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Response to the Report of the Expert
Panel of the final review on the western
North Pacific Japanese Special Permit
program (JARPNII)

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INTERNATIONAL
WHALING COMMISSION

Response to the ‘Report of the Expert Panel of the final review on the western North Pacific Japanese Special Permit program (JARPNII)’

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ABSTRACT

The International Whaling Commission’s Scientific Committee (IWC SC) held the final review workshop on the Japanese Whale Research Program under Special Permit in the western North Pacific–Phase II (JARPNII) in February 2016. The review was based on data and analyses for the period 2000-2014, but many of the analyses included data from the JARPN (1994-1999). The review followed the guidelines specified in the revised Annex P. The Expert Panel Workshop (Review Panel) carried out the review on the basis of 55 scientific primary documents and 37 “For Information” documents prepared by the proponents. The proponents participated in the workshop only with the aim of presenting papers on particular agenda items and of responding to questions of clarification and substance regarding the work that had been undertaken or further work that was expected to be undertaken. The report of the JARPNII final review workshop is presented in document SC/66b/Rep 6. The objective of the present paper is to summarize the views of the proponents on the evaluation and scientific recommendations from the Review Panel. In general the workshop report produced by the Review Panel represents a fair and balanced evaluation of the work conducted under JARPNII. The Review Panel welcomed the scientific contribution of JARPN/JARPNII. At the same time, it identified those areas where further work is required and provided suggestions and recommendations that, if correctly implemented, would contribute to improving the scientific contribution of JARPNII.

INTRODUCTION

The International Whaling Commission’s Scientific Committee (IWC SC) held the final review workshop of the Japanese Whale Research Program under Special Permit in the western North Pacific –Phase II (JARPNII) in February 2016. The review workshop involved evaluation of data and analyses for the period 2000-2014. Many of the analyses presented included data from the previous JARPN program (1994-1999).

The IWC SC had carried out the mid-term review of JARPNII in 2009 (IWC, 2010). Originally, the 2016 review was expected to be a review of an ongoing program, but it was made to be the ‘final’ review at the SC meeting in 2015.

The decision to finalize the JARPNII program was made taking account of the International Court of Justice (ICJ) Judgment in the case concerning *Whaling in the Antarctic (Australia v. Japan: New Zealand intervening)*. The ICJ Judgment on 31 March 2014 states that “[i]t is to be expected that Japan will take account of the reasoning and conclusions contained in this Judgment as it evaluates the possibility of granting any future permits under Article VIII, paragraph 1, of the Convention” (paragraph 246). Therefore, while JARPNII was not included within the subject matter of the case, the Government of Japan reviewed the design of the ongoing JARPN II under its decision described in the Statement by Ministry for Agriculture, Forestry and Fisheries on 18 April 2014.]¹

¹ ‘Policy towards the Future Whale Research Programs’, Statement by Minister of Agriculture, Forestry and Fisheries, the Government of Japan, 18 April 2014 (available at <http://www.jfa.maff.go.jp/e/pdf/danwa.pdf>). Following the review, the design of JARPN II were adjusted as follows:

First, in order to clarify the basis for the calculation of sample size, the Government of Japan adjusted the priority of the research objectives considered in connection with the calculation of sample size. Secondly, target species for lethal sampling were re-examined for effective and efficient implementation of the research. For example, as a result of the re-examination, sperm whales were excluded from the target based on the outcome of

This review workshop in 2016 was held under the IWC SC guidelines specified in the revised Annex P. This annex was revised at the 2015 IWC SC meeting in response to the Commission Resolution 2014 (IWC, 2016). The overall objective of the Annex P process is to provide a balanced and objective review of a special permit research. According to the report of the workshop (SC/66b/Rep 6), the priority objective of the workshop was, in particular to:

- (1) assess the extent of the programme's scientific output;
- (2) assess the degree to which the programme coordinated its activities with related research projects;
- (3) evaluate other contributions to important research and information needs outside the original set of objectives; and
- (4) evaluate how well the objectives of the research were met, and the extent to which results have led to demonstrated improvements in the conservation and management of whales and/or other marine living resources.

An international group of experts (Review Panel) examined a total of 55 scientific documents prepared by the proponents, one observer document from Australian scientists and a response document from the proponents. In addition, a total of 37 "For Information" documents were also made available to the review workshop. The report of the JARPNII final review workshop is presented in document SC/66b/Rep 6.

The objective of this paper is to summarize the views of the proponents, on the evaluation by and scientific recommendations of the Review Panel.

The list of primary documents presented to the JARPNII review workshop by the proponents is shown in Annex 1 to this paper. Other documents responding to some of the short-term recommendations from the Review Panel will be presented to the IWC SC meeting in 2016.

OVERVIEW OF THE VIEW OF THE PROPONENTS

General view

The proponents consider that, in general, the final review workshop report produced by the Review Panel represents a fair and balanced evaluation of the work conducted under JARPNII program till 2014. The Review Panel members examined the data, analyses and results contained in each of the 55 primary papers as well in a large number of "For Information" documents. While the Review Panel welcomed and praised many of the studies conducted, they also identified aspects of the research that were not fully satisfactory and provided suggestions and recommendations that, if correctly implemented, would contribute to improving the results and scientific contribution of JARPNII. The JARPNII final review report is written in a concise and compact manner.

Recommendations from the 2009 mid-term review workshop

The Review Panel was particularly interested to see how the recommendations made at the 2009 mid-term review workshop (IWC, 2010) had been addressed by the proponents. The proponents appreciate the Review Panel's recognition that substantial effort had been made to respond to the recommendations from the 2009 review workshop.

In addressing them, there were some difficulties in clearly identifying the relevance of some of the recommendations to each of the objective in the 2009 review workshop report in the case of Objective 2 (monitoring environmental pollutants). In this case, the recommendations were summarized in a particular section of the report in page 414 of IWC (2010), but other recommendations were dispersed through the report. The proponents had assumed that only the recommendations summarized in the specific section (page 414) were the recommendations which required a response.

The proponents also note that the present Review Panel failed to recognize the responses to the 2009 review workshop report prepared by the proponents in 2009 (Pastene *et al.*, 2009). The proponents had responded already to some of the general recommendations and suggestions from the 2009 review workshop report in that document.

the past research (see, SC/F16/JR/54, p.2). Sample sizes of the remained target species were recalculated taking account of the latest information. Thirdly, for the purpose of examination of whether information derived from non-lethal methods could substitute those derived from lethal methods, the Government of Japan also decided to carry out comparative studies between lethal and non-lethal methods in JARPNII during the three years from 2014 to 2016, before designing a new scientific whale research programme in the western North Pacific. Results will be presented and reviewed after the field survey in 2016 is completed.

Recommendations from the final review workshop

The report of the Review Panel for the final review contains a list of new recommendations for the proponents as well as for the IWC SC (summarized in Annex E of SC/66b/Rep 6). The views and plans of the proponents in response to these recommendations in Annex E are given later in this paper. The proponents are pleased to see that this time all recommendations have been summarized in a clear manner, in a specific table, by research topics and with a timeline. The proponents will make their best efforts to address the recommendations as the proponents continue to analyze the data produced under JARPNII for publication after the final review. The proponents also note that addressing these recommendations is a continuing work.

Evaluation of sub-objectives and contribution to conservation and management

The proponents consider that the evaluation of JARPNII sub-objectives in the Table 10 of the review report (SC/66b/Rep 6) is fair and balanced. They also agree with the Review Panel's evaluation on the contribution of JARPNII to conservation and management of whale resources (SC/66b/Rep 6).

RESPONSES TO CONCLUSIONS AND RECOMMENDATIONS FROM THE REVIEW PANEL

Relevant texts from the Review Panel report are copied here in italics while comments and responses of the proponent are written in plain letters.

Broad sampling scheme including sample size, areas and strategy including changes over time and responses to the 2009 workshop recommendations (Item 3.4)

'The Panel recommends that a new document based upon Annex F is developed by the proponents and submitted to the 2016 Annual Meeting of the Scientific Committee. In addition to the information on sightings, the document should record, for each year and season:

- (1) the predetermined tracklines for sampling and the rationale for those lines; and*
- (2) the actual coverage of those tracklines and the rationale for any decisions taken to deviate from the predetermined lines including the rationale for any new lines developed.'*

The proponents will provide further information on the sampling design for both coastal and offshore components at the 2016 IWC SC meeting in accordance with the recommendations above (see Bando *et al.*, 2016).

'The Panel recommends that a single document be provided to the 2016 Annual Meeting that:

- (1) provides a clearer rationale for the changes in sample sizes and any implications for meeting the original objectives of the programme (e.g. related to time series of data, analyses and sample size); and*
- (2) provides the field and analytical protocols for the comparison of using lethal and non-lethal techniques for each key parameter taking into account the advice provided in 2009.'*

As to (1), the proponents are of the view that they have already provided clear rationales for the adjustment, and wish to reiterate that the rationales for the adjustment on sample sizes were provided at the 2015 SC (SC/66a/SP10) as well as the review panel meeting (SC/F16/JR54), which is also described in this paper (see, footnote 1.). The Government of Japan reviewed the design of the ongoing JARPNII underscored by scientific reasoning, under its decision described in the Statement by Ministry for Agriculture, Forestry and Fisheries on 18 April 2014 (footnote 1), in order to take account of the ICJ Judgement. The purpose of the changes in sample sizes includes conducting comparative research between lethal and non-lethal methods. With regard to implications of the adjustment for meeting the objectives of the programme, the comparative research is designed to verify a hypothesis that lethal methods could be replaced by non-lethal methods. In other words, if non-lethal methods adopted since 2014 produce equivalently useful data as the lethal method, there will be no hindrances to meeting the original objectives of the program. While the proponents will submit the provisional results of the comparative research to the 2016 IWC SC, the results of the verification will be reported after the three years (2014-2016) research period. It should be noted that the adjustment is limited to 2014-2016 period and when non-lethal methods fail, their implications for time series of data would be limited to three years. Further explanation on this point will be provided for the 2016 IWC SC meeting, if necessary.

As to recommendation (2), the proponents will submit the field and analytical protocols concerning the comparison of lethal and non-lethal techniques which was employed since 2014, to the 2016 SC meeting in accordance with this recommendation. (see Mogoe *et al.*, 2016).

Stock structure (Item 4.4)

Overview of proponents on Item 4.4

The proponents consider that this section is a good summary of the information on stock structure presented by the proponents at the review workshop. They also consider that the conclusions of the Review Panel regarding the four sub-objectives are reasonable (Table 10 of SC/66b/Rep6).

In the case of the common minke whales, however, the proponents consider that the assessment of the information on stock structure by the Review Panel was based to too great an extent on the genetics information alone, and failed to take the more integrative approach needed for an overall conclusion.

The proponents recognize that more analyses (genetic and non-genetics) were conducted on common minke whales in comparison with Bryde's and sei whales, and that for the latter two species most of the analyses were based on genetics.

In the conclusions on sub-objectives, the Review Panel noted that *'an assessment of putative OW and OE common minke whale stocks was undertaken following the recommendations by the 2009 Panel. However, the Panel realizes that further progress on this sub-objective relies (due to the absence of genetic heterogeneity) on identifying the defining dispersal rates between the putative OW and OE 'stocks' and the genetic expectations at these dispersal rates'*.

The proponents are of the view that the assessment and interpretation of stock structure in the case of the common minke whale should be based on all available information, both genetics and non-genetics, and not only on the interpretation of the genetic data as the Review Panel did in terms of its statement above. The proponents consider that a parsimonious interpretation of all information (*e.g.* genetics (data examined by homogeneity test, STRUCTURE, DAPC), age distribution, morphometry, sexual segregation and migratory pattern), point clearly to a single O stock in the western North Pacific. Furthermore preliminary kinship information presented to the workshop showed that parent-calf pairs were distributed across coastal and offshore areas which is near impossible to reconcile with the OW coastal stock hypothesis. Furthermore the new age data showed clear differentiation in relation to age class presence between coastal and offshore areas, suggesting the existence of a single stock exhibiting geographical segregation by age and sex classes.

Scientific decisions related to managing whale stocks, such as identifying stock structure, should be based on the best available information, and the proponents' approach follows this principle. Although recommendations for new and additional analyses only on genetics involve scientifically interesting work, continuing to respond to them would not contribute very much further to the process of making sound scientific decisions on stock structure. To put this in another way, the proponents cannot identify any holistic argument in the Review Panel report that supports continued justification for the hypothesis of a coastal OW 'stock.'

Comments from proponents on Item 4.4.2 (Evaluation of progress on 2009 recommendations)

The proponents agree with the evaluation of the Review Panel (Table 3 of SC/66b/Rep 6). The proponents only comment is on the recommendation *'Employ approaches that do not rely upon the assumption of mutation-drift-migration equilibrium when estimating population divergence'*, which was evaluated as 'not addressed' by the Review Panel. The 2009 review workshop had recommended the use of IM to address this matter. However, the proponents considered that this approach was not useful for the case of population with low effect sizes, as in the case of the common minke, Bryde's and sei whales in the western North Pacific.

Comments from proponents on Item 4.4.3.1 (Medium-long term recommendations)

'The Panel has developed the following recommendations for the medium-term, i.e. normally to be completed 2-3 years after the 2016 Annual Meeting.

- (1) In order to facilitate a more definitive discrimination between single and multiple stock hypotheses, work should be undertaken to determine the demographic dispersal rates among areas at which whales in different areas can be managed as a single stock. Such an assessment of 'critical' dispersal rates by specific case (i.e. species, area(s) and management objective) and the corresponding levels of genetic divergence, should enable the rejection of 2+ stock hypotheses and hence confirmation of a single stock where applicable. This general and difficult issue had been raised by the 2009 Panel, but without specific recommendations as to how it might be achieved. However, recently an illustrative example of how this might be achieved has been presented in Van der Zee and Punt (2014) and this approach is recommended to the proponents.*
- (2) As recommended by the 2009 Panel, analytical approaches should be applied that do not assume mutation-drift-migration equilibrium, such as the IM methods (Hey, 2010).*
- (3) Serious consideration should be given to using genome-wide SNP genotyping approaches, such as RAD sequencing and GBS (Elshire et al., 2011; Miller et al., 2007). This will increase the data per sample thereby improving the accuracy and precision of genetic parameter estimates and facilitate additional analyses (Hey and Machado, 2003; Robinson et al., 2014).*

(4) *A focussed satellite tagging programme should be developed to greatly increase sample size to assess individual migration in the context of stock structure hypotheses more thoroughly.*

The proponents agree with recommendation (1), and will start working toward a definition of stock for management purposes by examining the literature indicated by the Review Panel.

Regarding recommendation (2), and as noted by the Review Panel in Table 3 of the report (SC/66b/Rep 6), these assessments may not be feasible for the cases of O stock common minke, Bryde's and sei whales where the effect sizes are low. Instead, the proponents will use kinship information as a way to estimate migration rates, as this is an approach that does not depend on the assumption of genetic equilibrium.

The proponents agreed with recommendation (3) for the long-term. Collaboration with Norwegian colleagues has already started to develop SNPs.

Regarding recommendation (4), the proponents agree to make efforts to increase the number of satellite tagging experiments. In the case of the Bryde's and sei whales, this information should be examined in conjunction with the available information on mark-recapture from the period of commercial whaling.

Comments from proponents on Item 4.4.3.2 (Short term recommendations)

'The Panel has developed a number of recommendations for the short-term, i.e. to be completed ideally by the 2016 Annual Meeting but certainly by the 2017 Annual Meeting.

- (1) All inferences regarding 'randomness' of observations (e.g. unassigned common minke whales) should be substantiated by a statistical assessment of the presumed randomness.*
- (2) The presence of multiple stocks within sample partitions should be assessed (employing, e.g., STRUCTURE and DAPC) for Bryde's and sei whales.*
- (3) More explicit information on quality checks be provided in each study as well as study-specific estimates or genotyping and DNA sequencing error rates.'*

The proponents agree with recommendation (1), and consider that it could be addressed in two ways: i) by increasing the number of microsatellite loci for a relevant coastal sub-area where a putative coastal stock has been proposed; with the increase in the number of loci, the number of unassigned animals eventually should approach near zero; and ii) by assessing statistically the assumption of randomness in the unassigned animals; the issue here is whether the geographical/genealogical distribution of unassigned samples is as expected for a random sub-set of the assigned samples.

Regarding recommendation (2), the proponents note that STRUCTURE was already been applied to sei and Bryde's whales during the 2009 mid-term review workshop (Kanda *et al.*, 2009a; b). However the proponents agree to conduct additional STRUCTURE analyses on these two species based on the enlarged data set.

Regarding recommendation (3), the proponents note that a document describing the procedures to ensure data quality in accordance with IWC guidelines for DNA quality has already been presented and discussed at the IWC SC in 2014 (Kanda *et al.*, 2014), and that the IWC SC welcomed this document and agreed that it responded appropriately to previous recommendations from the JARPAII review workshop (IWC, 2015: p. 59). However, the proponents agree to provide estimates of genotyping error rates at the 2016 IWC SC meeting.

More detailed responses to the three short-term recommendations above are provided in Pastene *et al.* (2016).

Feeding ecology and ecosystem studies: part 1. General information to inform ecosystem modelling on oceanography, distribution, abundance and status of whale stocks (Item 5.4)

Overview of proponents on Item 5.4

OCEANOGRAPHY

The proponents concur with the overview provided by the Review Panel that (1) there is a need to investigate the relationship between sub-surface temperature data presented to the workshop and any past regime shift, and (2) there is a need to investigate the effect of change in surface water temperature on pelagic fish off Kushiro in September. The first point made is valuable but temporal coverage of the oceanographic model (FRA-ROMS) used in the analysis undertaken limits such an analysis at this stage. It is expected that the temporal coverage will be expanded in the near future and the analysis requested by the Review Panel will be conducted once the data are available.

DISTRIBUTION

The proponents greatly appreciate the Review Panel's recognition that the spatial modelling work presented to the workshop had (1) considerably progressed since the 2009 review, (2) increased the understanding of whale

movement, segregation of spatial and temporal distribution by species and (3) increased the understanding of prey consumption in a spatial context. As pointed out by the Review Panel, the proponents are aware that there is still room for methodological improvement in many respects. However, one of the biggest challenges to be overcome in the context of the IWC SC is that there is no guideline for proper assessment of the results of spatial modelling. Development of guidelines for model based abundance estimation for RMP input and species distribution models (SDM) is now ongoing in the IWC SC. The proponents will attempt to improve their modelling in line with the development of the IWC SC guidelines.

The proponents consider that sighting survey coverage is sufficient to investigate seasonal changes in the spatial distribution of common minke, sei and Bryde's whales in the period of JARPNII (SC/F16/JR7). The proponents consider that the modelling method used is appropriate to achieve the objective of the paper. Nevertheless, the proponents concur with the Review Panel that consideration of handling time on sampling coverage of whales would be needed to estimate prey consumption in spatial context.

ABUNDANCE

The proponents appreciate and agree with the overview and evaluation by the Review Panel on abundance. The proponents recognize that the abundance estimates are important for a number of the program's objectives, including *inter alia* the assessment of total consumption, energy requirements and their use in ecosystem modelling; the assessment of exchange rates in the context of stock structure issues; and the work of the IWC SC on the conservation and management via *Implementation Reviews* and *in-depth assessment*, as mentioned by the Review Panel. The proponents intend to improve the abundance estimates following the recommendations provided by the Review Panel in Table 5 of SC/66b/Rep 6.

Comments from proponents on Item 5.4.2 (Evaluation of progress on 2009 recommendations)

The proponents agree with the evaluation by the Review Panel on abundance estimation related issues (Table 5 of SC/66b/Rep 6). Regarding the recommendation which was evaluated 'not addressed', the proponents note that the sighting data obtained during 1994-2001 are not appropriate for estimating abundance trends because the survey design in those years was not always intended to allow unbiased estimation of abundance in the area surveyed. One possible approach is to apply the results of spatial modelling work to address the problems of unequal or insufficient survey coverage.

Comments from proponents on Item 5.4.3.

OCEANOGRAPHY

'Panel recommends that at least chl-a concentration should be examined as a potential proxy for the food environment for whales; chl-a concentration is considered to reflect zooplankton production as food for prey species. In the medium-long term, the Panel recommends further oceanographic monitoring to compare with prey species distribution and abundance in the new regime.'

The proponents agree with the recommendation that oceanographic monitoring in the new regime be conducted. A long term monitoring program is required to detect regime shifts and this was one of the reasons why JARPNII was designed as an open ended program. Even after JARPNII, similar work should be conducted in the future to enhance understanding of how biological organisms including whales respond to regime shift in the western North Pacific.

Chl-*a* was already considered as a covariate in some of the spatial modelling presented to the workshop (SC/F16/JR7; SC/F16/JR10; SC/F16/JR16). Selection of environmental covariates depends on the objective of modelling but inclusion of the chl-*a* covariate in spatial modelling of large whales which were not considered in the papers presented to the workshop would be worth investigation. However, the proponents have a concern about the strength of linkage between chl-*a* and distribution of whales. Chl-*a* can be used as a proxy for secondary production (*e.g.* small pelagic fish) as mentioned by the Review Panel. Consequently, a time lag in the effect of chl-*a* on whales is expected as the effect works its way through trophic levels. It might be better to construct dynamic spatially explicit ecosystem models rather than static spatial models to investigate the relationship adequately.

DISTRIBUTION

*'In the medium-term, the Panel recommends that considerable effort be put into the methodological improvement of the spatial modelling in the various analysis related with the objectives on distribution of large whales and oceanography. A particular focus must be on the combination of survey data from the different years to make them more comparable in terms of distribution (and abundance) over time; use of data from other sources (*e.g.* the IWC POWER programme). This work is not only valuable itself but is essential for a better parameterisation of ecosystem models.'*

The Panel also recommends that additional effort be placed on fulfilling the 2009 recommendation with respect to the photo-identification data. This will contribute to the understanding of large scale movements and whale distribution within and outside the JARPN II survey area for several species.'

As mentioned above, there are no guidelines for the proper assessment of the results of spatial modelling in the IWC SC. Establishment of guidelines is necessary because many choices are possible to improve modelling results. The proponents are willing to improve their results as pointed out by the Review Panel in conjunction with the development of guidelines in the IWC SC. The proponents are also intend to incorporate other data sources, especially those collected through the IWC POWER programme to contribute to stock assessment of large whales such as sei whales.

The proponents have already provided statistical summaries relating to model fits in papers SC/F16/JR7, SC/F16/JR8, SC/F16/JR10 and SC/F16/JR16 which used either GLM or GAM as spatial models. Handling of extrapolation and the inclusion of a variance plot of the fitted prediction surface will be presented in the future along with improvements to the models.

In response to the recommendation by the Review Panel, the proponents will consider sharing of photo-identification data collected in JARPNII with other interested parties.

ABUNDANCE

'With respect to abundance, the Panel recommends:

- (1) exploration of methods to account for sampling differences between areas and years to obtain measures of short- and long-term variation and trends and estimates the extent of additional variance due to changes over time in spatial distribution; inter alia this will be essential for modelling efforts (e.g. food consumption models and ecosystem models);*
- (2) comparison of results from the design-based estimates of abundance with those of model-based estimates, which can be directly obtained from spatial models of distribution (e.g. SC/F16/JR16) and using additional data (e.g. from IWC POWER and other North Pacific surveys) - model-based estimates could potentially address problems of unequal sampling coverage between surveys and with further development could also account for additional sources or causes of variability.'*

The proponents agree with recommendation (1) and will implement it in the time frame suggested by the Review Panel. For this aim, mixed-effect models may be used.

The proponents also agree with the recommendation (2) by the Review Panel and will implement it within the time frame suggested by the Review Panel. This work needs to be conducted in line with the IWC SC's development of guidelines for model-based abundance estimation for RMP inputs and species distribution models (SDM).

Feeding ecology and ecosystem studies: part 2. Field and laboratory studies (Item 6.4)

Overview of proponents on Item 6.4

The proponents consider that this section is a good summary of the data and information on whale feeding habits and prey preferences presented at the review workshop. They also consider that the conclusions of the Review Panel regarding the sub-objectives are reasonable (Table 10 of SC/66b/Rep 6).

Comments from proponents on Item 6.4.2 (Evaluation of progress on 2009 recommendations)

The proponents agree with the evaluation of the Review Panel (Table 6 of SC/66b/Rep 6). Regarding the recommendation evaluated as 'not addressed' in Table 6, the proponents have provided some responses in Annex D.

Comments from proponents on Item 6.4.3.1 (Medium-long term recommendations)

'The Panel has developed the following recommendations for the medium-term i.e. normally to be completed 2-3 years after the 2016 Annual Meeting:

- (1) all sources of uncertainty should be quantified and an evaluation of which parameters contribute the most to uncertainty be conducted and taken into account in the analyses and modelling;*
- (2) the studies on allometric relationships should be developed further to refine the range of suitable allometric-energy intake/consumption relationships;*

- (3) *the analyses of diet composition should consider the effect of seasonal changes in energy density of the various prey species; and*
- (4) *stable isotope analysis of whale tissues and their prey should be introduced not only into the assessment of diet, but also to statistically evaluate overlap in distribution and trophic niche between baleen whale species.'*

The proponents agree with recommendations (1), (2), (3) and (4) and will implement them in terms of the time line suggested by the Review Panel. The proponents have already started a study in collaboration with Hokkaido University on recommendation (4).

Comments from proponents on Item 6.4.3.2 (Short term recommendations)

'The Panel has developed the following recommendations for the short-term i.e. to be completed ideally by the 2016 Annual Meeting but certainly by the 2017 Annual Meeting.

- (1) *The sampling distribution for the parameters should be used in the assessment of the uncertainty associated with the estimation of consumption;*
- (2) *Clarification should be provided on how density and diet consumption have been extrapolated outside the areas and months covered during the surveys and diet studies.'*

The proponents agree with recommendation (1), and will implement it by the 2017 IWC SC meeting and report the progress to the same meeting.

The proponents will respond to recommendation (2) in a document to be presented at the 2016 IWC SC meeting (see Bando *et al.*, 2016).

Feeding ecology and ecosystem studies: part 3. Ecosystem modelling (item 7.4)

Overview of proponents on Item 7.4

The proponents appreciate the Review Panel's recognition that the ecosystem work has progressed substantially since the 2009 workshop, and that this forms a reasonable basis for further work. As pointed out by the Review Panel, the proponents admit that the progress of modelling work was "negatively impacted by the review occurring before the originally envisioned end of the programme" (SC/66b/Rep 6). The proponents share the Review Panel's opinion that substantial data collection and analytical efforts are required to develop ecosystem models to the level that they could contribute to the provision of specific management advice as this is a major, complex and ambitious task. Bearing this background in mind and considering the recommendations/suggestions from the 2009 review workshop (IWC, 2010), the proponents focused their work mainly on the construction of basic models in the western North Pacific as a basis for the consideration of strategic management advice in the future. While more resources had been allocated to the work presented to this workshop since the review workshop in 2009, the proponents will seek additional resources if a similar program takes place in the future.

The proponents agree with the evaluation by the Review Panel and will effect improvements on these points further if a similar program takes place in the future.

Comments from proponents on Item 7.4.3.1

'The Panel has developed the following recommendations for the medium-term i.e. normally to be completed 2-3 years after the 2016 Annual Meeting.

- (1) *The generic recommendations identified by the 2009 Panel remain, and the Panel endorses them.*
- (2) *Clear objectives on the ultimate use of the models must be established to make further progress. One model may meet a general objective of better understanding ecosystem linkages, while a very different model may be more suited to delivering tactical advice for fishery management. For example, EwE modelling demonstrates linkages between small pelagic species and whales, both in the static mass balance and in the dynamic model. However, it is not clear how such modelling could directly inform strategic management.*
- (3) *Models can be better used in concert. The results of food web modelling should be used to establish key predation linkages to include in extended single-species or multispecies models. This best exploits the strengths of different types of models. Specifically, Ecopath should be used to define key relationships for further study within targeted statistical MRM/MICE models linked to specific objectives. In such a way the suite of available modelling tools can be used to integrate available knowledge.*
- (4) *Stable isotopes provide information on long term feeding patterns to inform models about trophic relationships between whales and their prey (see also Item 6.4).'*

The proponents agree that the generic recommendations identified by the 2009 review workshop remain applicable not only to this program but also to ecosystem modelling in general.

The main focus of the work presented to this workshop was building basic models rather than focusing on management questions. The idea was to stick to the recommendations/suggestions from the 2009 review workshop. The Panel for that workshop recognized that the work presented to this workshop formed a reasonable basis for further work. As clearly stated in the research plan, the overall objective of JARPNII was to contribute to the conservation and sustainable use of marine living resources including whales in the western North Pacific, especially within Japan's EEZ. The proponents agree with the specific recommendations by the Review Panel, which will be considered if a similar program takes place in the future.

The proponents concur with the Review Panel's recommendation regarding the utility of food web models to extract key predation linkage in MRM/MICE (Minimum Realistic Model/ Models of Intermediate Complexity for Ecosystem Assessment).

The proponents generally agree with the Review Panel's recommendation that stable isotopes can provide information on trophic levels, but their utility could be limited in the modelling work which needs species level rather than trophic level information.

Comments from proponents on Item 7.4.3.2 (EwE Model)

The Panel has developed the following recommendations for the medium-term i.e. normally to be completed 2-3 years after the 2016 Annual Meeting.

- (1) An evaluation of data quality for each input parameter (the 'pedigree': e.g. Gaichas et al. 2015) is needed to characterise uncertainty in model inputs.*
- (2) Further evaluation of PREBAL and other diagnostics should be conducted. The Panel was concerned by relatively low Ecotrophic Efficiencies for sardine and saury, which may indicate that predation on these species is not fully modelled. This would be worrying given the focus of the modelling on the relationship between small pelagic fishes and whales.*
- (3) The estimated vulnerabilities and other fit diagnostics could be presented more clearly and evaluated further. Software constraints inherent to Ecosim should not limit the consideration of uncertainty; sensitivity analysis using ranges of consumption estimates, for instance, could be done.*

The proponents concur with the Review Panel's recommendations, and uncertainty in Ecopath with Ecosim (EwE) will be investigated using pedigrees in future studies.

The proponents generally agree with the Review Panel's recommendations that further evaluation of 'PREBAL' (Link, 2010) and other diagnostics is required. However, it should be noted that low ecotrophic efficiencies (EE) for small pelagic fish might be an attribute specific to the western North Pacific as these species are capable of expanding their habitat from the coastal area of Japan to 180° longitude, unlike in other ecosystems where their distributions are confined to coastal areas. Such aspects will be investigated in future studies through the examination of diagnostics.

The proponents agree with the Review Panel's recommendations that estimated vulnerabilities and other fit diagnostics should be presented and evaluated clearly in the future analyses. Sensitivity analysis will also be conducted as pointed out by the Review Panel.

Comments from proponents on Item 7.4.3.3 (Extended single-species model)

The Panel has developed the following recommendations for the medium-term i.e. normally to be completed 2-3 years after the 2016 Annual Meeting.

- (1) The model should be developed to ensure that the majority of predation mortality is captured. A food web model (e.g. Ecopath) quantifies mortality from all predators in the ecosystem, and could be used to inform which major predators to include in this work.*
- (2) Additional diagnostics are needed. Specifically, there is a need to examine the fits to the fishery-independent survey data, the proportion information, and trends in fishing mortality. In addition, posterior predictive checks can be used to evaluate model fit in Bayesian models.*
- (3) The current spatial boundaries of the model and the use of fishery CPUE as an index of abundance should be more thoroughly justified.*
- (4) If CPUE for the dip net fishery is not considered likely to index abundance, the focus for model fitting should be the fishery independent survey.*
- (5) There is unlikely to be sufficient information to estimate the functional form of the feeding relationship and sensitivity to alternative plausible relationships should be examined.*
- (6) Some of the posteriors in SC/F16/JR29 appear implausible (e.g. the posterior for the intrinsic growth rate for the prey larger with most of its mass on values larger than 2 and the posterior mode for juvenile survival*

close to 1 in the absence of minke whales). This is likely a consequence of conflicts between the data sources or confounding of parameters due to insufficient data. The causes of the implausible posteriors can be explored by changing the weights assigned to the data sources and fitting the model.'

The proponents mostly agree with the Panel's recommendations (1)-(6).

As for recommendation (1), the proponents agree with this recommendation that the model should be extended to capture the majority of predator effects on the sandlance population. Also, as the Review Panel suggested, borrowing information from foodweb models might help proceeding with the model extension with additional species.

As for recommendation (2), the proponents appreciate this recommendation and agreed that more elaborated diagnoses would help us to develop and modify the models especially with fishery-independent data. Regarding the estimation, as long as the models are fitted by Bayesian methods, full diagnoses with the Bayesian predictive checking (e.g. use of a Bayesian p-value) are required in addition to the convergence check in MCMC. These issues will be fully addressed in a revised paper.

As for recommendation (3), the determination of appropriate study area is one of key issues in ecosystem modelling. Even in the simple extended single-species model for the sandlance population shown in SC/F16/JR29 (and its addendum), a clear-cut definition of the study area is not straightforward because scales of the habitat are not the same between the predator, the common minke whales and the sandlance. The proponents will also address this issue in the revised paper.

As for recommendation (4), the issue on selection of abundance indices can be regarded as one of statistical considerations because some indices may not include information on population dynamics adequately and sometimes those appear to conflict with other indices. Deleting fishery-dependent indices as mentioned by the Review Panel is a possible option, but the proponents will investigate how the fishery-dependent indices are used by down-weighting in the likelihood.

As for recommendation (5), the proponents would agree with the Review Panel's comments reflected in this recommendation that the data may not have sufficient information for selecting better functional forms of the "functional response curve" and even estimating the parameters given pre-specified models. This may be attributed to the limited information on abundance and possible inter-annual changes of the minke whales distribution in the study area. The difficulty will also be increased by incorporating additional predators as referred to in item (1) in this section. Some form of meta-analyses might be useful to reduce the burden of estimation. Examination through simulation may also help to identify necessary information for this type of estimation.

As for recommendation (6), the proponents agree with the Review Panel's view reflected in this recommendation. This matter is quite relevant to recommendation (4) in this section; controlling weights in the likelihood may resolve this issue to some extent. Also, constraints on several similar parameters (such as natural mortality rates between different life-stages) might also be effective, though it requires an additional diagnostics. These issues will be addressed in the revised paper.

Monitoring environmental pollutant in cetaceans and the marine ecosystem (Item 8.4)

Overview of proponents on Item 8.4

The proponents consider this section as a good summary of the information on monitoring environmental pollutants in cetaceans and marine ecosystem presented at the review workshop, and also they consider that the conclusions of the Review Panel regarding the three sub-objectives (Table 10 of SC/66b/Rep 6) are reasonable.

Comments from proponents on Item 8.4.2. (Evaluation of progress on 2009 recommendations)

The proponents agree with the evaluation by the Review Panel given in Table 9 of SC/66b/Rep 6. However, they would like to reiterate the lack of clarity in key or relevant recommendations from the 2009 review workshop report (see details in the 'Overview' section of this paper).

Comments from proponents on Item 8.4.3.1 (Medium-long term recommendations)

'The Panel has developed the following recommendations for the medium-term i.e. normally to be completed 2-3 years after the 2016 Annual Scientific Committee Meeting.

- (1) Since body length is a poor proxy for age, particularly in sexually mature whales, age data should be incorporated into the multivariate analysis of pollutant concentrations as soon as they become available.*

- (2) *Stable isotope values should be included in the analyses to investigate the bioaccumulation process of pollutants through the food chain.*
- (3) *The risk that these chemical pollutants present to the populations' abundance or distribution should be more widely assessed.'*

The proponents agree with recommendation (1), and will continue assembling additional age data for the multivariate analysis of pollutant concentrations.

The proponents agree with recommendation (2). The stable isotope analyses will be performed in collaboration with the Japan Chemical Analysis Center, Chiba Prefecture, Japan.

The proponents agree with recommendation (3) for the long-term. However they would like to reiterate that no signal of health risk due to pollutants, such as Hg and OCs, has been observed so far in whales taken during JARPEN and JARPENII.

Comments from proponents on Item 8.4.3.2 (Short term recommendations)

'The Panel has developed the following recommendations for the short-term i.e. ideally to be completed in revised papers to the 2016 Annual Scientific Committee Meeting.

- (1) *The statistical analyses should be improved, based on clear, well formulated hypotheses.*
- (2) *The OC concentrations now presented on a fresh weight basis should be recalculated as values on a lipid weight basis, and the Hg concentrations now on a fresh weight basis should be recalculated as those on a dry weight basis. This can be done straightforwardly through the lipid content and the dry weight of the samples, variables that are always produced during the analytical processing of the tissue.*
- (3) *Trends in pollutant concentrations should be explored using generalised additive models (GAMs) or other non-linear approaches, in addition to the linear models.*
- (4) *The pollutant concentrations found should be evaluated in comparison with data from previous studies conducted in comparable species and available in the literature.*

Regarding the recommendation (1), revised multiple linear regression analyses will be presented in two documents for the 2016 IWC SC meeting (Yasunaga *et al.*, 2016a; b).

Regarding the recommendation (2), re-analyses are not possible for some of the samples obtained before 2011 because the samples were washed away by tsunami that ensued the 2011 Great East Japan Earthquake. Further, the proponents note that the standard errors of moisture contents in liver in 13NPCS ($73.6 \pm 1.1\%$) and muscle in 12NP ($75.5 \pm 0.9\%$) of minke whales were within 1.5%. The proponents also note that for the objective of comparison of toxicological effects among animals, fresh weight-based concentrations are better than dry weight-based concentrations.

Regarding the recommendation (3), additional GAM analyses will be presented in two documents for the 2016 IWC SC meeting (Yasunaga *et al.*, 2016a; b).

Regarding the recommendation (4), comparison with data from previous studies will be presented in documents (Yasunaga *et al.*, 2016a; b).

Review of other contributions to important research needs (Item 9.2)

Comments from proponents on Item 9.2

'The Panel recommends investigation into whether there is any relationship between age or sex and readability that may affect the representativeness of the earplugs that can be read. The addition of absolute age data has great potential to improve analyses relevant to all three of the primary objectives. The Panel encourages the proponents to age as many of the existing samples as possible and to incorporate age where appropriate in updated analyses (e.g. see the recommendations on pollutant studies, Item 8.4.3).'

The proponents agree with recommendations about ageing, and further analysis about the representativeness of readable earplugs, such as the investigation of the relationship between sex and readability of earplugs will be conducted on common minke whale and sei whale. Age reading of Bryde's whale will be completed as soon as possible. The age data from earplugs will be used in various analyses, for example those related to pollutant studies.

Integration of results (Item 10.2)

The proponents agree with the view of the Review Panel that the proponents had attempted integration within sub-objective and objective rather than integration among objectives.

The proponents also recognize the difficulty to integrate all documents (and discussions on those documents at the IWC SC) prepared after the mid-term JARPNII review workshop. SC/F16/JR1 attempted to integrate the papers containing scientific information on JARPNII but the proponents recognize that not all 'historical' papers were considered in that integration.

Responses to panel conclusions with respect to Annex P (Item 11)

General issues (Item 11.1)

With regard to the recommendations about Annex P made under this item, since these are directed to the Scientific Committee, it is more appropriate to respond at the time this issue is discussed in the IWC SC.

Assessment of the programmes scientific outputs given the stated objectives and length of the programme (Item 11.2)

'It is clear from the review that (a) considerable scientific work has been undertaken and that the output has been accepted in peer-reviewed journals and has influenced the work of the IWC Scientific Committee but also that (b) a much greater emphasis should have been put on improved analyses and modelling – that would increase considerably the value of the scientific output of the existing data collected. The Panel therefore strongly encourages the proponents to follow the recommendations provided in this report and submit further work to peer-reviewed scientific journals.'

The proponents appreciate the Review Panel's recognition of the scientific output of JARPNII. More than 60 peer-reviewed publications have been obtained and more than 200 documents have been presented to the IWC SC meetings.

However, the proponents would like to emphasise that JARPNII work should primarily be reported to and peer-reviewed by the IWC SC as its primary aim is to contribute to the management recommendations developed in that forum.

Consideration of the level of co-ordination with other relevant research projects (Item 11.3)

The proponents appreciate the Review Panel's recognition of a much-improved collaboration with other research projects compared to that in 2009. The proponents will make efforts to increase that collaboration and coordination with scientists from other regions who are conducting similar research.

Evaluation of how well the stated objectives have been met and the extent to which the results have improved conservation and management (Item 11.4)

The proponents consider the evaluation of JARPNII sub-objectives by the Review Panel (Table 10 in SC/66b/Rep 6) to be balanced and fair. They also agree with the Review Panel's evaluation on the contribution of JARPNII to conservation and management. Additional comments have been given in the relevant sections of this paper above.

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Annex 1

List of documents for the JARPN II Review Workshop

Primary documents

Framework and methodology documents

SC/F16/JR1. Tamura, T., Kishiro, T., Yasunaga, G., Murase, H., Kitakado, T and Pastene, L.A. The Japanese Whale Research Program under Special Permit in the western North Pacific Phase-II (JARPN II): results and conclusions in the context of the three main objectives, and scientific considerations for future research.

SC/F16/JR2. Matsuoka, K., Hakamada, T. And Miyashita, T. Methodology and procedure of the dedicated sighting surveys in JARPN II (2008-2013) - Offshore component -.

SC/F16/JR3. Kishiro, T., Yoshida, H., Yasunaga, G., Bando, T., Mogoe, T. and Kato, H. Methodology and survey procedure under the JARPN II – coastal component of Sanriku and Kushiro-, during 2008 to 2014, with special emphasis on whale sampling procedures.

SC/F16/JR4. Bando, T., Yasunaga, G., Tamura, T., Matsuoka, K., Murase, H., Kishiro, T. and Miyashita, T. Methodology and survey procedures under the JARPN II - offshore component- during 2008 to 2014 with special emphasis on whale sampling procedures.

Objective 1: Feeding ecology and ecosystem studies

Oceanographic conditions

SC/F16/JR5. Okazaki, M., Masujima, M., Murase, H. and Morinaga, K. Oceanographic conditions in the JARPNII survey area from 2000 to 2013 using FRA-ROMS data.

SC/F16/JR6. Okazaki, M., Masujima, M., Murase, H. and Morinaga, K. Oceanographic conditions in the survey area of JARPNII coastal component off Kushiro in September from 2000 to 2013 using FRA-ROMS data.

Distribution and abundance of whales

SC/F16/JR7. Murase, H., Hakamada, T., Sasaki, H., Matsuoka, K. and Kitakado, T. Seasonal spatial distributions of common minke, sei and Bryde's whales in the JARPNII survey area from 2002 to 2013.

SC/F16/JR8. Murase, H., Hakamada, T., Matsuoka, K., Nishiwaki, S., Inagake, D., Okazaki, M., Toji, N. and Kitakado, T. Distribution of sei whales (*Balaenoptera borealis*) in the subarctic-sub-tropical transition area of the western North Pacific in relation to oceanic fronts. *Deep-Sea Research II* 107: 22-28, 2014.

SC/F16/JR9. Matsuoka, K., Hakamada, T. and Miyashita, T. Distribution of blue (*Balaenoptera musculus*), fin (*B. physalus*), humpback (*Megaptera novaeangliae*) and north Pacific right (*Eubalaena japonica*) whales in the western North Pacific based on JARPN and JARPN II surveys (1994 to 2014).

SC/F16/JR10. Sasaki, H., Murase, H., Kiwada, H., Matsuoka, K., Mitani, Y. and Saitoh, S. Habitat differentiation between sei (*Balaenoptera borealis*) and Bryde's whales (*B. brydei*) in the western North Pacific. *Fish. Oceanogr.* 22 (6): 496-508, 2013.

SC/F16/JR11. Hakamada, T. Matsuoka, K., Kishiro, T. and Miyashita, T. The number of western North Pacific common minke whales (*Balaenoptera acutorostrata*) distributed in JARPNII coastal survey areas.

SC/F16/JR12. Hakamada, T. and Matsuoka, K. The number of western North Pacific common minke, Bryde's and sei whales distributed in JARPNII offshore survey area.

SC/F16/JR13. Hakamada, T. and Matsuoka, K. The number of blue, fin, humpback, North Pacific right whales in the western North Pacific in the JARPN II offshore survey area.

SC/F16/JR14. Hakamada, T. and Matsuoka, K. The number of sperm whales in the western North Pacific in the JARPN II offshore survey area.

Prey consumption by whales

SC/F16/JR15. Tamura, T., Konishi, K. and Isoda, T. Updated estimation of prey consumption by sei, Bryde's and common minke whales in the western North Pacific.

SC/F16/JR16. Tamura, T., Murase, H., Sasaki, H. and Kitakado, T. Preliminary attempt of spatial estimation of prey consumption by sei whales in the JARPNII survey area using data obtained from 2002 to 2013.

Impact of prey consumption by whales on fisheries resources

SC/F16/JR17. Tamura, T., Kishiro, T., Yoshida, H., Konishi, K., Yasunaga, G., Bando, T., Saeki, M., Onodera, K., Mitsuhashi, M., Yamashita, Y., Funamoto, T. and Kato, H. Updated prey consumption by common minke whales and interaction with fisheries in coastal areas.

Biomass estimation of whale's prey species

SC/F16/JR18. Murase, H., Kawabata, A., Kubota, H., Nakagami, M., Amakasu, K., Abe, K., Miyashita, K. and Oozeki, Y. Basin-scale distribution pattern and biomass estimation of Japanese anchovy *Engraulis japonicas* in the western North Pacific. *Fish. Sci.* 78: 761-773, 2012.

SC/F16/JR19. Wada, A., Onodera, K., Saeki, M. and Tamura, T. Estimation of prey species biomass in the Sanriku region based on 2008 and 2009 JARPNII acoustic surveys.

Prey preference

SC/F16/JR20. Watanabe, H., Okazaki, M., Tamura, T., Konishi, K., Inagake, D., Bando, T., Kiwada, H. and Miyashita, T. Habitat and prey selection of common minke, sei, and Bryde's whales in mesoscale during summer in the subarctic and transition regions of the western North Pacific. *Fish. Sci.* 78:557-67, 2012.

SC/F16/JR21. Murase, H., Tamura, T., Kiwada, H., Fujise, Y., Watanabe, H., Ohizumi, H., Yonezaki, S., Okamura, H. and Kawahara, S. Prey selection of common minke (*Balaenoptera acutorostrata*) and Bryde's (*Balaenoptera edeni*) whales in the western North Pacific in 2000 and 2001. *Fish. Oceanogr.* 16 (2): 186-201, 2007.

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Feeding habit of whales

SC/F16/JR23. Konishi, K. Isoda, T. and Tamura, T. Decadal change of feeding ecology in sei, Bryde's and common minke whales in the offshore of the Western North Pacific.

SC/F16/JR24. Tamura, T., Kishiro, T., Yoshida, H., Konishi, K. and Kato, H. Relationship between feeding habit and maturity status of common minke whale off Kushiro.

SC/F16/JR25. Ishii, M., Murase, H., Fukuda, Y., Sawada, K., Sasakura, T., Tamura, T., Bando, T., Matsuoka, K., Shinohara, A., Nakatsuka, S., Katsumata, N., Miyashita, K. and Mitani, Y. A short note on feeding behavior of sei whales observed in JARPNII.

SC/F16/JR26. Isoda, T., Tamura, T., Konishi, K., Ohizumi, H. and Kubodera, T. Feeding habits of sperm whale (*Physeter macrocephalus*) in the western North Pacific in spring and summer.

Body condition indicators of whales

SC/F16/JR27. Konishi, K. Analyses of body condition in sei, Bryde's and common minke whales in the western North Pacific with JARPN and JARPNII dataset.

Ecosystem modeling

SC/F16/JR28. Murase, H., Tamura, T., Hakamada, T., Watari, S., Okazaki, M., Kiyofuji, H., Yonezaki, S. And Kitakado, T. Ecosystem modelling in the western North Pacific from 1994 to 2013 using Ecopath with Ecosim (EwE): some preliminary results.

SC/F16/JR29. Kitakado, T., Murase, H., Tamura, T. Predation impacts on sandlance population by consumption of common minke whales off Sanriku region.

Objective 2: Monitoring environmental pollutants in cetaceans and the marine ecosystem

i) Pattern of accumulation of pollutants in cetaceans and ii) Bioaccumulation process of pollutants through the food chain

SC/F16/JR30. Yasunaga, G. and Fujise, Y. Temporal trend of Total Hg levels in three baleen whale species based on JARPNII data for the period 1994-2014.

SC/F16/JR31. Yasunaga, G. and Fujise, Y. Yasunaga, G. and Fujise, Y. Temporal trend of PCB levels in common minke whales from the western North Pacific for the period 2002-2014.

SC/F16/JR32. Yasunaga, G. and Fujise, Y. Accumulation features of POPs of baleen whales in the western North Pacific based on samples collected during the 2012 JARPNII survey.

SC/F16/JR33. Yasunaga, G. and Fujise, Y. Comparison of total Hg levels in O and J type stock of common minke whales based on JARPN II coastal samples collected in 2012 and 2013.

SC/F16/JR34. Yasunaga, G. and Fujise, Y. A note on POPs and Hg accumulation in sperm whale based on JARPNII samples collected during 2001-2013.

iii) Relationship between chemical pollutants and cetacean health

SC/F16/JR35. Yasunaga, G. and Fujise, Y. Status of I131, Cs134 and Cs137 in baleen and sperm whales from the western North Pacific during 2011-2015.

SC/F16/JR36. Niimi, S., Imoto, M., Kunisue, T., Watanabe, M.X., Kim, E., Nakayama, K., Yasunaga, G., Fujise, Y., Tanabe, S. and Iwada, H. Effects of persistent organochlorine exposure on the liver transcriptome of the common minke whale (*Balaenoptera acutorostrata*) from the North Pacific. *Ecotoxicology and Environmental Safety* 108: 95-105, 2014.

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Objective 3: Stock structure of large whales

i) Common minke whale

SC/F16/JR38. Pastene, L.A., Goto, M., Taguchi, M. and Kitakado, T. Temporal and spatial distribution of the 'J' and 'O' stocks of common minke whale in waters around Japan based on microsatellite DNA.

SC/F16/JR39. Nakamura, G., Kadowaki, I., Nagatsuka, S., Hayashi, R., Kanda, N., Goto, M., Pastene, L.A and Kato, H. Morphological differences in the white patch on the flipper between J and O stocks of the North Pacific common minke whale.

SC/F16/JR40. Pastene, L.A., Goto, M., Taguchi, M. and Kitakado, T. Updated genetic analyses based on mitochondrial and microsatellite DNA indicated no sub-structure of the 'O' stock common minke whale in the western North Pacific.

SC/F16/JR41. Bando, T. and Hakamada, T. Morphometric analysis on stock structure of the 'O' stock common minke whale in the western North Pacific.

SC/F16/JR42. Kishiro, T. and Miyashita, T. Satellite tracking of a common minke whale in the coastal waters off Hokkaido, northern Japan in 2010. Document SC/63/RMP10. 10pp. 2011.

SC/F16/JR43. Kitakado, T. and Maeda, H. Fitting to catch-at-age data for North Pacific common minke whales in the Pacific side of Japan.

ii) Bryde's whale

SC/F16/JR44. Pastene, L.A., Goto, M., Taguchi, M. and Kitakado, T. Updated genetic analyses based on mtDNA and microsatellite DNA suggest possible stock differentiation of Bryde's whales between management sub-areas 1 and 2 in the North Pacific.

SC/F16/JR45. Murase, H., Tamura, T., Otani, S. and Nishiwaki, S. Satellite tracking of Bryde's whales *Balaenoptera edeni* in the offshore western North Pacific in summer 2006 and 2008. *Fish. Sci.* (in press).

iii) Sei whale

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