SC/67A/SCSP/09

Progress report of the work conducted in response to JARPNII research recommendations by the IWC Scientific Committee

Tsutomu Tamura, Toshihide Kitakado and Luis A. Pastene

INTERNATIONAL WHALING COMMISSION

Papers submitted to the IWC are produced to advance discussions within that meeting; they may be preliminary or exploratory.
It is important that if you wish to cite this paper outside the context of an IWC meeting, you notify the author at least six weeks before it is cited to ensure that it has not been superseded or found to contain errors.

Progress report of the work conducted in response to JARPNII research recommendations by the IWC Scientific Committee

Tsutomu Tamura[1], Toshihide Kitakado[2] and Luis A. Pastene[1]

[1]*Institute of Cetacean Research, Toyomicho 4-5, Chuo-ku, Tokyo 104-0055, Japan*
[2]*Tokyo University of Marine Science and Technology, Konan 5-7-4, Minato-ku, Tokyo 108-8477, Japan*

ABSTRACT

The 2016 report of the Expert Panel final review of JARPNII provided several scientific recommendations for additional analyses related to the main three objectives of the JARPNII. The recommendations, that the proponents consider useful in refining some of the analyses, were endorsed by the International Whaling Commission Scientific Committee (IWC SC) meeting in 2016. The IWC SC also agreed on a timeframe to complete the analyses. While the final review of the JARPNII program was duly completed in accordance with Annex P in 2016, the proponents believe that continuous update on progresses in response to the recommendations would be appreciated by the IWC SC. For this purpose, this paper presents the overall progress of the work on recommendations implemented by the proponents to date. A synthesis of the additional analyses will be presented when they are completed in line with the IWC SC-agreed timeframe.

INTRODUCTION

The final review of JARPNII was carried out in February 2016 through a workshop of an Expert Panel., The report of the workshop was presented to the 2016 International Whaling Commission Scientific Committee (IWC SC) Annual Meeting (IWC, 2017a). The Expert Panel offered several recommendations for additional analyses related with the main research objectives of JARPNII. The recommendations from the Expert Panel were endorsed by the 2016 IWC SC annual meeting. At the same time the IWC SC agreed on a timeframe to complete the additional analyses recommended (IWC, 2017b).

The proponents recognize that the recommendations made are useful to refine some of the analyses presented to the workshop. Some of the analyses conducted in response to these recommendations have already been presented to the IWC SC annual meetings (e.g. Pastene *et al*., 2016; Goto *et al*., 2016), and IWC SC intersessional workshops (*e.g.* Taguchi *et al*., 2017). While the final review of the JARPNII program was duly completed in accordance with Annex P, the proponents believe that continuous update on progresses in response to the recommendations would be appreciated by the SC.

This paper presents the overall progress of the work on recommendations implemented by the proponents to date. A synthesis of the additional analyses will be presented when the work is completed in line with the IWC SC-agreed timeframe. The proponents considered that the 2019 IWC SC annual meeting could be the timing for them to produce the synthesis document as the IWC SC's timeframe for several recommendations was '2-3 years after the 2016 Annual Meeting' (IWC, 2017b). The proponents wish to maintain some degree of flexibility in the timing to respond the recommendations within the period 2016-2019. Also, they will give low priority to recommendations considered not essential to address JARPNII research objectives.

PROGRESS REPORT

Several of the recommendations will be responded to by incorporating/analyzing data and information collected in the period 2014-16. The proponents have already completed the data set relevant to JARPNII objectives, corresponding to the period 2014-16, and presented this data and information to the NEWREP-NP Expert Panel workshop (see Tamura *et al*., 2017).

Recommendations related to sampling design and sample size

1: (a) The predetermined track lines for sampling and the rationale for those lines;
(b) The actual coverage of those tracklines and the rationale for any decisions……
(c) The issue of whether the actual sampling that occurred can be said to be representative ….
(d) The extent to which this may affect those objectives/parameters/analyses….
2: Papers using data from the inshore component must fully address the implications of the sampling design
3: (a) Provides a clearer rationale for the changes in sample sizes
(b) Provides the field and analytical protocols for the comparison of using lethal and non-lethal techniques

The proponents responded to the above recommendations in Tamura *et al*. (2016a), Bando *et al*. (2016) and Yasunaga *et al*. (2017a). Several analyses are ongoing. With respect to the lethal and non-lethal techniques, Yasunaga *et al* (2017b) will report at this meeting.

Recommendations related to stock structure

4: All inferences regarding 'randomness' of observations should be substantiated by a statistical assessment…
5: The presence of multiple stocks within sample partitions should be assessed (STRUCTURE and DAPC)…
6: More explicit information on quality checks be provided in each study (e.g. DNA sequencing error rates.)
7: Undertake work to determine the demographic dispersal rates among areas (Van der Zee and Punt, 2014) .
8: Analyses that do not assume mutation-drift-migration equilibrium
9: Using genome-wide SNP genotyping approaches
10: Focused satellite tagging programme should be developed

Most of the recommendations described above on stock structure from the JARPN II mid-term review (IWC, 2010) and JARPNII final review (IWC, 2017a) workshops have been addressed: Tamura *et al*. (2017) for recommendation 4; Pastene *et al*. (2016) and Taguchi *et al*. (2017) for recommendations 5; Goto *et al*. (2016) for recommendation 6; Tiedemann *et al*. (2017) for recommendation 8. The novel SNPs for minke whale species were developed under the collaborative research with Norway (Malde *et al*., under review), which will be used for the subsequent genetic analyses in response to the recommendation 9. All these documents have been submitted and discussed at the IWC SC. The recommendation 7 will be addressed after a discussion on direction of the analysis at the IWC SC.

The work on the last recommendation 10 is on-going. Data collection effort will be enhanced by the NEWREP-NP of which, the data of Bryde's and sei whales will be examined in conjunction with the available information on mark-recapture from the period of commercial whaling.

Recommendations related to feeding ecology and ecosystem – oceanography

11: Chl-a concentration should be examined.
12: oceanographic monitoring is required.

For recommendation 11, already included in some analyses and discussed in Tamura *et al*. (2016a). With respect to the recommendation 12, the proponents agreed – this is long-term monitoring. It will be addressed under Ancillary Objective I of the research plan for NEWREP-NP.

Recommendations related to feeding ecology and ecosystem – distribution

13: Develop some papers: (a) include statistical summaries; (b) avoid extrapolation of the regression models outside to data-poor areas or areas lacking coverage; (c) include variance plots,
14: Considerable effort be put into the methodological improvement of the spatial modelling….
15: Additional effort be placed on …the photo-identification data,
16: Explore methods to account for sampling differences between areas and years …,
17: Compare results from the design-based estimates of abundance with those of model-based estimates….

For recommendations 13 and 14, improvement of analyses of Matsuoka *et al*. (2016) (spatial abundance estimation) and Tamura *et al*. (2016b) (spatial prey consumption estimation) is undergoing. Because they are companion papers, the improvement is conducted in parallel. Some of the results were presented to 2016 PICES annual meeting (Sasaki *et al*, 2016) to invite comments from regional experts. The improved version will be presented to the 2017 PICES annual meeting for further consideration. A fully improved version will be submitted to IWC/SC after 2018.

Under recommendation 15, the proponents agreed that consideration will be given to sharing photo-ID data. The database validations have been started for several species. With respect to recommendation 16, the proponents agreed and expect to achieve this within the timeframe. This will explore the method using a model such as a mixed effect model. The proponents agreed with recommendation 17 and expect to achieve this within the timeframe and in line with the IWC guidelines discussed at the Scientific Committee in 2017.

Recommendations related to feeding ecology and ecosystem - field and laboratory studies

18: The sampling distribution for the parameters should be used in the assessment….
19: Clarification should be provided on how density and diet consumption have been extrapolated …
20: All sources of uncertainty should be quantified and an evaluation…
21: The studies on allometric relationships should be developed….,
22: Consider the effect of seasonal changes in energy density of the various prey species
23: stable isotope of whale tissues and their prey should be introduced…..

The proponents have conducted additional work and analyses under Recommendations 18-22, following the timeframe which was agreed by the IWC SC in 2016. Substantial progress was made on the treatment of uncertainty associated with the estimation of prey consumption by whales (Recommendation 18), on the investigation of the effects of seasonal changes in energy density of the various prey species on the analyses of diet composition (Recommendation 22), and on Recommendation 23, on the stable isotope analysis of whale tissues and their prey species. With respect to Recommendation 23, a study has begun with Hokkaido University. Preliminary results were shown in Tamura *et al.* 2017. From this feasibility study, it was revealed that stable isotope ratio of both whale skin and prey species shows seasonal and yearly variation and it is necessary to analyze samples covering the whole feeding season and area. Although only skin was analyzed in this study, other tissues such as muscle or liver would be useful to consider turnover time. Further analysis will be carried out to evaluate the possibility of contribution by stable isotope analysis to feeding ecology study of whale species in the western North Pacific. The final report will be presented at the 2018 IWC/SC meeting.

Recommendations related to feeding ecology and ecosystem - ecosystem modeling

25: Generic recommendations identified by the 2009 Panel remain.
26: Establish clear objectives on the ultimate use of the models to make further progress...
27: Use models in concert e.g. use food web modelling to establish key predation linkages …
28: Use stable isotopes to provide information on long term feeding patterns ….
29: With respect to the EwE modelling:
(a) evaluate data quality for each input parameter;
(b) further evaluate PREBAL and other diagnostics;
(c) present more clearly and evaluate further the estimated vulnerabilities and other fit diagnostics….
30: With respect to extended single-species modelling:
(a) ensure that the majority of predation mortality is captured;
(b) carry out additional diagnostics
(1) examine the fits to (a) fishery-independent survey data, (b) proportion information, (c) trends in fishing mortality
(2) use posterior predictive checks to evaluate Bayesian model;
(c) provide thorough justification for the current spatial boundaries of the model, the use of fishery CPUE..
(d) focus the model fitting on the fishery-independent survey if CPUE not considered likely to index abundance.
(e) examine sensitivity to alternative plausible functional forms of the feeding relationship.
(f) explore the causes of the implausible posteriors…

The proponents agree with recommendations 25-27. The proponents also agree with recommendation 28 in broader term but note that use in modeling may be limited. With respect to the EwE modeling and the extended single-species modeling, the proponents agree and will undertake analyses within the time frame but note some limitations with EE in the western North Pacific situation and identify some difficulties with lack of data for item (e) of recommendation 30. Under recommendation 29, an improved version of the model was presented to "ICES/PICES: Drivers of dynamics of small pelagic fish resources" in March 2017 to invite comments from experts on small pelagic fish (Watari *et al.*, 2017). Further improvement will be considered based on the comments if any. A fully improved version will be submitted to the IWC/SC after 2018. Under recommendation 30, some work has been undertaken such as standardization of CPUE series and use of them in the model fitting. In addition to Bayesian methods, estimation with ML method has been revisited. All but (e) will be finalized in 2018.

Recommendations related to environmental pollutants

31: To improve the statistical analyses based on clear and well-formulated hypotheses.
32: Recalculate OC concentrations as values on a lipid weight basis, Hg concentrations on a dry weight basis.
33: Explore trends in pollutant concentrations using generalized additive models / other non-linear approaches
34: Evaluate the pollutant concentrations found in comparison with data from previous studies….

35: Incorporate age data into the multivariate analysis of pollutant concentrations…
36: To include stable isotope values in the analyses to investigate the bioaccumulation process of pollutants…
37: To assess more widely the risk that these chemical pollutants present to the populations' abundance or distribution.

Most of the recommendations on environmental pollutants from the JARPNII final review (IWC, 2017a) workshops, described above, have been addressed: Hg (Yasunaga *et al*., 2016a) and PCB (Yasunaga *et al*, 2016b) for recommendations 31, 33 and 34. For recommendation 32, the proponents elucidated some difficulties to address this recommendation due to loss of samples resulting from the 2011 tsunami.
For recommendations 35 and 36, the proponents agreed and expect to achieve this within the timeframe (2-3 years after the 2016 Annual Meeting). Recommendation 35 will continue to be addressed under Ancillary Objective II (i) and (iii) of the research plan for NEWREP-NP.

The proponents give low priority to recommendation 37 considered not essential to further address JARPNII research objectives, because "*the results of the JARPNII studies demonstrated that PCBs and mercury were at very low levels in these stocks, well below established no observable effect levels (NOELs)*" as the Expert Panel pointed out (IWC, 2017c).

Recommendations related to ageing
38: To investigate into whether there is any relationship between age or sex and readability…
39: To age as many of the existing samples as possible and to incorporate age…updated analyses

The proponents agree and work is underway. Some progress on ageing was provided at the NEWREP-NP review workshop and Implementation review workshop of western North Pacific Bryde's whales (Bando and Kato, 2017; IWC, 2017c; 2017d,). Progress of analyses incorporating age data is also described at recommendation 35. This will be addressed under Ancillary Objective II (i) and (iii) of the research plan for NEWREP-NP.

REFERENCES

Bando, T., Yoshida, H., Kishiro, T., Yasunaga, G., Mogoe, T., Konishi, K., Tamura, T., Fujise, Y. and Kato, H. 2016. Further information on sampling design of JARPNII. Paper SC/66b/SP/04 presented to the IWC Scientific Committee. June 2016 (unpublished). 22pp.

Bando, T. and Kato, H. 2017. Report on progress in earplug-based age determination and estimation of biological parameters of Bryde's whales collected during 2000 to 2014 JARPNII surveys. Paper SC/M17/RMP03 presented to the Workshop on the *Implementation Review* of western North Pacific Bryde's whales, March 2017 (unpublished). 8pp.

Goto, M., Yoshida, H. and Pastene, L.A. 2016. A note with an estimate of microsatellite genotyping error rate for common minke whales. Paper SC/66b/DNA/01 presented to the IWC Scientific Committee, June 2016 (unpublished). 3pp.

International Whaling Commission. 2010. Report of the Expert Workshop to Review the Ongoing JARPN II Programme. *J. Cetacean Res. Manage.* 11 (suppl. 2): 405-449.

International Whaling Commission. 2017a. Report of the Expert Panel of the Final Review on the Western North Pacific Japanese Special Permit Programme (JARPN II). *J. Cetacean Res. Manage.* 18 (suppl.): 527-592.

International Whaling Commission 2017b. Report of the Scientific Committee. *J. Cetacean Res. Manage*. (*Suppl.*) 18: 1-xxx.

International Whaling Commission. 2017c. Report of the Expert Panel Workshop on the Proposed Research Plan for New Scientific Whale Research Programme in the western North Pacific (NEWREP-NP). Paper SC/67a/REP/01 presented to the 67ath IWC Scientific Committee, May 2017. 80pp.

International Whaling Commission. 2017d. Report of the Workshop on the Implementation Review of western North Pacific Bryde's whales. Paper SC/67a/REPxx presented to the 67ath IWC Scientific Committee, May 2017. xxpp.

Matsuoka, K., Hakamada, T. and Miyashita, T. 2016. 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 JARPNII surveys (1994 to 2014). Paper SC/F16/JR/9 presented to the JARPNII special permit expert panel review workshop, Tokyo, February 2016 (unpublished). 12pp.

Pastene, L.A., Goto, M. and Taguchi, M. 2016. Additional genetic analyses on stock structure in North Pacific Bryde's and sei whales. Paper SC/66b/SD/01 presented to the IWC Scientific Committee, June 2016 (unpublished). 11pp.

Sasaki, H., Tamura, T., Hakamada, T., Matsuoka, K., Murase, H. and Kitakado, T. 2016. Spatial estimation of prey consumption by common minke, Bryde's and sei whales in the western North Pacific: A preliminary attempt. 2016 PICES Annual Meeting. OMNI Hotel, San Diego, USA, 3 November 2016 (abstract).

Taguchi, M., Goto, M., Takahashi, M., Kitakado, T. and Pastene, L.A. 2017. DAPC analysis for Bryde's whales in the North Pacific using microsatellite DNA data. Paper SC/MAR17/RMP/01 presented to the Workshop on the Implementation Review of western North Pacific Bryde's whales, March 2017 (unpublished). 7pp.

Tamura, T., Kishiro, T., Bando, T., Yasunaga, G., Murase, H., Maeda, H., Kitakado, T. and Pastene, L.A. 2016a. Response to the 'Report of the expert panel of the final review on the western North Pacific Japanese special permit program (JARPNII)'. Paper SC/66b/SP/01 presented to the IWC Scientific Committee. June 2016 (unpublished). 17pp.

Tamura, T., Murase, H., Sasaki, H. and Kitakado, T. 2016b. Preliminary attempt of spatial estimation of prey consumption by sei whales in the JARPNII survey area using data obtained from 2002 to 2013. Paper SC/F16/JR/16 presented to the JARPNII special permit expert panel review workshop, Tokyo, February 2016 (unpublished). 21pp.

Tamura, T., Kitakado, K. and Pastene, L.A. 2017. Progress Report of the Work Responding Recommendations from the JARPNII Final Review Workshop. Paper SC/J17/JR02 Rev1 presented to the presented to the Expert Panel of the review on the western North Pacific Japanese Special Permit programme (NEWREP-NP). January. 2017 (unpublished). 50pp.

Tiedemann, R., Tiedemann, M.R., Goto, M., Taguchi, M. and Pastene L.A. 2017. Finding parent-offspring pairs among western North Pacific common minke whale. Paper SC/67a/SD/xx presented to the IWC Scientific Committee, May 2017 (unpublished). xxpp.

Watari, S., Murase, H., Yonezaki, S., Okazaki, M., Kiyofuji, H., Tamura, T., Hakamada, T. and Kitakado, T. 2017. Ecosystem modeling in the western North Pacific with a focus on small pelagic fish. International Symposium: Drivers of dynamics of small pelagic fish resources. Victoria Conference Centre, Victoria, Canada. 6-11 March, 2017 (abstract).

Yasunaga, G., Hakamada, T. and Fujise, Y. 2016a. Update of the Analyses on Temporal trend of Total Hg levels in three baleen whale species based on JARPN and JARPNII data for the period 1994-2014. Paper SC/66b/E/08 presented to the IWC Scientific Committee, June 2016 (unpublished). 18pp.

Yasunaga, G., Hakamada, T. and Fujise, Y. 2016b. Update of the Analyses on Temporal trend of PCB levels in common minke whales from the western North Pacific for the period 2002-2014. Paper SC/66b/E/07 presented to the IWC Scientific Committee, June 2016 (unpublished). 11pp.

Yasunaga, G., Mogoe, T., Tamura, T., Yoshida, H., Bando, T. and Kato, H. 2017a. Results of the feasibility study on non-lethal techniques to address the key research objective of JARPNII, based on data and samples obtained in the period 2014-2016. Paper SC/J17/JR03 presented to the presented to the Expert

Panel of the review on the western North Pacific Japanese Special Permit programme (NEWREP-NP), January, 2017 (unpublished). 38pp.

Yasunaga, G., Inoue, S., Yoshida, H. and Kitakado, T. 2017b. Update on analyses on efficiency of biopsy sampling for sei, Bryde's and common minke whales, based on data and samples obtained in the 2014-2016 JARPNII surveys. Paper SC/67a/SP/xx presented to the IWC Scientific Committee, May 2017 (unpublished). xxpp.