies on non-lethal methods on an ongoing basis. As demonstrated in the proposed research plan for NEWREP-A, the proponents are committed to the continuous field work and analysis of the feasibility of non-lethal methods. When future potential for technical and analytical advancements are recognized, feasibility studies will be incorporated in the NEWREP-A research plan.

It should be noted that although the Review Panel seems to assume that 'a short (e.g. 2-3 year) gap in the existing series' will not have 'serious consequences for monitoring change' (Item 8 of SC/66a/Rep6, p35), the proposed plan as well as observations above have already made it clear that the feasibility assessment of non-lethal methods for age data based on currently available scientific knowledge has been completed and it has demonstrated the need for lethal sampling at this juncture. The proponents,

therefore, consider it unnecessary to wait for a few years in launching the lethal aspect of the proposed NEWREP-A.

Specific comments and responses to each recommendation

This section provides detailed responses and comments to the 29 specific recommendations made by the Review Panel on field work and analytical methods in Table 1 of the present paper. To help in the understanding of the work under Main Objective II, flowcharts were prepared and presented in the Addendum to the NEWREP-A research plan (Document SC/66a/SP2).

1. *Evaluate the level of improvement that might be expected either in the SCAA or in RMP performance by improved precision in biological parameters using simulation studies including updated Implementation Simulation Trials (2.1.2) (Main Objective I)*

The Review Panel stated that 'Whilst the NEWREP-A proposal does discuss improvements in some biological parameters, it does not evaluate the level of improvement that might be expected either in the SCAA or in RMP performance by precision in biological parameters which is an important component of evaluating the importance of this part of the proposal' (Item 2.1.2 of SC/66a/Rep6, p6). The proponents take note of the importance of the Review Panel's recommendation to evaluate the level of improvement that might be expected in the NEWREP-A program. Better estimation of biological parameters such as natural mortality, age-at-sexual maturity, change in the carrying capacity (*K*) and MSYR is central to draw inference of population dynamics via the SCAA. Furthermore, the estimation of *K* and MSYR is crucial in terms of the RMP performance, although these parameters are extremely difficult to estimate, as acknowledged by the Review Panel report.

With regard to the evaluation of the expected level of improvement in the SCAA and RMP performance, the proponents note that 'the Panel **recommends** that this be done by the proponents using the simulation studies. Step one might involve the proponents developing *ISTs* based on existing information (including that developed under JARPA and JARPAII), while step 2 might be to examine how performance might improve with expected reduction of uncertainty in particular parameters. Such work will also enable improved estimation of sample size' (Item 2.1.2 of SC/66a/Rep6, p6). The proponents agree that this approach is in theory useful to link the sample size and success rate of the program. In implementing this approach, it should be noted that the proponents need to set out a series of work plan to evaluate the expected level of improvement in relation to the SCAA/RMP. The proponents consider that the work in response to this recommendation should be given the highest priority among the recommendations linking Main Objective I and its analytical procedures.

The proponents have designed the following work plan to be implemented before the IWC SC meeting. The proponents note that some of the work to deal with the Recommendations 10, 11, 12, 13 and 26 below, can essentially be treated within the same framework as the SCAA analysis. The proponents will report to the 2015 IWC SC meeting on the outcome from the following work plan.

a) Prepare a document describing a specification of calculation to be used for this evaluation process (which will be based on the SCAA framework).
b) Using existing data, assess how the biological parameters such as change in the ASM give impacts on the estimation outcomes in the SCAA through some possible metrics [incl. Recommendation 13].
c) Using existing data, conduct SCAA analysis with consideration on the existing mixing information [Recommendation 11].
d) Conduct additional simulation tests with a more realistic model to assess the sample size using data generated from the SCAA [Recommendation 26].
e) Conduct simulation performance tests to evaluate the level of improvement in the precision of quantities estimated by the SCAA during the period of NEWREP-A given the proposed sample size (or a modified one).
f) Using existing data, assess how the assumptions made such as "resting females are immature females" give impacts on the estimation outcomes in the SCAA) [Recommendation 10].
g) Using existing data, assess if the estimation of time-varying natural mortality is feasible in the existing SCAA) [Recommendation 12].
h) Conduct a simple simulation of the RMP/*IST* (maybe begin with a single stock hypothesis) to evaluate the extent of improvement of RMP performance).
i) Conduct more simulations of the RMP/*IST* (some including two-stock hypotheses) to evaluate the extent of improvement of RMP performance).

2. *Analyses to distinguish between 2-stock with mixing versus isolation by distance (3.1.3) (Main Objective I).*

In discussing the topics on stock structure of the Antarctic minke whale in the context of evaluation of improvement in SCAA or RMP performance, the Review Panel stated that '[t]he proponents note that all of the sub-objectives under Objective I (iii) are designed to help refine current stock-structure hypotheses of Antarctic minke whales. The Panel **agrees** that this emphasis is appropriate because, as mentioned elsewhere, refining hypotheses related to stock structure is one of the key elements in improving performance of the RMP'(Item 3.1.3 of SC/66a/Rep6, p9) . Also 'The Panel **welcomes** the proposal to expand the geographic range of the sampling to inform conclusions about stock structure. An implicit assumption of the current two-stocks-with-mixing hypothesis is that the I and P stocks both have as-yet-undetermined boundaries beyond the current study areas. If that is not the case (if, for example, the two stocks have continuous distributions and another zone of mixing on the other side of Antarctica), then this would be important information for incorporation into the *Implementation Simulation Trials'* (Item 3.1.3 of SC/66a/Rep6, p11).

The Review Panel reiterated the view expressed in the JARPAII review in 2014 that 'the available data might also be consistent with an isolation-by-distance model [(IBD)], in which there are no discrete populations; instead, interbreeding occurs primarily among individuals that are geographically proximate' (Item 3.1.3 of SC/66a/Rep6, p10). In the same review, the JARPAII review panel recommended one type of analysis that could potentially distinguish between these two hypotheses using existing data. To test these two hypotheses (2-stocks with mixing versus a single-stock IBD) the Review Panel suggested three new analyses based on genetic data noting that 'each of these analyses can be conducted fairly simply with existing data and **recommends** that this be undertaken as a priority' (Item 3.1.3 of SC/66a/Rep6, p11). The Review Panel further noted that 'given the small genetic differences between the two putative stocks (F_{ST} about 0.001), any one of these tests might not have high power, but collectively they might provide sufficient information to indicate the relative plausibility of the two competing hypotheses' (Item 3.1.3 of SC/66a/Rep6, p11).

Furthermore 'the Panel **notes** that although the above approaches focus on genetic analyses, some methods (such as pairwise distances, perhaps using Mahalanobis distances) could also be used with the morphometric data. This is important as previous analyses (Kitakado *et al*., 2014a) have suggested that a combination of genetic and morphometric data may be more powerful than genetic data alone' (Item 3.1.3 of SC/66a/Rep6, p11).

The proponents appreciate the comments and suggestions for additional analytical approaches from the Review Panel. The proponents note that following the short-term recommendations of JARPAII review meeting in 2014, further analyses were conducted and two papers on stocks structure of the Antarctic minke whale were presented and discussed at the Working Group on Stock Definition in 2014: hypothesis testing of genetic data (Pastene *et al*., 2014), and integrated analysis of genetic and morphometric data (Kitakado *et al*., 2014a). For the reasons given at the Working Group meeting, the proponents are convinced that the two stocks with mixing hypothesis is more plausible than the isolation by distance hypothesis. The IWC SC agreed in 2014 that it would be reasonable to continue to use the two-stock hypothesis as a default for an in-depth assessment, although further data might of course change the picture in future (IWC, 2015).

During its 2014 discussions of implications of Pastene *et al*. (2014) and Kitakado *et al*. (2014a), the Working Group recognized that the data utilized in these two papers were collected only from feeding areas, making the biological mechanism for an IBD effect difficult to understand. Nevertheless, the Working Group agreed that it would be useful to determine whether the genetic/morphometric data are consistent with a single-stock IBD hypothesis and recommended that appropriate evaluations be conducted intersessionally.

The proponents agree with the suggestions of the Working Group and consequently, the proponents will make effort to conduct the analyses recommended by the NEWREP-A Review Panel during the 2015/16 intersessional period, to elucidate whether the genetic and morphometric data are consistent with the IBD hypothesis.

The proponents note that the Review Panel considered this recommendation as a relevant issue related to sample size [Recommendation 2]. While the proponents agree with the idea of the Review Panel on the interactions between stock analysis and sample size, they do not agree with the urgency given by

the Review Panel to this recommendation. The basic assumption for this and others proposals in NEWREP-A is the occurrence of two-stocks in the research area. As noted above the proponents assign this hypothesis the highest plausibility, and the IWC SC agreed that it would be reasonable to continue to use the two-stock hypothesis as a default for in-depth assessment (IWC, 2015).

3. *Simulation study to examine how additional sampling could be expected to improve precision and/or reduce bias in estimates of mixing rates (3.1.3) (Main Objective I).*

The proponents note that the 'the Panel also **agrees** that good information on stock structure, including information on mixing within the feeding grounds is also especially important for any assessment approach. Whilst the RMP does not require perfect knowledge of stock structure, examination of the results of *Implementations* and *Implementation Reviews* for other species and ocean areas has shown that the performance of the RMP in terms of user objectives is increased with no effect on conservation performance as stock structure uncertainty is reduced' (Item 2.1.2 of SC/66a/Rep6).

The current method for estimating the mixing proportion (see Kitakado *et al*., 2014a) employs data from genetic and morphometric measurements simultaneously. Given that the information on parameters of allele frequency distributions and mean morphometric measurements in each baseline stock is large enough (based on the accumulated data from the past research programs JARPA and JARPAII) and that the current method assumes year- and sex-specific mixing proportions, the estimation performance of mixing proportions depends on the true mixing proportion in the sampling year and sample size in that year. Therefore, it might be possible to assess future estimation performance coarsely from the relationship between sample size in the mixing zone and estimated standard errors observed in the existing analysis (although the estimated mixing proportion in some years are not very reliable at this moment due to mixing zones sometimes estimated well to the east or well to the west).

As the proponents identified, and also as recommended at the 2014 JARPAII review meeting, it would be beneficial to see estimation performance by using a random effect model for the mixing proportions to achieve better estimation, by using a statistical principle of "borrowing strength". That is the case for the future estimation of mixing under the NEWREP-A. In this sense the Review Panel noted that 'the NEWREP-A proposal lacks a quantitative evaluation of the expected improvement in management-relevant information that can be expected to accrue from the proposed experimental design. A key metric that affects performance of the RMP is the mixing rate among populations and how that varies in space and time. The Panel **recommends** that an evaluation of how additional sampling could be expected to improve precision and/or reduce bias in estimates of mixing rates' (Item 3.1.3 of SC/66a/Rep6, p11).

The proponents recognise the simulation study for assessing estimation performance of mixing proportions recommended by the Review Panel is worth conducting because the estimation performance of mixing proportion is in accordance with our research interest to achieve the Main Objective I of the NEWREP-A. However, and as indicated above, the estimation performance of mixing proportions mainly depends on the true mixing proportion in the sampling year and sample size in that year, and these have been evaluated so far although the incorporation of random effects may improve the precision to some extent. Even so, the proponents will prioritize the tasks with respect to Recommendation 1 because they directly relate to evaluation of the sample size and level of improvements in the SCAA and RMP performance. Therefore the work in response to this recommendation on stock mixing will be conducted once the proponents have some progress in the task related to Recommendation 1 above.

4. *Comprehensive biopsy sampling feasibility study (3.1.3.1) (Main Objectives I and II).*

The proponents note that the Review Panel '**welcomes** the proposed efforts to evaluate efficacy of biopsy sampling of Antarctic minke whales' and noted that 'a key component of assessing their feasibility relates to the practicalities of obtaining sufficient biopsy samples (in absolute numbers as well as quantity of relevant tissue per sample e.g. skin, top layer of blubber, complete blubber layer) from Antarctic minke whales in Antarctic waters, whatever their ultimate use is' (Item 3.1.3.1 of SC/66a/Rep6, p11).

The proponents further note that 'the Panel **recommends** that an experiment to examine the effort required to obtain biopsy samples from Antarctic minke whales be given high priority at the start of

any long-term programme', and made four specific suggestions: '1) involve people with expertise in successfully biopsy sampling common minke whales in the North Atlantic; 2) mimic the sampling strategy developed for lethal sampling (e.g. when dealing with schools >2); 3) record information on time taken, sea state, swell, etc. to enable a plausible measure of effort required to be developed; and 4) consider the amount of tissue and nature of tissue required (for each analysis and in total)' (Item 3.1.3.1 of SC/66a/Rep6, p11-12). Some of those suggestions have been already envisaged in Appendix 6 of the proposed plan for NEWREP-A with a detailed timeline included herein (see Figure 1), in which the feasibility study will be undertaken at an early stage of the first six-year research period.

The proponents will take account of the above mentioned four specific suggestions by the Review Panel as much as practicable in developing a detailed implementation plan for this feasibility study.

In relation to the first suggestion, the proponents acknowledged the importance of collaborating with experienced foreign experts in this field, and note that there are some Japanese scientists with experience in successful biopsy sampling of common minke whales in the North Pacific (Nishiwaki, 2000; Yoshida *et al.*, 2010; Yoshida *et al.*, 2011) as well as Antarctic minke whales in the Antarctic waters (Nishiwaki *et al.*, 1990; Nishiwaki, 2000). The proponents put the great importance of establishing the 'ideal' framework of the study suggested by the Review Panel (e.g. representativeness of the entire area and time period, random sampling techniques, etc.). This 'ideal' framework will be considered as the second step after examining the practicability of the sampling technique itself in the initial stage.

The proponents also note that the Review Panel recommends this feasibility study for 1-2 field seasons, as an item 'relevant to a full evaluation of whether any new lethal sampling is required.' In this regard, it should be noted that biopsy sampling alone does not provide any data, i.e. biopsy sampling can produce useful data only if there are established analytical methodologies corresponding to the required data items. As duly recognized by the Review Panel, there is no established analytical methodology to obtain age and other crucial data using biopsy samples at the present time (see Items 3.3.4 and 3.4.3.1 of SC/66a/Rep6), and therefore, it is reasonable to conduct this feasibility study on biopsy sampling in parallel with the related feasibility studies (i.e. DNA methylation analysis responding to recommendation 8 and hormones analysis in blubber responding to recommendation 9).

The proponents note that the proposal for a cetacean sighting survey in the Antarctic in the 2014/15 austral summer season (Matsuoka *et al.*, 2014) included experiments on biopsy sampling and feces observation/collection for Antarctic minke whale. The biopsy experiment was planned to take place in offshore waters (e.g. the northern stratum). Unfortunately, as the density of Antarctic minke whales in such waters was very low and the weather and sea condition did not allow during the observations (e.g. Weather-Beaufort scale over 4), the experiments could not be conducted.

5. *Comprehensive telemetry feasibility study (3.1.5) (Main Objectives I and II).*

The proponents note that the Review Panel welcomes the proponents' proposed trials of tagging studies on Antarctic minke whales for several purposes (Items 3.1.5, 3.2.2 and 3.9.3.1 of SC/66a/Rep6) and recommends that the proponents give high priority to this item with several specific recommendations/comments.

The proponents will undertake this research item at an early stage of the first six-year research period taking account of the specific recommendations/comments of the Review Panel in developing detailed implementation plans for trials. In particular, based on the Panel's recommendation (Item 3.1.5 of SC/66a/Rep6, p12), the proponents will seek the possibility of collaboration with foreign/other research groups with experience in such work rather than try to develop these techniques on their own, noting that there are some examples in Japan of successful tagging studies on common minke whales in the North Pacific (Kishiro and Miyashita, 2011; Kishiro *et al.*, 2013).

6. *Estimate g(0) for all species (3.2.2) (Main Objective II).*

The proponents note that 'the Panel **welcomes** the plans to obtain estimates of $g(0)$ for Antarctic minke whales by using IO mode, recognizing this was a key component in the lengthy process to obtain abundance estimates from the IDCR/SOWER surveys' (Item 3.2.2 of SC/66a/Rep6, p13). In addition, 'the Panel **recommends** that every effort be made to estimate $g(0)$ for the other whale species, at least to determine rather than assume whether it is significantly different from one' (Item 3.2.2 of

SC/66a/Rep6, p13). The proponents agree with this recommendation, and to respond to it, identification of duplicate sightings will be also conducted for whale species other than the Antarctic minke whale during the NEWREP-A sighting survey in IO mode. To determine whether $g(0)$ is significantly different from one, the proponents will conduct analyses on duplicate sightings for those whale species for which sufficient data are obtained during the NEWREP-A program. Information on mean diving time will be used to estimate $g(0)$ more precisely if such data become available.

7. *Review sighting survey design and methods (3.2.2) (Main Objectives I and II).*

The proponents note that 'the Panel **welcomes** the emphasis on obtaining abundance estimates in the NEWREP-A proposal' and that 'the sighting surveys are planned to follow the survey protocols set out in the 'Requirements and Guidelines' for conducting surveys and analyzing data within the Revised Management Scheme' (Item 3.2.2 of SC/66a/Rep6, p13). Furthermore 'the Panel **welcomes** the plans to obtain estimates of $g(0)$ for Antarctic minke whales by using IO mode' (Item 3.2.2 of SC/66a/Rep6, p13).

On the other hand, 'the Panel **recommends** the survey design and analysis methods be carefully considered to enable the survey results to have multiple uses', and then 'the Panel **recommends** that the proponents: **(1)** carefully consider a number of options for survey design and methods taking into account: (a) the experience gained from the several years of data analysis before the Scientific Committee adopted abundance estimates from the previous IWC IDCR/SOWER cruises; (b) the developments in spatial modelling approaches; (c) the experience of previous multi-disciplinary survey efforts; (d) the recommendations from the JARPAII review; (e) the possibility of incorporating more focused surveys to address specific issues in some years; (f) consideration of whales within the ice; (g) updated power analyses of the effects of survey interval and estimation of trend to determine necessary levels of effort and survey design in the future (including consideration of the regions outside the core study area (additional longitudinal range in Areas III, VI, and coverage north of 60°S)). **(2)** work closely with the IWC Scientific Committee before finalising their survey approaches; **(3)** ensure that future survey plans submitted to the Scientific Committee follow fully the guidelines for such survey plans, including incorporating proposed track lines - since the dedicated sighting survey/echo sounder platform will be separated from the sighting/sampling vessels, sabotage should not be an issue' (Item 3.2.2 of SC/66a/Rep6, p14-15).

The proponents agree with the Review Panel recommendations above. Consequently the proponents will reconsider their survey design, survey methods and analytical methods as far as enough survey effort of whale sighting survey is secured so as to obtain whale abundance estimates precisely. The proponents will submit papers that describe more details of survey design and survey procedure (that take into account the specific research activities for the particular year), to the annual IWC SC meetings. Finally the proponents will work closely with the IWC SC before finalizing the survey approaches, and will ensure that the survey design plans follow fully the guidelines for such surveys plans.

8. *Examine feasibility of using DNA methylation ageing technique with Antarctic minke whales using good quality earplugs, testing against geographical areas and different time periods and using several laboratories (3.3.4) (Main Objective I).*

The proponents note that in discussing the biological parameters to be investigated in NEWREP-A 'the Panel **agrees** that at present, the techniques commonly used for the determination of the biological parameters used in the SCAA model (see Item 3.3.4) require lethal sampling: i.e. earplugs for age determination (see Item 3.3) and animal length. In addition, the proposed version will require reproductive organs for sexual maturity' (Item 3.4.3.1 of SC/66a/Rep6, p17).

On the other hand, 'the Panel **notes** that there are new techniques available that require validation and calibration that may enable the determination of these biological parameters for Antarctic minke whales in the future using non-lethal techniques' (Item 3.4.3.1 of SC/66a/Rep6, p17). Among these techniques the Review Panel discussed the DNA Methylation (DNA-M) technique and noted that 'this technique does not provide the chronological age of the individuals but rather a physiological age that can be used as a proxy for chronological age'(Item 3.3.4 of SC/66a/Rep6, p16). It further noted that 'the technique may require calibration by species, population and period' and that 'given the novelty of the technique and the fact that it has only been applied to a single population of a single species of cetacean, there is as yet no experience on this regard'(Item 3.3.4 of SC/66a/Rep6,

p16). Consequently 'the Panel **welcomes** the fact that the proponents intend to investigate this new approach during NEWREP-A' and '**recommends** that the method be investigated early in the programme, initially using a sub-sample of animals only with clear 'highly readable' earplugs. The samples should also be divided by stock and also by time period (to the extent possible) to examine possible differences in the calibration slopes within different geographical areas and time period'. Finally 'the Panel also **notes** the importance of evaluating interlaboratory reproducibility and **recommends** that this be examined by having independent laboratories running a control set' (Item 3.3.4 of SC/66a/Rep6, p16).

The proponents agree with the comments and suggestions from the Review Panel. In fact NEWREP-A already recognized that the DNA-M technique is a new one requiring calibration if it is to be used on other species, populations and periods. Following that plan and the recommendations from the Review Panel, at first, the stock effect on the DNA-M technique will be examined using 50 highly readable earplugs each from I-stock animals sampled in Area IVW and P-stock animals sampled in Area VE under JARPA II, ideally from whales sampled in a same year in each Area. In the next step the effect of the period will be examined by using a similar number of samples from different austral summers. DNA methylation changes will be identified at the Antarctic minke whale genes homologous to the humpback whales. The procedure for identification of age-related DNA methylation site and measurement of methylation level will follow previous studies (Maegawa *et al*., 2010; Bocklandt *et al*., 2011; Polanowski *et al*., 2014). ICR scientists have already contacted a specialized laboratory and a university in Tokyo so that this study can be conducted in collaboration with experts. Preliminary results will be reported to the 2017 IWC SC meeting and final results at the 2018 IWC SC meeting. The proponents are responding in this way to address the Review Panel recommendation that this feasibility study be conducted early during the NEWREP-A program. The proponents also agree with the Review Panel suggestions to evaluate the accuracy and reliability in the analysis of methylation rates obtained at different laboratories (interlaboratory calibration), and this will be addressed in consultation with the IWC SC.

Finally the proponents note that the Review Panel states that 'if the correlation [between earplug counts and DNA methylation rates] is low, it will not be possible to determine which method is better because the true ages are not known', and consider that this statement is somewhat misleading. It should be noted that, if that is the case, DNA methylation rates alone cannot provide any age data which can be used in population dynamics studies, while earplug counts still can (Lockyer, 1984; Punt *et al.*, in press).

9. Examine use of hormones in blubber to detect sexual maturity (3.4.3.1) (Main Objective I).

The proponents note that 'the Panel **recommends** that the proponents also investigate the possibility of obtaining information on sexual maturity through hormones in blubber' (Item 3.4.3.1 of SC/66a/Rep6, p17).

The proponents emphasize the fact that all previous studies on this particular topic concluded that the analysis of progesterone concentration in blubber can only distinguish pregnant from non-pregnant whales (not mature from immature) because no differences in concentration were observed between immature females and non-pregnant mature females (Mansour *et al.*, 2002; Kellar *et al.*, 2006).

The proponents note that attempts to determine the reproductive status of females by the progesterone levels in blood were undertaken for Icelandic common minke whales. Since there was a large difference in the progesterone levels between pregnant and non-pregnant individuals, the hormone level was considered as an effective indicator of pregnancy and could be used for determination of reproductive status for females with no observed fetus or for which both ovaries could not be collected (Gunnlaugsson and Vikingsson, 2013). Furthermore, the possibility of misclassification was suggested because not all ovulating females are indeed pregnant and integrative analysis with other techniques such as a histological sample of the uterine horn or the mammary gland was recommended at the Iceland Special Permit Review meeting (IWC, 2014).

To respond the recommendation from the Review Panel, the proponents will conduct progesterone analyses in blubber tissues of Antarctic minke whales using JARPAII samples. Females with various reproductive status such as ovulating, resting and pregnant with small fetus will be selected, and hormone levels will be compared with histological information for reproductive organs. Analysis of

progesterone level for a total of 50 Antarctic minke whale samples will be assayed using the compact ELISA workstation (Crocodile, Titertek Berthold). Progesterone will be assayed with the Cayman Practice ELISA Kits (Cayman Chemical), according to the manufacturers' protocols. Preliminary results will be reported in the 2017 IWC SC meeting.

It should be noted that the result of this examination alone does not affect the need for lethal sampling or the proposed sample size, i.e. it would have some meaning in relation to lethal sampling only if analytical methods to obtain age data (e.g. DNA-M) using blubber are established and biopsy sampling can provides sufficient amount of blubber tissue samples. Therefore, it is reasonable to conduct this study in parallel with the related feasibility studies (i.e. studies responding to recommendations 4 and 8).

10. *Evaluate the effect on SCAA of assuming 'resting' females are immature females (3.4.3.1) (Main Objective I).*

During the discussions related to the recommendation 9 above, 'the Panel **notes** that the relevant parameter for possible use in the SCAA model is the proportion of mature adult females; as the proportion of pregnant females is high and that of resting mature females low, although this would be expected to change under a hypothesis that density-dependent factors could affect the dynamics of the population, the Panel **recommends** that simulation studies should be used to examine the effect on the SCAA of errors that may result from assuming that resting females are in fact immature females (low hormone levels are common to both)' (Item 3.4.3.1 of SC/66a/Rep6, p17).

The proponents agree with this recommendation and will address it in the context of the work related to Recommendation 1 (see the text responding to Recommendation 1 above).

It should be noted that the result of this simulation study alone does not affect the need for lethal sampling or the proposed sample size, i.e. it would have some meaning in relation to lethal sampling only if analytical methods to obtain age data (e.g. DNA-M) and pregnancy status information (e.g. hormone analysis) using blubber are established, and biopsy sampling can provides sufficient amount of blubber tissue samples. Therefore, it is reasonable to conduct this study in parallel with the related studies (i.e. studies responding to recommendations 4, 8 and 9).

11. *Update SCAA with respect to density-dependence following Punt et al., in press, and stock mixing based on existing data (3.4.3.2) (Main Objective I).*

During the discussions on modifications to the SCAA, the Review Panel recommended that the density-dependence function used in Punt *et al*. (in press) be adopted by the proponents. The Review Panel also noted that 'the major extensions to the SCAA in NEWREP-A include allowing for mixing of populations. The existing SCAA code allows for mixing of stocks by area but to date this variant of the SCAA has not been used as analyses of mixing are currently preliminary (Punt *et al*., in press). The Panel **agrees** that there is sufficient information from JARPA and JARPA II data to update the SCAA to include mixing and **recommends** that this be done' (Item 3.4.3.2 of SC/66a/Rep6, p17).

The proponents agree to use Punt *et al*. (in press) function for density-dependence. The proponents will also conduct the recommended update of the SCAA in the context of the work responding other recommendations on the SCAA analyses. The proponents will conduct it before the IWC SC meeting.

12. *Identify more fully the data to be used to inform the time-varying natural mortality in the SCAA and analyse existing data to determine the feasibility and accuracy of obtaining such estimates (3.4.3.2) (Main Objective I).*

During the discussion on modifications to the SCAA, 'the Panel **recommends** that the proponents identify more fully the data to be used to inform the time-varying natural mortality and present analyses of previously collected data to determine the feasibility and accuracy of obtaining such estimates' (Item 3.4.3.2 of SC/66a/Rep6, p18).

The proponents note that it may be difficult to distinguish the time-varying natural mortality from other potential confounding factors. The proponents will make effort to address this recommendation in the context of the work responding to Recommendation 1 above by assessing if the estimation of time-

varying natural mortality is feasible in the existing SCAA using the existing data and report progress on this before the 2015 IWC SC meeting.

13. *Develop metrics to evaluate the benefits of including time varying ASM data in the SCAA (3.4.3.2) (Main Objective I).*

During the discussions on modifications to the SCAA the Review Panel sated the following. 'A key extension to the SCAA is to include time-varying age-at-50%-maturity information. The Panel **recommends** that the proponents develop metrics to evaluate the benefits of including these data in the SCAA' (Item 3.4.3.2 of SC/66a/Rep6, p18).

The proponents will address this in the context of the work related to Recommendation 1 by assessing how the biological parameters such as change in the ASM give impacts on the estimation outcomes in the SCAA through some primary parameter estimates using existing data.

14. *Consider the adoption of this multibeam sonar in krill surveys (3.6.2.1) (Main Objective II).*

Under the discussions on 'survey scale' for krill 'the Panel **notes** that the degree of overlap between visual and acoustic sampling can be improved by use of multibeam sonars that sample a swath (up to ca 100m either side of the ship depending on frequency and hardware) either side of the ship. Cox *et al*. (2009) for example revealed a much greater match between krill distribution and distribution of air-breathing predators through use of multibeam data than downward-looking echosounder data. Multibeam technology is increasingly affordable (for example WAASP which now records water column data, c $50K). The Panel **recommends** that the proponents consider adoption of this technology in their surveys' (Item 3.6.2.1 of SC/66a/Rep6, p20-21).

The proponents concur with the Review Panel on this recommendation, and they will consider the installation of multibeam sonar to a research vessel. It should be noted that the application of the multibeam technology to fisheries science is relatively new and no associated standard abundance estimation method for krill has been established in CCAMLR. The proponents also stress that the proposed research plan is still valid as the proponents' interest on prey-predator relationship is not at a small scale but at a larger scale.

15. *Trial the ship and echosounder system(s) in Japan well before going to the Antarctic to determine the likely effective acoustic sampling range and potential for detecting krill for multiple frequencies over the required survey depth. Conduct for both annual and board-scale survey vessels (3.6.2.3) (Main Objective II).*

Under the discussions on 'noise', and to address the effect of the ship's noise, 'the Panel **recommends** that the ship and echosounder system(s) be trialled well before going to the Antarctic to determine the likely effective acoustic sampling range (signal-to-noise by depth characterization) and potential for detecting krill' (Item 3.6.2.3 of SC/66a/Rep6, p21)

The proponents concur with the Review Panel on this recommendation and will allocate sufficient time for the trial well before going to the Antarctic.

16. *In the years (two out of 12) when both NEWREP-A and CCAMLR-type surveys are conducted, try to survey the same transects by both vessels in near synchrony (3.6.2.5) (Main Objective II).*

Under the discussion on 'between-vessel comparison' in the krill survey, and in the years (two out of 12) when it is proposed that both NEWREP-A and CCAMLR-type surveys are conducted, 'the Panel **recommends** that surveys of the same transects by both vessels are conducted in as close to a synchronous manner as possible to enable some cross-calibration between vessels, enabling perhaps the relative estimates to be anchored to a more absolute framework' (Item 3.6.2.5 of SC/66a/Rep6, p21).

The proponents consider that the difference between current echosounder systems is minimal if they are well calibrated using standard calibration spheres. Nevertheless, the proponents will consider carrying out cross-calibration between the NEWREP-A sighting vessel with echosounder and CCAMLR-type krill survey vessel as the recommendation has the potential to improve the data precision and accuracy. It will be carried out in waters around Japan instead of in the survey area.

These vessels are expected to be operated in different Management Areas at different timing because their primary objectives are different. The sighting survey vessel will cover the IWC Management Areas III, IV, V and VI, and the primary objective is not abundance estimate of krill but whales. The CCAMLR-type krill survey vessel is expected to cover the CCAMLR Statistical Divisions 58.4.1 and 58.4.2. As conducting such a calibration in the survey area is operationally difficult and costly, the proponents will carry out it in waters around Japan in a near synchronous way, as the first priority. However, the proponents might conduct it in the survey area as well if conditions are met.

17. *Conduct full analysis of statistical power to detect changes in krill abundance from proposed techniques (3.6.2.6) (Main Objective II).*

Under the discussion on 'statistical power' for the analysis of krill data, the following was stated by the Panel. 'The proponents recognise that the annual surveys will provide an index of relative abundance rather than absolute abundance, whilst the large-scale survey is expected to yield estimates of absolute abundance. The proponents suggest that variance from the former may range from 10-37% whilst that from the latter will be of the order of around 20%. However, they do not define the effect size that they wish to be able to detect for either type of survey, where this is appropriate (e.g. related to possible changes in the ecosystem). For example, in an ecosystem context, what scale of interannual variability do the proponents wish to detect, and how large a change in krill abundance will need to be detected to inform feeding models? In the absence of this, the Panel is unable to evaluate whether either survey type will deliver the required data. The Panel therefore **recommends** that the proponents conduct an analysis of statistical power. The Panel notes that the CVs reported above relate only to transect-to-transect variability, and do not include any uncertainty due to issues related to, for example, bias in krill size-distribution estimation. The power analysis should consider all such influences. CCAMLR's WG-EMM has considered factors contributory to uncertainty in surveys of krill (https://www.ccamlr.org/en/wg-emm-95/72) and the Panel **recommends** that the proponents interact with this community' (Item 3.6.2.6 of SC/66a/Rep6, p21).

The proponents note that uncertainties in surveys of krill stemming from sound propagation, empirical TS model and detection sensitivity were studied by using data obtained during CCAMLR 2000 (Demer, 2004). Although this author pointed out that some potential sources bias (e.g. stemming from uncertainties in sound propagation parameters, TS, species classification, bubble attenuation, thresholding, area definition, conversion of number density to biomass density etc.) should be investigated further, these aspects have not been investigated fully in CCAMLR since then. These aspects are difficult to test before the survey because the analysis requires data obtained through the survey. The proponents will consider these points in collaboration with experts in CCAMLR community to improve the knowledge of this field. It should be noted that in general, given that very few krill surveys have been carried out, CCAMLR has welcome any additions, and without specifying pre-conditions, probably because their focus is simply on building up a basic data set.

18. *Develop more detailed plans to consider whether comparisons between stomach contents and proposed krill survey data are feasible and if so, how they can be done (3.6.2.7) (Main Objective II).*

Under the discussions on 'krill sampling: feeding ecology issues', the Review Panel stated the following. 'The proponents suggested that krill caught in large horizontally-towed frame nets will be used for comparison with stomach contents. Since the vessel proposed to be the dedicated sighting vessel cannot tow such a net, the Panel assumes that stomach-to-net comparisons will only be possible in two of the planned 12 years i.e. when the large-scale CCAMLR-type surveys are envisioned. Although it is not possible without having the cruise tracks to compare, it seems unlikely that the dedicated sighting vessel and the CCAMLR-type large-scale krill survey will be in the same position at the same time to enable robust spatio-temporal comparisons between net samples and stomach samples to be conducted. The Panel **recommends** that further more detailed plans be developed to consider how and if such comparisons are to be made' (Item 3.6.2.7 of SC/66a/Rep6, p21).

To respond to this Review Panel recommendation, the proponents will consider conducting a simultaneous survey by a krill survey vessel equipped with a frame-type trawl and echosounder, the dedicated sighting survey vessel equipped with an echosounder and the whale sampling vessels within a small-scale experimental survey area over a short time period (e.g. one week) so that comparisons among vessels/samples can be made.

19. *Ensure that sufficient time is allocated for adequate net sampling, based an analysis of previous net sampling data (e.g. BROKE/BROKE West data) (3.7.2) (Main Objective II).*

Under the discussions on 'demography of krill' the Review Panel stated the following. 'Sampling using the large frame net proposed under the large-scale CCAMLR-type surveys is the most likely to deliver krill representative of local size structure. The Panel notes that size structure may well not be uniform throughout the proposed survey areas and recommends that sufficient time should be allocated to the survey schedule for adequate net sampling. To determine this time requirement, the Panel **recommends** that the proponents carry out an analysis of previous net sampling data; consideration of BROKE/BROKE West data will inform the amount of net sampling effort that would be required to adequately-characterise the expected variability in krill size structure required for demographic studies and informing (from a TS perspective) analysis of the acoustic surveys' (Item 3.7.2 of SC/66a/Rep6, p22)

The proponents concur with the Review Panel on this recommendation and will allocate sufficient time for net sampling. As mentioned in the NEWREP-A proposal, survey design standards similar to those developed and implemented for CCAMLR 2000 (Trathan *et al*., 2001), BROKE (Nicol *et al*., 2000) and BROKE-West (Nicol *et al*., 2010) will be applied to the proposed CCAMLR-type krill surveys. In BROKE, a total of 160 trawl hauls were made in 2,326 n.miles of survey transects in 51 days (approximately 3 hauls per day) (Pauly *et al*. 2000). In BROKE-West, a total of 126 trawl hauls were made in 3,537 n.miles of survey transects in 51 days (approximately 2.5 hauls per day) (Nicol *et al*., 2010). These sampling frequencies will be guidelines for our survey. The detailed survey plan will be developed in consultation with CCAMLR.

20. *Give careful consideration to scale and design of oceanographic sampling, taking into account BROKE/BROKE West data (3.8.2) (Main Objective II).*

Under the discussions on 'oceanography' the Review Panel stated the following. 'Oceanographic data are required for several reasons including: (a) determining sound velocity and attenuation parameters for interpretation of acoustic survey data; (b) considering the distribution of populations of krill within potentially discrete water masses; (c) considering environmental change; and (d) potentially providing information for spatial modelling and explanatory variables when estimating abundance. The spatial scales over which data are required for different objectives may be different, and the proposal does not provide sufficient detail for the Panel to evaluate this component of the programme. The Panel **recommends** that careful consideration be given to these scales in design of the oceanographic sampling programme. Observations at just a single station per day, for example, are probably insufficient to characterise the potentially variable physical environment in a manner adequate for quantitative treatment of acoustic survey data. XCTD deployments could be made more frequently than once per day during the acoustic surveys. Furthermore, there may be gains to be made by considering data available from, for example, other sources such as Argo floats. The importance of considering data from outside the direct programme is considered further under Item 3.10.2' (Item 3.8.2 of SC/66a/Rep6, p23).

The proponents also note that 'The Panel **recommends** that due consideration should be given to the spatial distribution of oceanographic sampling, and a regular geographic sampling design might be preferable. Benefit could arise from occupation of the same CTD stations as occupied during BROKE and BROKE West' (Item 3.8.2 of SC/66a/Rep6, p23).

The proponents concur with the Review Panel on this recommendation and they will design sampling site carefully. In BROKE, a total of 147 sites were set in 2,326 n.miles of survey transects in 51 days (approximately 3 sites per day) (Pauly *et al*. 2000). In BROKE-West, a total of 118 sites were set in 3,537 n.miles of survey transects in 51 days (approximately 2 sites per day) (Nicol *et al*., 2010). These sampling frequencies will be guidelines for designing our survey. The detailed survey plan will be developed in consultation with CCAMLR.

21. *Compare overlap in diet amongst fin and Antarctic minke whales using stable isotopes in skin, with concurrent analyses of krill samples to obtain stable isotope baselines (3.9.3.1) (Main Objective II).*

The proponents note that 'the Review Panel **agrees** that stomach content data do provide insights into diet composition (prey species) as well as the size and composition of prey that are consumed…' (Item

3.9.3.1 of SC/66a/Rep6, p24). The Review Panel further noted that 'Under one hypothesis i.e. that competition increases between minke whales and other species of baleen whales, as the latter recover, it is important to determine whether changes occur in species composition as well as size composition in the Antarctic minke whale diet. For example, under JARPA II, some overlap was observed between fin whales and minke whales in diet composition, although the sample size for fin whales was small (Murase *et al*., 2014). The proponents suggest a feasibility study to determine whether stable isotope ratios (δ13C and δ15N) may provide information on this regard. However, the Panel **notes** that this is already a standard technique routinely used to investigate overlap in diet between species; it has already been successfully applied to mysticetes on a number of occasions (e. g. Ryan *et al*., 2013). Such a study can be conducted with skin samples and thus the Panel **recommends** its implementation without the need for a feasibility study. The Panel **recommends** concurrent analyses of krill samples to ensure the correct determination of stable isotope baselines, which may vary geographically and temporally, particularly considering the probable shift in trophic level of krill through the season' (Item 3.9.3.1 of SC/66a/Rep6, p24).

The proponents agree that consideration of stable isotope ratios (δ13C and δ15N) constitutes a standard technique routinely used to investigate overlap in the trophic level of diet among predator species. As a first step the proponents will analyse prey species (krill) to ensure the correct determination of stable isotope baselines, during the first six-year period of NEWREP-A. The proponents consider that the stable isotopes ratios in krill reflect the area where krill distribute. Consequently sampling of krill for this analysis will be made in different geographical strata. At least five samples per sub areas (e.g. East-south, East-North and Prydz Bay) will be analyzed every year. Accumulated information on isotope ratios in krill will be applied for the analysis of the overlap in diet amongst fin, humpback and Antarctic minke whales. After the first six years, the baseline data for krill will thus have been obtained. These results will be evaluated at the mid-term review of NEWREP-A.

Concurrently, the proponents will examine the overlap in diet amongst fin, humpback and Antarctic minke whales using stable isotope ratios in skin samples by lethal methods (Antarctic minke whales) and by biopsy sampling (fin and humpback whales) through NEWREP-A surveys. This analysis will be carried out early in the NEWREP-A program and the results will be reported to the IWC SC when available.

22. *Develop a more powerful approach to estimating energy intake (requirements) using a bioenergetics model; evaluate non-lethal methods for obtaining a time series of tuning data for such models (3.9.3.1) (Main Objective II).*

The proponents note that 'the Panel notes that stomach content data can provide some information on diet composition (species and size classes of prey consumed) and time of feeding. However, the Panel **recommends** that a more powerful approach to estimating energy intake (requirements) is to develop a bioenergetics model that estimates basic energy requirements using standard allometric relationships and previously collected data. Such a model would need to take into account age and maturity status of the animals. Costs of growth and the build-up in stored energy reserves could be estimated using the change in body mass, as well as changes in energy density of collected animals (e.g. changes in lipid content in blubber, fat storage in core), growth and energy density of the foetus and placenta. These could be evaluated as within-season changes in growth and energy storage, to determine total energy requirements. Such data can be used for inter-annual comparisons in growth and energy reserves – these might be expected if density-dependent factors are affecting the dynamics of the population. Such effects may result from changes in Antarctic minke whale abundance, competition or changes in environmental carrying capacity. They would be expected to impact on minke whale growth rates, energy storage (lipid content of blubber, energy density of the core), foetal development or growth of calves and would be reflected as changes in body mass, lipid content of the blubber, energy density in the core or slower growth at age. An illustrative example for some of this is found in Lindstrøm *et al*. (2009)' (Item 3.9.3.1 of SC/66a/Rep6, p24).

With regard the recommendation above for the estimation of consumption using a bioenergetics model, referring Lindstrøm *et al*. (2009) as an illustrative example, the proponents draw attention to the related work conducted by Tamura and Konishi (2009) and Tamura *et al*. (2014). These authors used body weight and maturity status in the standard allometric model. However, the scope of the recommendation from the Review Panel above is much wider and more complicated. The proponents understand that this exercise will help achieve the Main Objective II. The proponents will make efforts to develop more sophisticated calculations adding some categories such as age, growth and maturity

status based on energy requirements through change in blubber mass and lipid contents as suggested. It should be noted that the proponents will use the data collected previously regarding the body weight-length relationship and maturity status as much as possible; however the proponents also need recent data to examine the lipid content and blubber weight relationship and to monitor and forecast the dynamics of the Antarctic marine ecosystem from NEWREP-A samples. It should be noted however that using data collected previously is important in building the basic structure of the bioenergetics model but collection of recent data is essential for monitoring and forecasting the dynamics of the Antarctic marine ecosystem. Preliminary results of the analyses will be reported to the 2016 IWC SC meeting. It should be noted that the proponents also conduct consumption calculations based on the stomach contents in parallel.

For both calculation methods based on allometry (bioenergetics model) and stomach contents, the proponents will conduct the Monte-Carlo simulation trials which have been recommended by the JARPAII Review Panel and the IWC SC to take into account the actual range of the estimates including the uncertainties (see Tamura *et al.* 2014). In the calculation from the stomach contents, the proponents will continue to make efforts to minimize uncertainties in *r* (the ratio of low/high feeding intake), the length of the feeding season and the extent of night feeding for better estimation by satellite tagging, stable isotope of baleen plates and night-time sampling.

23. *Investigate stable isotopes along edge of baleen plates to see if this provides insights into duration of time on feeding grounds (3.9.3.1) (Main Objective II).*

In discussing techniques to investigate duration of Antarctic minke whales in the feeding grounds the Review Panel stated the following. 'However, the Panel also **notes** that satellite transmitters and data loggers will, of course, only be able to provide information from the moment they are deployed; under the proposed programme this will occur sometime after the arrival of the whales on the feeding grounds. Unless tags remain attached for almost a complete year, they will only provide a date of departure from the feeding grounds, not the date of arrival, thus preventing determination of the complete feeding period. The Panel **notes** that sequential analysis of stable isotope signals along the edge of baleen plates may provide an insight into such duration (e.g. Aguilar *et al.*, 2014; Best and Schell, 1996; Lee *et al*., 2005) and **recommends** that this be investigated from existing samples, if they exist' (Item 3.9.3.1 of SC/66a/Rep6, p25).

The proponents agree with this recommendation. Information from this approach can be compared with the results of the satellite tagging studies on duration of whales in the feeding grounds. The proponents note that stable isotopes in baleen plate were studied for some baleen whale species including the North Pacific common minke whale. The growth rate of the baleen plates for the North Pacific common minke whale was estimated to be 129 mm/y, and it appeared that a dietary record of about 1.4 years remained in the baleen plate (Mitani *et al.*, 2006).

The growth rate of the baleen plates for the Antarctic minke whale has not been reported. Considering this and the recommendation from the Review Panel, the proponents will conduct stable isotopes analyses ($\delta 13C$ and $\delta 15N$) in baleen plates to estimate the duration of the period in the feeding grounds in the Antarctic minke whale. The proponents will analyse stable isotopes in baleen plates (n=10-20) of Antarctic minke whales collected under JARPAII early during the NEWREP-A program. The results of the analyses will be reported to the IWC SC in 2018.

24. Use 'non-lethal' techniques on all animals; develop 'condition indices'; work to develop non-lethal techniques for total consumption (3.9.3.3) (Main Objective II).

The proponents note that several feasibility studies will be conducted through NEWREP-A to investigate the usefulness of non-lethal techniques in feeding ecology studies. Furthermore, the proponents note that the Review Panel recognises that there are few or no well-developed non-lethal alternatives for studies on 'condition index', 'total consumption', or 'prey composition' at present, and that in Item 3.9.3.3 it does not clearly recommend any specific non-lethal methods to be explored while mentioning a few possible alternatives with some potential. The proponents share that recognition, and they do not have any particular idea on possible approaches to be taken for those studies at the moment either. Therefore, our intention is to always pay attention to advancement of novel methodologies or approaches in the broad field of related scientific research and to revise the NEWREP-A research plan to incorporate such methodologies/approaches if they are considered to be worth exploring for those

studies. In this regard, any information or advice on such methodologies and/or approaches with some potential will be always welcomed throughout NEWREP-A.

25. *Provide an improved outline of the proposed ecosystem and multispecies model structures and provide a data gap analysis (3.11.2) (Main Objective II).*

The proponents note that 'the Panel agrees that the ecosystem and multispecies modelling in the proposal seems generally to be valid approach to the main Objective II of investigating the ecosystem through modelling studies' (Item 3.11.2 of SC/66a/Rep6, p28).

The proponents also note that the Review Panel '**recommends** that any revised proposal should include an outline of the proposed model structure in the Appendix 12 of the NEWREP-A proposal'. Furthermore the Review Panel made the following statement. 'The multispecies modelling would require knowledge, preferably based on time series of data, on the following for each predator species. For each input the relevant section of this report is given in brackets

(1) Number/biomass of each species (3.2)
(2) Total consumption by each species (3.9)
(3) Relative consumption of different prey by each predator species (3.9)
(4) Predator response to changed food availability (3.9)
(5) Link between food consumption and biological outcomes (e.g. condition, growth, breeding success) (3.9)
(6) Total available food (3.6)

The Panel **recommends** that the project proposal include more emphasis on describing now each of these data needs will be achieved and a 'gap analysis' should be conducted early in the timeframe. This would use the model structure to identify the relative importance and quality of the data underlying the various sections of the model' (Item 3.11.2 of SC/66a/Rep6, p28).

The proponents agree with those two recommendations from the Review Panel and recognize that the proponents should describe in more details the data considered for the models. Following the Review Panel suggestions, the proponents will provide, for each species, a brief description of the underlying data and data quality together with an explanation of how the information will be acquired. Data gap will be identified.

The proponents understand that information on data for the modelling exercise and on how the information will be obtained was explained in different sections of the NEWREP-A research plan, and also in Kitakado *et al.* (2014b), but that such information should be more detailed and assembled in the context of the Review Panel recommendations. The proponents agree that the outline of the model structure to be developed would assist in the identification of the relative importance and quality of the data.

The proponents note that the Review Panel suggests that this work 'should be conducted early in the timeframe'. In Table 1 of SC/66a/Rep6, the Review Panel suggest a time 'within three months'. The proponents agree that this should be conducted early in the timeframe of NEWREP-A research and therefore they will work on the two recommendations above during the 2015-16 period. Progress of this work will be presented to the 2016 IWC SC meeting and a final report will be presented to the 2017 IWC SC meeting.

It should be clarified here that the two types of ecosystem models, multispecies production model and whole (spatial) model, will be developed in parallel.

26. *Provide a thorough power analysis of sample sizes required to detect change in ASM and follow the other recommendations in this Item (4.3.2) (Main Objective I).*

During the discussion on sample size estimation, 'the Panel **recommends** that the proponents conduct a power analyses for ASM using simulation by postulating a fairly complex and realistic process model, fitting it to available data, and then simplifying it by eliminating factors that are not supported by the data' (Item 4.3.2 of SC/66a/Rep6, p31).

This recommendation will be addressed in the context of the work related to Recommendation 1 (see the text responding to Recommendation 1 above). The proponents will report on the outcome at the 2015 IWC SC meeting.

27. *Provide additional analyses on effect of catches upon the stocks for comparison with those presented (5.2 and 8.5) (Others).*

With regard to the effect of proposed catches upon the stocks the Panel summarized the following: 'The proponents provided results based on one application of the CLA and by using program Fitter (de la Mare, 1989) to conclude that catches of the order of 333 every second year in the two study areas will not harm the stocks. Given the estimated abundances of the stocks involved, the precautionary nature of the RMP and the nature of the sampling regime proposed following transect lines, the Panel **agrees** that this conclusion is very likely robust to whichever analytical method is applied' (Item 8.5 of SC/66a/Rep6, p41). However the Panel made some recommendations for additional analyses: i) based on RMP variant that had been recommended by the Scientific Committee in 1992, and using 0.72 as the tuning level; ii) projections based on the SCAA rather than Fitter.

Given that the Review Panel already states in its report that "this conclusion is very likely robust", the proponents do not consider the additional analyses suggested as urgent. Through the NEWREP-A program they will continue to use the combination of the RMP-type approach (as suggested at the JARPAII review meeting) and other available methods including Fitter to further evaluate the effect of the catches on the stocks. For this aim they will use the most recent information as input data.

28. *Improve mechanisms for co-operative research (7.2 and 8.7) (Others).*

The proponents note that the Review Panel made the following statement on this matter. 'Whilst welcoming the intention of the proponents for outside collaboration, the Panel **agrees** that at this stage there is insufficient information available for it to comment on the extent and the scope of collaborations with national and international scientific bodies'. The proponents further note that the Review Panel lists three specific points on this matter: (1) *ad hoc* collaborations on specific issues; (2) the development of a formal protocol for outside scientists to express interest; and (3) the development of a strategy to promote incorporation of external Japanese and/or foreign scientists into the research (Item 8.7 of SC/66a/Rep6, p40).

Regarding the first point, and as noted by the Review Panel, the proponents are in the process of contacting potential partners, and co-operative research will be identified and arranged for specific items in due course, preferably before research activities on such items start. As for the second point, the proponents recognize the necessity to introduce such a formal protocol in order to enhance the efficient collaboration. The proponents will develop and post such a protocol on the ICR's website (both in Japanese and English) well in advance of the first research cruise under the NEWREP-A. With respect to the third point, the proponents agree to the elaboration of a strategy to promote incorporation of external Japanese and/or foreign scientists/organizations into the NEWREP-A. Our idea at the present time is: 1) to continue to contact specific potential collaborators directly; and 2) to invite co-operative research widely through the internet (e.g. ICR's website) and at related meetings (including those of the IWC Scientific Committee) indicating specific research items for collaboration. Our proposed 'annual progress report' to the IWC SC (see the next item), would also help to promote research collaboration with external scientists/organizations, since, as noted by the Review Panel, 'the NEWREP-A programme could potentially provide new information relevant to the work of the Scientific Committee, in addition to those related to in-depth assessments, RMP and ecosystem modelling'.

The proponents also note that the Review Panel especially mentions the importance of co-operation with CCAMLR in relation to the proposed krill surveys (Items 7.2.1 and 8.7). As the first step for that, a Japanese scientist to be involved in those surveys participated in SG-ASAM (Sub-Group on Acoustic Survey and Analysis Methods) of SC-CAMLR, which was held in Busan, Republic of Korea, over 9-13 March 2015. The proponents will present an outline of their research plan for the CCAMLR-type krill survey (in the first 6-year period) at WG-EMM (Working Group on Ecosystem Monitoring and Management) of SC-CAMLR to be held in Warsaw, Poland, over 6-17 July 2015. The proponents plan to submit a full survey plan to the next WG-EMM in 2016, reflecting the comments derived from discussions at SG-ASAM, WG-EMM and SC-CAMLR in 2015.

29. *Provide information on programme management, personnel and logistic resources (8.2) (Others)*

The proponents note with pleasure that the Panel welcomed the greater detail concerning timelines provided at the review workshop while it recommended provision of further information on program management, personnel and logistic resources. The proponents also note that the Panel regarded this recommendation as 'relevant to improve existing components of the proposed programme' and suggested to respond it 'throughout the program' in the Table 1 of SC/66a/Rep6.

As for the whole program management, the Fisheries Agency of Japan (FAJ) will assume responsibility for this including provision of the funding necessary. Regarding personnel resources to be engaged in the program, scientists from the ICR will play the leading role in order to pursue research activities and achieve the research objectives of NEWREP-A in collaboration with scientists from other domestic and/or foreign organizations, such as the Tokyo University of Marine Science and Technology, the National Research Institute of Far Seas Fisheries and the National Research Institute of Fisheries Science (ICR scientists are currently contacting foreign colleagues and relevant research institutions to discuss future collaboration under the NEWREP-A).

Having said that, since it is almost impossible to fix every aspect of the program management 'throughout the program' at an initial stage, the proponents intend to provide relevant information to the IWC SC every year in an annual progress report for the SC's comments and suggestions so that the proponents could secure steady progress of the program in an open and transparent manner. This information will contain any progress achieved for each sub-objective (e.g. abundance estimates for Antarctic minke whales taking into account of $g(0)$ and additional variance) as well as the involvement of external scientists/organizations and their roles. This annual update and comment process through the IWC SC will appreciably improve the management of the proposed program throughout its duration.

The latest version of the program timeline is presented in Figure 1.

SPECIFIC COMMENTS AND RESPONSES TO OTHER RECOMMENDATIONS

Calibration among age readers (earplug) (3.3.4)

The Review Panel stresses the importance of (a) not relying solely on one reader in any long-term programme and (b) calibration of any new readers (and periodically 'old' readers) using the existing standard dataset.

The proponents note that age reading of NEWREP-A earplugs will be conducted by the same scientist who read JARPA II samples. Therefore, inter-reader variability will not be an issue at the first stage of NEWREP-A. However in the longer time the proponents agree on the importance of multi readers for improving the reliability of age data based on earplugs, and the proponents are planning to train a new reader (s) through the first six years of NEWREP-A. Detailed calibration will be conducted and inter-reader variability will be assessed by the method of Kitakado *et al.* (2013) when different readers participate in age reading.

Species targeted for abundance estimates in Main Objective II (2.2.2)

In its evaluation on the relevance of Main Objective II of NEWREP-A 'the Panel **recommends** that species for which abundance estimates are obtained in Objective II (ii) match with the species to be modelled in Objectives II (iv) and II (v)' (Item 2.2.2 of SC/66a/Rep6, p8).

The proponents agree with this recommendation. In principle, species for which abundance estimates are obtained in Objective II (ii) are planned to match with the species to be used in ecosystem models.

Use of retinol as body condition index (3.9.3.2)

The proponents note that in relation to the proposed use of retinol as chemical marker 'the Panel **questions** the validity of this approach and they **reiterates** that body mass-at-length, blubber mass,

percent lipid (in blubber) and other metrics are likely to be more robust than retinol' (Item 3.9.3.2 of SC/66a/Rep6, p25).

The proponents agree with the Review Panel on this point. Instead of retinol, the proponents plan to analyse the lipid content % of blubber throughout NEWREP-A research. At first, the total lipid content % of blubber from mid lateral position (near the position used in JARPA and JARPA II for the point measurement of blubber thickness) will be analysed since this position has been informative of changes of blubber thickness in relation to feeding season (Konishi *et al.*, 2008). The lipid content % of blubber will be compared to other body condition indicators such as blubber thickness and girth measurements. As an initial feasibility test, the measurements of body conditions (blubber thickness, girth, total fat weight and he total lipid content % of blubber) from Antarctic minke whales collected under the NEWREP-A will be used. At least 50 whales for each sex and sub area will be used for this analysis.

Use of drones for body length measurement (3.4.3.1)

'The Panel **notes** that aerial photogrammetric techniques (from aircraft and drones) can be effectively used to estimate whale length (Perryman *et al*. 2014) and so the Panel **recommends** considering the possibility of using drones' (Item 3.4.3.2 of SC/66a/Rep6, p17).

The proponents recognize that attempts to photograph the animal from the sky using drone to estimate body length has been developed in recent years (Goebel *et al*., 2015; Perryman *et al*., 2014). The proponents note that photogrammetric techniques from drones are useful for the investigation of wild animals without threatening target individuals, but there are some limitations in this technique such as limitation of payload capacity, ability to withstand high wind and short endurance. Considering the use of drones on moving vessels under high wind speed and large swell conditions which are specific feature in northern part of NEWREP-A research area, the proponents reached the conclusion that the use of drones in NEWREP-A is impractical at this stage.

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Table 1. Summary of the responses from the proponents to the 29 recommendations provided by the Review Panel, including timeframe of the works. A=To evaluate contribution of a particular objective or sub-objective of the programme to meet conservation and management needs; B=to evaluate feasibility of particular techniques (whether lethal or non-lethal); C= relevant to a full evaluation of whether any new lethal sampling is required; D= relevant to issues related to sample size (irrespective of method used to obtain data); E= relevant to improve existing components of the proposed programme (key for 'Purposes' obtained from SC/66a/Rep6) ('Reasoning' is for longer timeframe planned by the proponents than the timeframe suggested by the Review Panel)

Review Panel recommendations				Proponents' responses		
# (Item)	Summary	Purpose	Timeframe	Summary	Timeframe	Reasoning
1 (2.1.2)	Evaluate the level of improvement that might be expected either in the SCAA or in RMP performance by improved precision in biological parameters using simulation studies including updated Implementation Simulation Trials	A, C, D	Within 6 months	Simulation study to be conducted	Before the 2015 IWC SC meeting	-
2 (3.1.3)	Analyses to distinguish between 2-stocks with mixing versus isolation by distance	A, D	Within 3 months	Analyses to be conducted to elucidate whether the genetic and morphometric data are consistent with isolation by distance hypothesis	Within program (results to be presented to 2016 IWC SC meeting)	IWC SC agreed that it would be reasonable to use the two-stock hypothesis as a default for in-depth assessment (IWC, 2014), i.e. the two-stock with mixing hypothesis is more plausible than the isolation by distance hypothesis. .
3 (3.1.3)	Simulation study to examine how additional sampling could be expected to improve precision and/or reduce bias in estimates of mixing rates	A, D	Within 3 months	Simulation study to be conducted	Within program (results to be presented to 2016 IWC SC meeting)	Priority is given to the tasks with respect to recommendation 1 above.
4 (3.1.3.1)	Comprehensive biopsy sampling feasibility study	B, C, D, E	1-2 field seasons	Feasibility study to be conducted, taking account of all four technical suggestions	Within program (first two-three years)	-
5 (3.1.5)	Comprehensive telemetry feasibility study	B, E	2-3 field seasons	Feasibility study to be conducted, taking account the technical suggestions, particularly making effort to collaborate with research groups with experience in	Within program (first two-three years)	-

				telemetry study of whales		
6 (3.2.2)	Estimate $g(0)$ for all species	E	Throughout program	Data to be collected using IO mode and analyzed for not only the Antarctic minkes but also other whale species	Throughout program	-
7 (3.2.2)	(1) review survey design and methods taking into account: (a) analysis of IWC IDCR/SOTHE PROPONENTSR cruises; (b) spatial modelling developments; (c) experience of previous multi-disciplinary surveys; (d) JARPAII review recommendations; (e) the possibility of focused surveys on specific issues in some years; (f) whales within the ice; (g) updated analyses of the effects of survey interval and estimation of trend (2) work closely with the IWC Scientific Committee before finalizing survey approaches; (3) ensure that future survey plans submitted to the Scientific Committee follow fully the guidelines for such survey plans, including incorporating proposed track lines	E	Within 6 months then throughout	Sighting survey plans taking account of the technical suggestions to be presented and discussed at annual IWC SC meetings	Throughout program	-
8 (3.3.4)	Examine feasibility of using DNA methylation ageing technique with Antarctic minke whales using good quality earplugs, testing against geographical areas and different time periods	B, C, D	Within 1 year	Feasibility study to be conducted, initially using existing 'highly readable' earplug samples and testing for stock, sex and year of sampling differences.	Within program (preliminary results to be presented to 2017 and final results to 2018 IWC SC meeting)	Proponents need acquire familiarity with the technique. The result of this feasibility study alone does not affect the proposed sample size.

	and using several laboratories					
9 (3.4.3.1)	Examine use of hormones in blubber to detect sexual maturity	B, C, D	Within 2 years	Feasibility study to be conducted initially using existing blubber samples from JARPAII, for female at different reproductive status	Within program (results to be presented to the 2017 IWC SC meeting)	-
10 (3.4.3.1)	Evaluate the effect on SCAA of assuming 'resting' females are immature females	A, C, D	Within 6 months	Simulation study to be conducted	Before start of the program	-
11 (3.4.3.2)	Update SCAA with respect to density-dependence following Punt et al., in press, and stock mixing based on existing data	A, C, D	Within 3 months	Simulation study to be conducted	Before the 2015 IWC SC meeting	-
12 (3.4.3.2)	Identify more fully the data to be used to inform the time-varying natural mortality in the SCAA and analyze existing data to determine the feasibility and accuracy of obtaining such estimates.	A, C, D	Within 6 months	Simulation study to be conducted in the context of work related to recommendation1 above	Before the 2015 IWC SC meeting	-
13 (3.4.3.2)	Develop metrics to evaluate the benefits of including time varying ASM data in the SCAA	A, C, D	Within 3 months	Simulation study to be conducted in the context of the work related to recommendation 1 above	Before the 2015 IWC SC meeting	-
14 (3.6.2.1)	Consider the adoption of this multibeam sonar in krill surveys.	E	Within 6 months	The adoption of the multibeam sonar in krill survey vessels to be considered	Within program (before the first CCAMLR-type krill survey to be conducted)	Not urgent issue and needs careful consideration
15 (3.6.2.3)	Trial the ship and echosounder system(s) in Japan the well before going to the Antarctic to determine the likely effective acoustic sampling range and potential for detecting krill for multiple frequencies over the required survey depth. Conduct for both annual	B, E	Within 1 year for annual surveys	Trial the ship and echosounder system (s) to be conducted well before going to the Antarctic every year	Throughout program	-

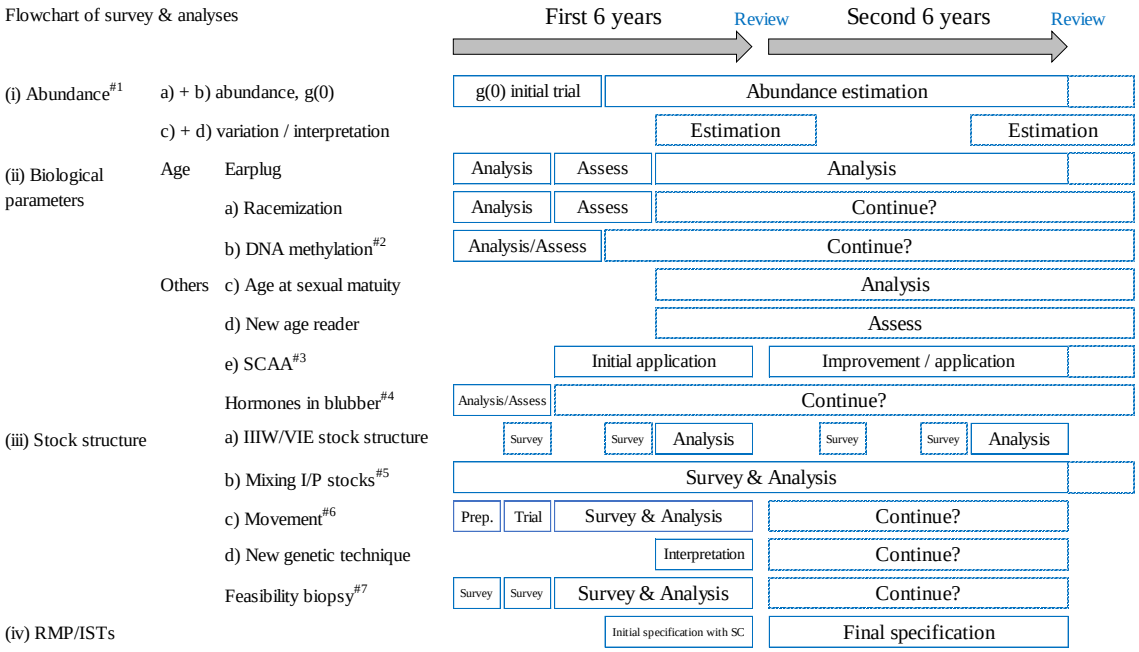
	and broad-scale survey vessels.					
16 (3.6.2.5)	In the years (two out of 12) when both NEWREP-A and CCAMLR-type surveys are conducted, try to survey the same transects by both vessels in near synchrony	E	Within program	Cross-calibration between the two types of krill survey vessels to be carried out in waters around Japan in a near synchronous way (possibly in the survey area if conditions are met)	Within program	-
17 (3.6.2.6)	Conduct full analysis of statistical power to detect changes in krill abundance from proposed techniques	A, E	Within 6 months	To be considered in collaboration with CCAMLR experts	Within program (earlier in the program)	Not an urgent issue and needs careful consideration in consultation with CCAMLR experts
18 (3.6.2.7)	Develop more detailed plans to consider whether comparisons between stomach contents and proposed krill survey data are feasible and if so, how they can be done	A, B, C	Within 3 months	Consideration to be given to conduct a simultaneous survey by the three type of vessels (two types of krill survey vessels and the whale sampling vessel) within a small-scale experimental survey area over a short time period (one week)	Within program (before the first CCAMLR-type krill survey)	Not an urgent issue and needs careful consideration in consultation with CCAMLR experts
19 (3.7.2)	Ensure that sufficient time is allocated for adequate net sampling, based an analysis of previous net sampling data (e.g. BROKE/BROKE West data).	E	Within program	Sufficient time for net sampling to be allocated considering previous CCAMLR-surveys as guidelines	Within program (before the first CCAMLR-type krill survey)	-
20 (3.8.2)	Give careful consideration to scale and design of oceanographic sampling, taking into account BROKE/BROKE West data	E	Within program	Careful consideration to be given to the scale and design of oceanographic survey, considering previous CCAMLR-surveys as guidelines	Within program (before the first CCAMLR-type krill survey)	-
21 (3.9.3.1)	Compare overlap in diet amongst fin and Antarctic minke whales using stable isotopes in skin, with concurrent analyses of krill samples to obtain stable isotope	E	Throughout program	Isotope study to be conducted in two parts: first analyses in the prey species (krill) to ensure the correct determination of stable isotope baselines, and second analyses in three baleen whale species based on blubber samples	Within program (first six years as a first step)	-

	baselines,					
22 (3.9.3.1)	Develop a more powerful approach to estimating energy intake (requirements) using a bioenergetics model; evaluate non-lethal methods for obtaining a time series of tuning data for such models	A, B, D	Within 6 months	Effort to be made to develop more sophisticated bioenergetics models using the data collected previously regarding the body weight-length relationship and maturity status as much as possible, in parallel with prey consumption estimates based on stomach contents	Within program (preliminary results to be presented to 2016 IWC SC meeting)	The result of this exercise alone does not affect the proposed sample size
23 (3.9.3.1)	Investigate stable isotopes along edge of baleen plates to see if this provides insights into duration of time on feeding grounds.	B	Within 6 months	Study to be conducted initially using baleen plates of Antarctic minke whale collected during the JARPAII. Results will be compared with the results of satellite tagging studies	Within program (preliminary results to be presented to 2018 IWC SC meeting	Time is required by the proponents to acquire familiarity with the technique. The result of this investigation does not affect the proposed sample size
24 (3.9.3.3)	use 'non-lethal' techniques on all animals; develop 'condition indices'; work to develop non-lethal techniques for total consumption	E	Within program	Feasibility studies to be conducted if there will be novel non-lethal methodologies and/or approaches with some potential	Throughout program	-
25 (3.11.2)	Provide an improved outline of the proposed ecosystem and multispecies model structures and provide a data gap analysis	E	Within 3 months	More detailed description of underlying data and data quality related to ecosystem modelling to be provided, with an explanation of how the information will be acquired. Data gaps will be identified	Within program (preliminary results will be presented to the 2016 IWC SC meeting and final results will be presented to the 2017 IWC SC meeting)	Needs careful consideration
26 (4.3.2)	Provide a thorough power analysis of sample sizes required to detect change in ASM and follow the other recommendations in this Item	D	Within 3 months	Simulation study to be conducted	Before the 2015 IWC SC meeting	-
27 (5.2 and 8.5)	Provide additional analyses on effect of catches upon the stocks for comparison with those presented	E	Within 3 months	Additional analyses to be conducted based on RMP-type and other available methods including Fitter, and reflecting further improvement of SCAA	Within the program (first six years)	Given the conclusion of the Review Panel, there is no urgency in conducting this work
28 (7.2 and 8.7)	Improve mechanisms for co-operative research	E	Within 3 months	Attempts to be made to improve the mechanism based on three suggestions	Before and throughout program (first six years)	-

29 (8.2)	Provide information on programme management, personnel and logistic resources	E	Throughout program	Information to be provided as the program progress. Relevant information to be provided to the IWC SC every year in an annual progress report for the SC's comments and suggestions	Throughout program	-

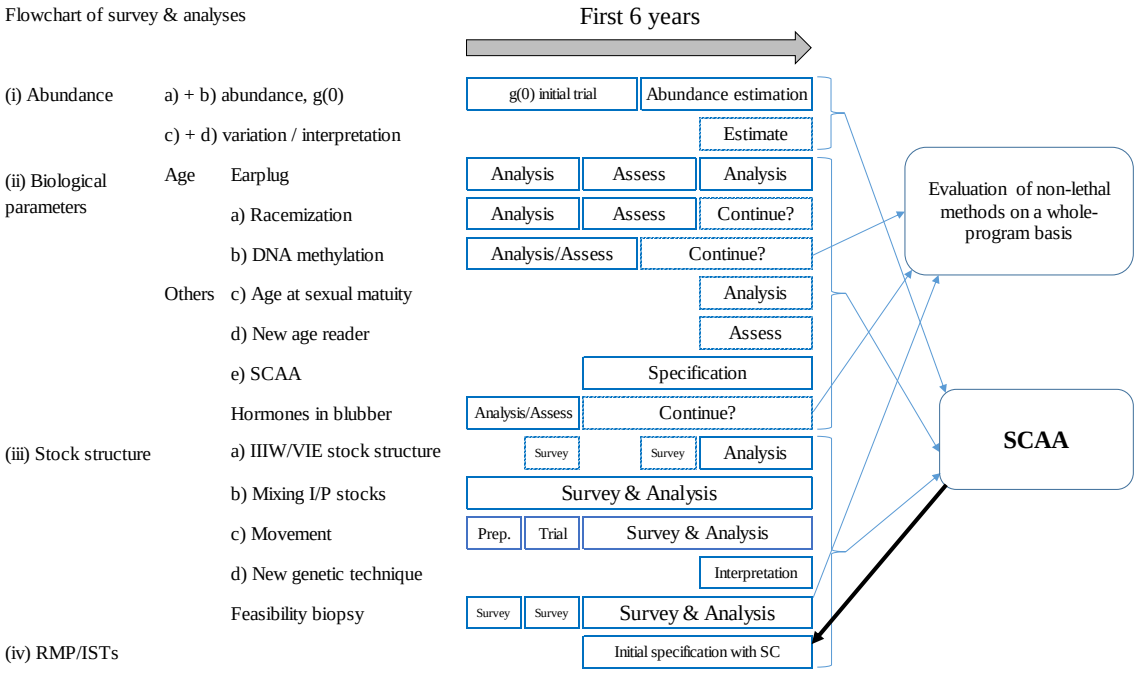
Main Objective I

Flowchart of survey & analyses



Main Objective I

Flowchart of survey & analyses



[#1] The survey plan for each austral summer season including details of the survey design, will be presented to the annual IWC SC meetings. The survey design will take into account the specific research activities planned for a particular Area and austral summer season, and will follow the seven guidelines or suggestions provided by the Review Panel regarding survey design. The survey design for the first two-three years will include feasibility studies on biopsy sampling and telemetry of Antarctic minke whale. The survey plan for the 2015/16 austral summer season will be presented to the 2015 IWC SC meeting (see details in the main text).

[#2] At first, the stock effect on the DNA methylation technique will be examined using 50 highly readable earplugs each from I and P-stocks. In the next step the effect of the period will be examined by using similar number of samples from different austral summers. A specialized laboratory and a university in Tokyo have been contacted so that this study can be conducted in collaboration with experts. Preliminary results will be reported to the 2017 IWC SC meeting and final results at the 2018 IWC SC meeting.

[#3] The proponents will respond to several SCAA/RMP-related recommendations from the Review Panel through a specific plan to be implemented with the highest priority (see details in main text). A progress of the work in this plan will be presented to the 2015 IWC SC meeting, before the starting of the program.

[#4] The proponents will conduct progesterone analyses in blubber tissues of Antarctic minke whales using JARPAII samples. Females with various reproductive status such as ovulating, resting and pregnant with small fetus will be selected, and

hormone levels will be compared with histological information of reproductive organ. Analysis of progesterone level for a total of 50 Antarctic minke whale samples will be assayed using the compact ELISA workstation (Crocodile, Titertek Berthold). Progesterone will be assayed with the Cayman Practice ELISA Kits (Cayman Chemical), according to the manufacturers' protocols. Preliminary results will be reported to the 2017 IWC SC meeting.

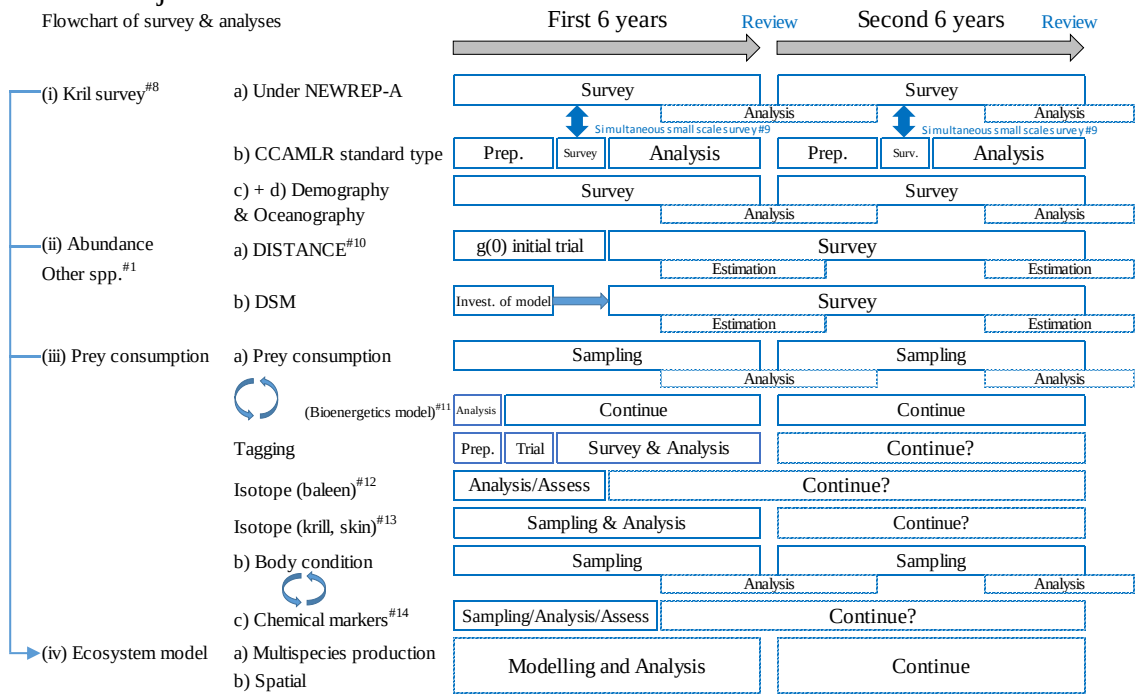
[#5] The estimation of performance will consider the use of a random effect model for the mixing proportions, by using a statistical principle of "borrowing strength". This work will be conducted once the proponents have some progress in the tasks related to recommendations on SCAA/RMP, which have the highest priority.

[#6] The feasibility study on telemetry in Antarctic minke whale will be undertaken along the dedicated sighting surveys, in the early stage of the first six-year period of NEWREP-A. Detailed study design will be provided in the sighting survey plan to be presented and discussed at the annual IWC SC meetings. With regard field methods as well as tag types, the proponents will collaborate and consult with experienced foreign and Japanese colleagues (see details in the main text).

[#7] The feasibility study on biopsy sampling in Antarctic minke whale will be undertaken along the dedicated sighting surveys, in the early stage of the first six-year period of NEWREP-A. Originally the NEWREP-A plan stated that this feasibility study would be conducted in Areas IIIW and VIE. Because this feasibility should be conducted early in the program, it will be conducted in the IWC Area to be covered by the sighting surveys in 2015/16, 2016/17 and 2017/18 (not necessarily in Areas IIIW and VIE). Detailed study design will be provided in the sighting survey plan to be presented and discussed at the annual IWC SC meetings (see details in the main text).

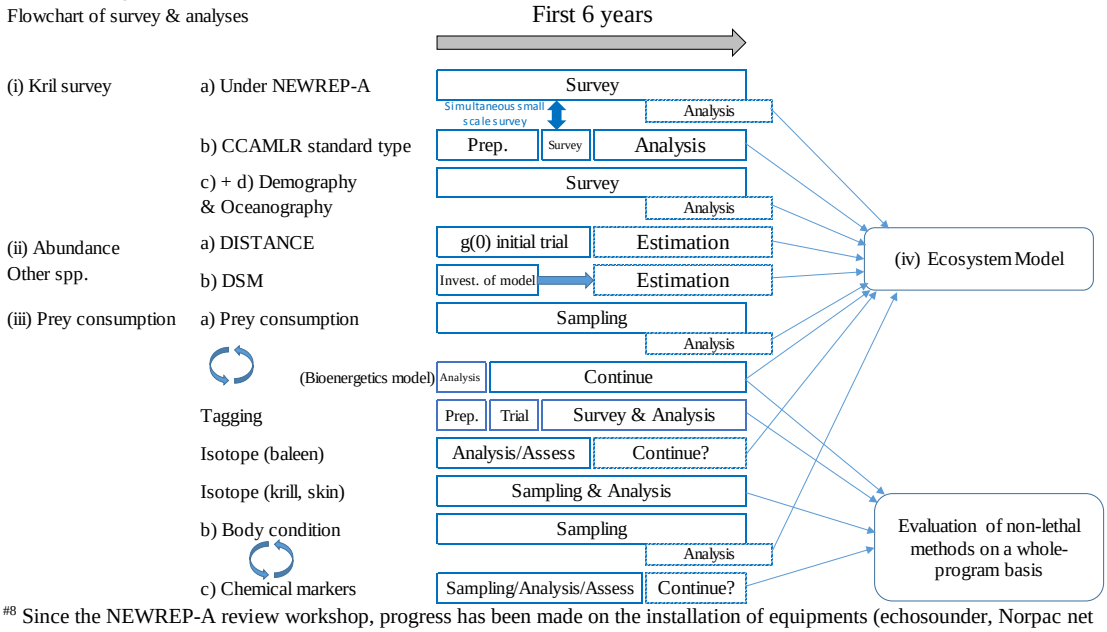
Main Objective II

Flowchart of survey & analyses



Main Objective II

Flowchart of survey & analyses



[#8] Since the NEWREP-A review workshop, progress has been made on the installation of equipments (echosounder, Norpac net and CTD) in the research vessel that will be engaged in krill surveys under NEWREP-A. During this work the specifications made by the Review Panel for those instruments are being taken into consideration.

[#9] The proponents will consider to conduct a simultaneous survey by a krill survey vessel equipped with a frame-type trawl and echosounder, the dedicated sighting vessel equipped with an echosounder and the whale sampling vessels within a small-scale experimental survey area over a short time period (e.g. one week) so that comparisons among vessels/samples can be made.

[#10] Identification of duplicate sightings will be also conducted for whale species other than Antarctic minke whale during the NEWREP-A sighting surveys in IO mode. To determine whether *g(0)* is significantly different from one, analyses on duplicate sightings will be conducted for those whale species where sufficient data are obtained during the NEWREP-A program. Details will be provided in the sighting survey plans to be presented to the annual meetings of the IWC SC.

[#11] The proponents will make effort to build more sophisticated models adding some categories such as age, growth and maturity status based on the energy requirement by change in blubber mass and lipid contents. Previously and newly collected data will be used. Preliminary results of this work will be reported to the 2016 IWC SC meeting (see details in the main text).

[#12] Stable isotopes analyses (δ13C and δ15N) along the edge of baleen plates will be conducted to estimate time duration of Antarctic minke whale in the feeding grounds. Stable isotopes in baleen plates (n=10-20) of Antarctic minke whales sampled under JARPA II will be analysed early in the research program, as an initial step. The results of the analyses will be reported to the IWC SC in 2018.

[#13] As a first step in the work to compare overlap in diet amongst fin and Antarctic minke whale using stable isotope, krill samples will be analyzed to ensure the correct determination of stable isotope baselines. This will be done during the first six-

year period of NEWREP-A. Concurrently, the proponents will examine the overlap in diet amongst fin, humpback and Antarctic minke whales using stable isotope ratios in skin samples collected by lethal method (Antarctic minke whales) and by biopsy sampling (fin and humpback whales). This analysis will be carried out early in the NEWREP-A program based on the information accumulated on stable isotope baselines of krill in each area. Results will be presented to the IWC SC meeting as appropriate in the first six-year period and evaluated at the mid-term review of NEWREP-A (see details in the main text).

[#14] At first, the total lipid content % of blubber will be compared to other body condition indicators such as blubber thickness and girth measurements. As an initial feasibility test, the measurements of body conditions (blubber thickness, girth, total fat weight and the total lipid content % of blubber) from Antarctic minke whales collected under the NEWREP-A will be used. At least 50 whales for each sex and sub areas will be used or this analysis.

Figure 1. Updated timeline of research activities under NEWREP-A's Main Objectives I and II. For both Main Objectives, the upper part of the figures shows the timeline for the research activities in the entire 12-year period. The lower parts of the figures show the timelines for the first 6-year period, specifying the outputs and evaluation to be conducted after the first period. This figure is based on that originally presented to the NEWREP-A review workshop.