Response to the 'Report of the Expert Workshop to Review the JARPN II Programme'

Luis A. Pastene[1], Hiroshi Hatanaka[1], Yoshihiro Fujise[1], Naohisa Kanda[1], Hiroto Murase[1], Tsutomu Tamura[1], Mitsuyo Mori[1], Genta Yasunaga[1], Hikaru Watanabe[2] and Tomio Miyashita[2]

[1]*Institute of Cetacean Research, Toyomi-cho 4-5, Chuo-ku, Tokyo 104-0055, Japan*
[2]*National Research Institute of Far Seas Fisheries, Fukuura 2-12-4, Kanazawa-ku, Yokohama, Kanagawa 236-8648, Japan*

ABSTRACT

The International Whaling Commission's Scientific Committee carried out a workshop to review the progress made in the research conducted under the Japanese Whale Research Program under Special Permit in the North Pacific–Phase II (JARPN II) in its first six years (2002-2007). The review followed the new protocol agreed by the IWC SC in 2008. An Independent Expert Panel examined a total of 36 scientific papers prepared by Japanese scientists in response to the Terms of Reference of the workshop. Scientists related to the JARPN II research participated in the Workshop only with the aim of presenting papers on particular agenda items and to respond 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 expert workshop to review the JARPN II programme is presented in document SC/61/Rep1. The present paper summarizes the views of scientists related to the JARPN II research on the scientific output of the review workshop, and the manner in which they are addressing the main scientific suggestions from the Independent Expert Panel. In general the workshop report produced by the Panel represents a fair and balanced evaluation of the work conducted by the JARPN II in its first six years. Most of the suggestions from the Independent Review Panel are considered useful and will contribute to improve the research output from the first six years as well as future research under the JARPN II.

INTRODUCTION

The International Whaling Commission's Scientific Committee (IWC SC) carried out a workshop to review the progress made in the research conducted under the Japanese Whale Research Program under Special Permit in the North Pacific–Phase II (JARPN II) in its first six years (2002-2007). The workshop was conducted following the new protocol agreed by the IWC SC in 2008 (IWC, 2009a). The primary tasks of the review workshop were to (IWC, 2009b):

a) Review the scientific work undertaken thus far against the stated objectives of the programme and to review future plans in the context of the likelihood of meeting those objectives;
b) Review of the techniques used (lethal and non-lethal);
c) Review of the appropriate sample sizes; and
d) Review of the effects of any catches on the relevant stocks

An Independent Expert Panel (IEP) examined a total of 36 scientific papers prepared by Japanese scientists, related to the Terms of Reference of the review workshop. The report of the IEP is given in document SC/61/Rep1 (IWC, 2009b) ('IEP report' in this paper).

The objective of the present paper is to summarize the views of scientists related to the JARPN II research ('JARPN II scientists' in this paper) regarding the scientific output of the review workshop, and the manner in which they are addressing the main scientific suggestions by the IEP.

Specific analyses conducted in response to some suggestions and recommendations are presented in documents SC/61/JR2-9. The list of papers presented to the JARPN II review workshop including the respective document numbers is shown in Appendix 1.

OVERVIEW

JARPN II scientists consider that the evaluation by the IEP of the JARPN II research in its first six years was objective and balanced. For each of the JARPN II research objectives the IEP praised the quality and scientific contribution of the research. At the same time the IEP identified those areas where further work is required and provided suggestions and recommendations that if correctly implemented, will contribute to improve analyses from the first six years of research as well as future research under JARPN II.

On the first objective of JARPN II (Feeding ecology and ecosystem studies) the IEP appreciated 'the notable amount of effort undertaken and the generally high quality of the sampling programme, resultant data and information from JARPN II studies on whale food habits and prey preferences. The sampling programme was generally well-coordinated across a wide range of vessels and platforms, and the degree of concurrently collected multi-disciplinary data was laudable. These efforts have resulted in valuable datasets that have great potential for concerted analytical work on a broad range of topics, not all directly related to the JARPN II programme objectives' (IEP report, page 6). On the modeling work the IEP agreed that 'the models as developed thus far are not yet at the stage where they can be used to draw even general conclusions and certainly cannot be used to reliably inform management advice. Nevertheless, they comprised a substantial and laudable effort, and an encouraging start to the necessary process of synthesising the data collected during the programme' (IEP report, page 8). The IEP also identified areas requiring further work and provided recommendations on further analyses.

On the second objective of JARPN II (Pollutant monitoring) the IEP concluded that 'the JARPN II pollutant studies represent a valuable contribution to our knowledge in this area and acknowledged the considerable amount of work presented. The programme is addressing its objectives' (IEP report, page 11). The IEP also recommended further work.

On the third objective of JARPN II (Stock structure) the IEP acknowledged 'the substantial scope of the genetic analyses undertaken under JARPN II, which provides a uniquely large data set for testing hypotheses regarding stock structure in the target species. Analyses conducted with the genetic data under JARPN II were in general sound and of a nature common to other genetic analyses within and outside the IWC Scientific Committee framework. The inclusion of morphological and morphometric studies as well as genetic information helps to provide a more well-rounded picture of stock structure' (IEP report, page 17). The IEP also agreed that 'the genetic and other analyses do (and will in the future) assist in the formulation/narrowing of hypotheses for use in RMP *Implementation Simulation Trials'* (IEP report, page 32). The IEP also identified areas requiring further work and provided recommendations on further analyses.

Regarding other contributions to important research needs the IEP congratulated the proponents 'for simultaneously collecting *in situ* sea surface and water column characteristics while conducting the whale and prey surveys, recognising the practical challenges of coordinating these sampling methods on the same ship at the same time' (IEP report, page 20). It also welcomed analysis conducted on distribution of large whale species (IEP report, page 20). As in the case of the other JARPN II components the IEP identified areas requiring further work and provided recommendations on further analyses.

JARPN II scientists consider that many of the recommendations of the IEP on future JARPN II work are also valid for the assessments of other species and stocks currently considered under the RMP and AWMP. This is particularly valid for the recommendations on stock structure research.

Due to a lack of comparative data the IEP was unable to evaluate lethal and non-lethal techniques in the context of JARPN II objectives. On this topic JARPN II scientists would like to emphasize that JARPN II makes use of both techniques and that the combined use of both techniques are important for the main objective of the program (Feeding ecology and ecosystem studies) (e.g. sighting surveys for abundance estimates and whale biological survey for investigating stomach contents). Also they would like to point out that the IEP recognised 'that at present, certain data, primarily stomach content data, are only available via lethal sampling' (IEP report, page 26). As recognised by the IEP a quantitative comparison between lethal and non-lethal for studying particular research items is not part of the present JARPN II programme (IEP report, page 27). Therefore the lack of comparative data allowing for an evaluation on this subject is not responsibility of JARPN II scientists. Notwithstanding this, JARPN II scientists would like to contribute positively on the recommendations offered by the IEP on this topic.

The IEP was not able to provide scientific advice on the appropriateness of the sample sizes of the whale survey component of JARPN II. Recognising that a full evaluation of sample sizes for an integrated study is a major undertaking, the IEP provided guidance to the proponents to assist in the process (IEP report, pages 27-28). In each case (objective) the IEP recommended that the development of refined, more quantified sub-objectives for each component of the programme should be undertaken as a priority; this lack of such sub-objectives is a general weakness of the present JARPA II programme' (IEP report, page 28). JARPN II scientists consider that this recommendation is important. They are already conducting some work under the guidance of the IEP (particularly on the first and third objective of JARPN II). Once this work is completed the recommendation on the development of more refined, quantified sub-objectives will be addressed.

The IEP concluded that the information available did not constitute a sufficient basis to provide advice on the effect of planned JARPN II catches on common minke whale (IEP report, page 30). Further the IEP was unable to provide a complete scientific review of the effect of catches upon western North Pacific sei whales until additional work is undertaken (IEP report, page 31). JARPN II scientists consider that the reasons for this lack of evaluation are: a) lack of data for some areas outside the JARPN II survey area, particularly for common minke whales; b) insufficient analysis of the available data, for example regarding the scientific basis of extrapolation of abundance in the case of the sei whale; and c) lack of agreement within the IWC SC on some population dynamics parameters important for such evaluation, e.g. MSYR, as well on the plausibility of stock structure scenarios, particularly in the case of the common minke whale.

These recommendations on the different topics addressed by the review workshop and the responses from JARPN II scientists are provided in the next section of this paper.

RESPONSES TO SUGGESTIONS AND RECOMMENDATIONS FROM THE INDEPENDENT EXPERT PANEL

A summary of recommendations from the IEP and responses from JARPN II scientists is shown in Table 1.

Review of JARPN II results

Feeding ecology and ecosystem studies

Prey consumption by cetaceans and prey preference of cetaceans (coastal and offshore components)

Documents SC/J09/JR9, 16, 17 on whale's consumption rates, and SC/J09/JR10, 11, 18 on prey preference of whales, were presented to the review workshop. On the basis of the discussion of these documents the IEP made the following recommendations:

Recommendations:
Regarding whale's consumption rates presented at the workshop, one of the IEP's major concerns related to the lack of full treatment of uncertainty. The IEP recommended that additional analyses be undertaken to identify the greatest sources of uncertainty and to determine appropriate sampling and analytical strategies to address them (**IEP report, page 6**). On this particular topic, Annex F of the IEP report shows the steps in the estimations of consumption rates for which estimates of uncertainty are required (**IEP report, page 52**). Some particular work was recommended in time for the 2009 SC meeting (**IEP report, page 6**):

(a) Incorporate the use of several reasonable models and include the range of possible results in reporting the work; (b) use that range in subsequent analyses (including any ecosystem modelling) that employ these daily/annual consumption estimates; (c) undertake sensitivity analyses for the range of parameter values used in the consumption equations; d) to provide the formulae used to scale up daily, individual whale consumption rates to annual, population level rates;

The IEP also noted that an essential component of this will be to improve the precision of the abundance estimates that are used to extrapolate to population-level rates, for both the coastal (the possibility of regular well-designed aerial surveys should be considered) and the offshore regions (a full synoptic survey of the region should be considered) (**IEP report, page 5**)

Response:
All these issues noted by the IEP are common to the analyses on prey consumption presented originally in Documents SC/J09/JR9, 16 and 17, for both whales in the coastal and offshore components of JARPN II. Therefore an examination of the uncertainty in the different steps and parameters involved in the estimation of consumption rates is presented in a single paper that used the information from the offshore component of JARPN II on common minke, Bryde's and sei whales (Tamura *et al*., 2009, Document SC/61/JR2 in this meeting). The output of this examination will be used to re-consider prey consumption estimates for common minke whale in the coastal component of JARPN II.

Tamura *et al*. (2009) examined the uncertainty in several components involved in estimating the amount and types of prey consumed by whales, assisted by a recent review of whale consumption estimates by Leaper and Lavigne (2007). First they compared a total of six models currently used for estimating daily consumption in whales. This comparison was conducted in terms of daily consumption (kg) as a function of body biomass. Differences in daily consumption among methods increase with body mass and they are substantial for whales with large body mass. For further examination of the uncertainty in other components the authors chose, the two more extreme models e.g. those producing the largest (equation 7) and the smallest (equation 6) amount of daily prey consumption.

The next item examined was the uncertainty in the information on energy contents of prey species. This information is important for four of the models considered in the examination, including the model used in JARPN II. The examination suggested that differences in energy contents among prey species can not be disregarded in applying these models. In the case of the JARPN II research the caloric values of dominant prey species of whales in the western North Pacific was determined. However the sample sizes were small and the authors concluded that a larger number of samples should be examined to take into account intra-seasonal differences in energy contents.

The next item examined by Tamura *et al*. (2009) was the uncertainty involved to scale up daily individual whale consumption rates to individual annual rates. On this particular item two aspects were considered: the ratio of high and low feeding seasons in terms of the energy intake per year, and the numbers of days spent by whales in the high feeding season. If the proportion of the energy intake during high feeding season was in the range 70-90% of the annual total, the range of *H* index (a feeding index of high feeding season) for common minke, sei and Bryde's whales was estimated at 1.05-1.72, 1.19-1.80 and 1.19-1.80, respectively. A review of relevant literature suggested that the number of days spent in the high feeding season was 214, 183 and 184 for common minke, sei and Bryde's whales, respectively.

Next the authors estimated the range of daily prey consumption by sex and reproductive status of each species using the equations 7 and 6 mentioned above. Estimates of daily prey consumption of mature females common minke, sei and Bryde's whales were 47-158kg, 102-491kg and 132-577kg, respectively. A comparison of these figures with the observed stomach content weight suggested that consumption rates as estimated by equestion 6 could be underestimated. By using estimates of the number of whales in the survey area the range of total prey consumption estimates in the research area for common minke whales were 122 thousands tons (95%CI: 74-203) and 281 thousands tons (95%CI: 183-435) by equations 6 and 7, respectively.

It is suggested that for modeling purposes the range of prey consumption estimates from different models (excluding model in equation 6) be used in the future. As shown in Tamura *et al*. (2009) prey consumption by equation 6 could be underestimated. In the future, data logging telemetry could provide valuable information on times of food intakes in a day and diurnal changes in stomach content weight will become clearer through future research. Such information will be valuable to further evaluate these different models.

It is clear from the evaluation of Tamura *et al*. (2009) that additional information on caloric values of prey species is required to increase the precision of some models using such information. Also additional data on prey composition by season and area as well composition of sex and maturity stage by season and sub-area are required to increase precision of estimates. Regarding residence time data are available for the time of arrival of whales into the feeding area but little data are available for the time whale leave the area. Sighting surveys designed for late fall or early winter should be considered in future.

It is important to increase the precision of the abundance estimates that are used to extrapolate to population-level rates. However, aerial surveys in coastal waters may not be a suitable method to collect data for estimate abundance of minke whales. Previous sighting surveys for finless porpoises in Japanese coastal waters (including the Sendai Bay) have used airplanes. During these surveys finless porpoise, sperm and beaked whales were observed, however, no sightings of common minke whales were made (H. Yoshida pers. comm.). It seems that the water color in the area was usually muddy making it difficult to detect minke whales in these surveys.

Suggestions or recommendations

At the medium-to long-term, the IEP recommended the following (**IEP report, page 7**):

a) Combine the oceanographic data, prey distributions and sighting survey data statistically to investigate how prey and whale distributions are associated with oceanographic conditions, and how whale distributions are related to distributions of prey–in this regard the sei whale example spatial modelling approach given in

SC/J09/JR36 needs to be refined and extended further; b) combine data on prey distributions as observed in the area where the whales were caught with the diet of the whales (referred to as the micro scale) statistically to evaluate how well the whale diet reflects prey availability in the area where it was caught; c) compare results from the approaches listed above with the results on selectivity already produced and presented at the workshop.

Response:
JARPN II scientists appreciated the positive evaluation by the IEP of the survey methodologies as well of the analytical methods of prey preference presented to the workshop. The constructive recommendations above by the IEP are welcomed and the suggested analysis will be conducted as medium to long term objectives. Because the analyses recommended by the IEP are still in the early stage in this field, development of novel approaches will be required. This can be achieved by using the extensive data set of JARPNII as pointed out by the expert panel. JARPN II scientists are also aware of development of other approach to estimate prey preference. Some initial attempts (SC/J09/JR19 and SC/J09/JR36) were reported to JARPN II review workshop.

Firstly prey distribution data will be incorporated into the spatial models such as GAM and Non-Parametric Multiplicative Regression (NPMR) within the time frame of two to three years by using the data collected during the first six-year period of JARPN II. This method will be also adopted for other regions like the coastal component off Kushiro as well for other whale species in the near future. Second the applicability of the data to estimate prey preference at micro scale in a manner similar as already conducted in the Barents Sea (Smout and Lindstrøm, 2007), will be investigated. The time frame for this work will be three to four years. Effect of spatio temporal scale on prey preference has not been investigated fully even if it is considered as one of the important factosr in ecosystem models. Scaling issue regarding to prey preference will also be considered. First and second points will be conducted by using the data collected during the first six-year period of JARPN II. Then, these methods will be applied to new data sets collected during the second six-year period of JARPN II, and the results will be presented to the next review meeting. Experimental survey on prey preference might be conducted before the next review meeting based on the results of the above mentioned analyses.

Ecosystem modeling (coastal and offshore components)

Documents SC/J09/JR14, 21 and 22 on progress on ecosystem modeling were presented to the review workshop. On the basis of the discussion of these papers the IEP made the following recommendations:

Generic recommendations (IEP report, page 8-9):

a) The models developed should be used to identify the areas of uncertainty with the greatest impact on model outputs of relevance to management, and hence to guide the prioritization of future data collection and the associated sample size/sampling design; b) a wider range of models need to be considered. Further work should aim towards fitting dynamic models to time series of data, especially abundance indices; c) the area covered by JARPN II is not spatially homogeneous, and serious consideration should be given to developing separate models for three regions distinguished by the inshore or shelf region, the sub-Arctic oceanic region of the Oyashio current and the sub-tropical region of the Oyashio and Kuroshio transition zone; d) there is a need to take much wider account of uncertainty at all stages of the modelling process, including that associated with the prey consumption rates of whales (e.g. the Bayesian approach of SC/J09/JR14 should be readily extendable towards that specific end, and more generally other approaches such as sensitivity testing should be employed); e) the importance, ultimately, of developing models which incorporate natural variability in dynamic processes (e.g. recruitment variability for prey species) was emphasized, although it was recognised that this might not be possible for certain ecosystem modelling packages. This is in addition to taking account of uncertainty in model structure and parameter values. The complexity of ecosystems and the difficulty of modelling species interactions adequately might mean that management actions based on such models are more likely introduce unexpected instabilities than current single-species based approaches; this suggests a more cautious approach will be needed on the part of decision makers.

Response:
JARPN II scientists consider these recommendations as quite reasonable and modelers are considering these recommendations to plan their future work. Modelers will aim towards fitting the models to available time series data. In addition, spatial structure of the model (e.g. distinguishing Oyashio and Kuroshio transition zone etc.) will be reinvestigated. This may require a certain amount of time since it requires a wider range of knowledge on species involved and needs to take consideration the movement of the species between various zones. Current ecosystem models have considered some of the uncertainties involved in the model, for example those related to functional response form and strength in trophic flow. Though it is admitted that this is not enough it

is planned that further uncertainties in model structure and parameter values will be taken into account in the model step by step. However, it should be noted that the Ecopath with Ecosim model can not in general include natural variability (recommendation e) above). In this point, further emphasis may be on building MRM type models.

Regarding recommendation d) above some of the analyses recommended to evaluate uncertainty of prey consumption rates are being conducted. In a next step this information will be considered in the modeling process.

Specific recommendations (IEP report, page 9):

a) With respect to the Bayesian analysis of SC/J09/JR14, the IEP agreed that if there are other predators making individual contributions to sand lance natural mortality of similar size to that estimated for minke whales, their explicit inclusion in this model must be considered. It agrees that Type I functional relationships are unrealistic and need not be considered further. As noted earlier, any results presented should distinguish yields of the prey species to predators and the fishery; b) for the EwE approach of SC/J09/JR21, the IEP agreed that it is important to concentrate first on improving the Ecopath component of this EwE analysis, before moving on to the next step of extending from a static to a dynamic model such as Ecosim; c) the species included in the Ecopath analysis should be reviewed giving attention to Ecopath models developed for other regions; in particular the inclusion of gelatinous zooplankton should be considered. Furthermore the values of the parameters of this Ecopath analysis should be compared with values for those others, with attention directed towards any instances of major discrepancies. Inspection of some features of diagnostic plots of the current Ecopath results suggest reconsideration of some of the parameter values, e.g. the plot of log biomass against species does not decline as rapidly as customary, suggesting perhaps that the abundance of primary producers is underestimated; for a number of species, the fraction of production consumed within the system (the ecotrophic efficiency parameter EE) is unrealistically close to the maximum of possible of 1; and the P/C ratio (production by a species relative to its food consumption) is unrealistically high for some species; d) The features noted suggest the need to rebalance the Ecopath model. Alternative approaches to doing so should be considered. For example, rather than use values for some parameters drawn from other regions, placing a bound on some relationship (e.g. $P/C<0.6$) may lead to an improved result overall; e) further analyses must take full account of the uncertainties associated with model inputs e.g. using Ecoranger; f) finally, the IEP noted that the approach in SC/J09/JR22 was the most preliminary presented. Further work on MRM approaches is encouraged and should focus in particular on fitting such models to time series of data.

Response:
Again JARPN II scientists consider these recommendations as quite reasonable and modelers will consider these recommendations in their plan for future work. In improving the Ecopath component, further data on low trophic levels (e.g. zooplankton, primary producers) are required as suggested by the IEP in recommendation c) above. The implementation of this recommendation will require research collaboration with other institutions which have further knowledge and data on these low trophic level species. By updating these data and with careful attention to rebalancing the model, we hope the current model will be improved. In addition, Ecoranger will be used in investigating uncertainties associated with model inputs.

Monitoring Environmental Pollutants in Cetaceans and the Marine Ecosystem

Pattern of accumulation of pollutants in cetaceans
Bioaccumulation process of pollutants through the food chain
Relationships between chemical pollutants and cetacean health

Documents SC/J09/JR23, 24 and 25 on environmental pollutants were presented to the review workshop. The IEP made both paper-specific recommendations (with suggestions to present some results at the 2009 SC meeting), and general recommendations to be implemented over a longer period of time.

Paper-specific recommendations:

SC/J09/JR23 (**IEP report, page 11-12**)
(a) The analyses should be carried out by age when age data become available; (b) if possible future studies also examine levels in the liver to facilitate comparison with other studies. c) a GAM fitted to these data would be a better method for determining the change points and examining non-linear trends in the Hg levels. If possible such an analysis should be presented at the 2009 Annual Meeting; d) the IEP received a figure showing the flow

of total mercury in the predators and their prey, not included in the paper. The IEP found this valuable in linking both parts of the study together and in illustrating how the concentration found in each species are related to one another, the IEP recommended that this figure be included in a revised paper for the 2009 SC meeting.

Response:
Yasunaga and Fujse (2009a) (Document SC/61/JR3 in this meeting) conducted an additional analysis on total mercury (THg) trend in common minke whale based on generalized additive model (GAM). This additional analysis was conducted to further examine temporal trend of THg levels in common minke whales from sub-area 9 in the period 1994-2007. Results of this analysis suggested two periods: the first extending until 1999 showing a decreasing trend and a second from 2000 showing a stable trend. These results based on GAM are the same as those obtained in the original paper based on multiple linear regression analyses (SC/J09/JR23). This paper also includes a schematic figure on total Hg (THg) flow in the western North Pacific food web. This figure indicated that differences in food habitat can explain the pattern of Hg accumulation of baleen whales.

JARPN II scientists agreed that age data should be considered in the analyses when such a data become available (a) above), and they will give consideration to the use of liver samples in the near future (b) above). The system for age determination of baleen whales taken under special permit has been re-structured in an effort shared between the ICR and the Tokyo University of Marine Science and Technology. This re-structuring implies refinement of past methods as well the exploration of new methods for age determination of whales. One output of this exercise will be new data on age determination for the whale's species taken under JARPN II, and these data will be used for implementing recommendation a) above. Liver samples have been already collected during the JARPN II samples and a number of these will be examined to facilitate comparison with other studies that have used this tissue for analyzing Hg.

SC/J09/JR24 (**IEP report, page 12**)
a) The IEP noted that it was not clear whether the study animals reported in the paper SC/J09/JR24 were all mature males, although it was clarified that this was the case. This should be made clear in a revised paper presented to the 2009 Annual Meeting; b) the IEP recommended that future studies must be carried out on a lipid weight basis; c) the IEP recommended that in future, sampling for PCBs and Hg from the same individuals is undertaken to allow combined analyses of these often co-occurring contaminants.

Response:
Yasunaga and Fujise (2009b) (Document SC/61/JR4 in this meeting) conducted an additional analysis on PCB trend in mature males of common minke, Bryde's and sei whales from the western North Pacific in response to the IEP recommendation that future studies on PCB must be carried out on a lipid weight basis. For this additional analysis a total of fifteen animals in each whale species were analyzed for fat contents and this was converted into concentrations in fat wt. basis. Results of the statistical analysis on PCB level trends in these baleen whale species were consistent with those originally presented in SC/J09/JR24.

JARPN II scientists will give consideration to suggestion c) above (sampling for PCBs and Hg from the same individual) in the near future. As a first step they will investigate the sample availability for the individual whales already investigated for either PCBs or Hg. If additional samples still exist analyses will be conducted for PCB or Hg so that information from both contaminants can be obtained from the same individual. If not, future sampling of tissues for both contaminants from the same whale will be considered.

SC/J09/JR25 (**IEP report, page 12**)
a) The IEP recommended that in a revised paper submitted to the 2009 Annual Meeting, greater emphasis is given to the important ecotoxicological finding that demethylation abilities appeared to be different among the species, and higher selenium levels, especially in Bryde's whales, indicated they were likely to be less vulnerable to effects of MeHg than the other species; b) although concentrations of THg in liver, kidney and muscle (i.e. the main target organs) were presented, the IEP agreed that for total body burden estimates, additional organs would need to be included. It suggests that the authors investigate whether the available literature indicates whether the proportion found in these tissues can be derived and thus total burden estimates made; c) the IEP recommended examination of THg in brain tissue particularly for comparing the more coastal bycaught animals to the coastal and offshore JARPN II samples, as these would provide a valuable (perhaps more exposed) comparison group. It was observed that brain tissue is very important if the newer contaminants are to be investigated in the future. Additionally, polybrominated compounds target adrenal glands as well as fat, so contaminant levels can be as high in these organs as they are in the blubber.

Response:
JARPN II scientists concur with the IEP that the ecotoxicological finding mentioned in a) above is important. Although no new paper is presented to the 2009 SC meeting, emphasis will be given to this in future research. During the intersessional period the literature will be checkd to investigate whether the proportion found in the tissues analysed can be derived and thus total burden can be estimated. If not, analysis of additional organs will be considered.

JARPN II scientists also concur with the IEP that analysis of brain tissue is important for the reasons given in the IEP report, and effort will be made to sample such tissue in future surveys, as no such tissue has been collected so far by JARPN II (b) and c) above). JARPN II scientists understand the suggestion to examine THg in samples of minke whales from bycaught animals (c) above). However they consider it difficult to implement this recommendation. The ICR is in charge of genetic monitoring of bycaught animals. According to current regulations, sending a genetic sample of the by-caught animal (with some ancillary information) is the only requisite for having the by-caught whale being processed and sold in the market by the fishermen involved in the by-catch. Fishermen do not have the expertise to select and collect internal tissues. As a consequence tissue other than skin samples for genetic analysis are not available from by-caught animals.

General recommendations (IEP report, page 12-13):

a) Any future contaminant exposure and uptake studies should be based on a balanced, structured study design with a specific number of individuals sampled within each strata (e.g. by species, sex, stage, ocean regime and location). All the necessary data on exposure and confounding variables should be obtained from all of the specifically targeted individuals and a control or comparison group should be included. In this way a more powerful and statistically robust study to address clearly stated hypotheses could be designed and carried out; b) tissues should be archived (frozen at –20^{o}C or lower if possible) for future retrospective analyses; c) the importance of having absolute age as an additional covariate for the interpretation of the results, both the pollutant levels and to provide further information on population structure, cannot be over-emphasised and every effort should be made to obtain such data; d) consideration should be given to including coastal, J-stock bycaught minke whales in future studies as these would provide a valuable (perhaps more exposed) comparison group; e) future studies should include data on stable isotope ratios and fatty acid profiles from a variety of tissues (for example muscle, liver, brain, blubber, skin) as these profiles, also indicative of diet, could help determine what the whales had been feeding on in the past (particularly important for assessing predator prey relationships in blubber PCBs and other persistent organic pollutants (POPs)) that are integrated in these tissues over a long timeframe, for an example see Fisk *et al.* (2001). This would help discriminate among reasons for temporal changes (i.e. dietary changes or exposure variation with constant diet); f) the air and water samples obtained could have been useful in a 'fate and behaviour' study but congener specific data (especially for PCBs) and other elements would need to have been included to make a substantive contribution to knowledge in this field. There are various modelling approaches that could be implemented but more results for air and water, including the effect of weather using simultaneously collected data, are required. More resources and effort needs be allocated this aspect of the monitoring; g) simple mass balance studies (input-output estimates) would contribute to our knowledge of the partitioning and offloading of contaminants in these species and the potential impact of changes in exposure. For this, additional analysis of blood, bile, faeces and urine is required; h) the contaminant results should eventually be linked to the prey consumption studies. For example, the proponents could model the flow of Hg in the marine ecosystem (using, as one example, the approach taken by Booth and Zeller (2005), who used Ecotracer, a new routine in Ecopath, for this) and determine how changes in the flow of energy within the system might affect the flow of contaminants and their deposition rates.

Response:
a) This recommendation is related to the issue of sample sizes and corresponding power analysis recommended (see section on sample size below). As explained in the section on sample size below the study design suggested will be considered after the power analysis that take into account covariates has been conducted.
b) All the tissues and organs such as muscle, liver, kidney and blubber of all whales sampled by JARPN II have been stored at -20ºC.
c) As explained above the age reading system based on earplug has been restructured and other methods are being developed. Age and other covariates will be incorporated in the study on pollutant monitoring once these data become available.
d) JARPN II scientists understand the utility of coastal by-caught J-stock whales for comparison purposes in the pollutant study. For the reasons given above, tissue samples of by-caught minke whales are not available for the environmental study.

e) JARPN II scientists consider this suggestion valuable and would like to inform that a study on patterns of stable carbon and nitrogen isotopes in the baleen of common minke whale from the western North Pacific was previously conducted and published (Mitani *et al*., 2006). In this study stable carbon and nitrogen isotope ratios were determined in the baleen plates of 17 common minke whales as well as prey species (krill *Euphausia pacifica*, Japanese anchovy *Engraulis japonicus* and Pacific saury *Cololabis saira*) collected in the stomach contents, to investigate the trophic relationship between the minke whales and their prey. A few δ15N-depleted peaks occurred along the length of baleen plates for 10 males irrespective of stomach content (anchovies and sauries). Similar δ15Ndepleted peaks were also found for one female and two immature individuals. It was likely that these δ15N-depleted peaks formed in early summer. The stable nitrogen isotope ratio (δ15N) values in Pacific saury (9.3 ± 1.4‰) did not differ significantly from that in Japanese anchovy (8.8 ± 0.9‰). In contrast, δ15N in krill (7.2 ± 0.5‰ in July and 8.0 ± 0.2‰ in September) were significantly lower than in the Pacific saury. The authors suggested that these peaks may reflect the dietary change from krill to fishes in the feeding migration of the whales. Growth rate of the baleen plate was estimated to be 129 mm/y, and it appeared that a dietary record of about 1.4 years remained in the baleen plate. For two immature whales, the maximum value of δ15N occurred at the tip of baleen. This δ15N enrichment may possibly be useful for discriminating weanlings and older whales. JARPN II scientists will consider further studies in this field that take into account the suggestion of the IEP.
f) JARPN II scientists agree that additional data for air and water are required for future modeling purposes. However appropriate consideration should be given to the logistic involved, especially to the equipment and clean rooms required for examining trace elements and isomers of organochlorines in the environmental sample from offshore.
g) This recommendation is important for studying the fate of pollutants. The logistics involved in the sampling of blood, bile, faeces and urine under JARPN II, which are required for the simple mass balance study, will be considered in the intersessional period.
h) This is an interesting and useful suggestion. Modeling of Hg flow and/or energy flow in marine ecosystem will be tried in future. However JARPN II scientists consider that before embarking on such a modeling exercise, it is important to first implement the other recommendations regarding Hg determination in each component of the food chain.

Stock Structure
Common minke whale
Bryde's whale
Sei whale
Sperm whale

Documents SC/J09/JR26, 27, 28, 29, 30, 31, 32, 33 on stock structure analyses (genetics and non-genetics) in those whale species were presented to the review workshop. Based on the discussion of these documents the IEP provided short, medium and long-term recommendations:

Short-term recommendations (Simple issues) (IEP report, page 18):

a) The genetic assessments should include a brief description of procedures to ensure data quality. This section should refer to the recently adopted IWC guidelines for DNA data quality; b) the revised papers should include estimates of genetic divergence (along with levels of uncertainty) in addition to probabilities of homogeneity; *c) P* values (and divergence estimates) should be reported for all loci combined rather than for each locus separately. In addition to providing more useful information and increasing statistical power, this will help reduce issues related to multiple testing; d) multiple testing issues will still arise in some cases. In general, use of the False Discovery Rate (Benjamini and Yekutieli, 2001) could be preferable to the Bonferroni correction, as it is less conservative and does not sacrifice as much power. Another strategy that can be useful is to exercise discretion in the number of pairwise comparisons that are evaluated–for example, by only comparing samples that are geographically proximate and hence most likely to be connected demographically. See Okland *et al*. (2008) for an example of this approach; e) provide more details on the analyses involving the program *STRUCTURE (Pritchard et al., 2000a)*; f) include a brief discussion of experimental design with respect to sampling. Although the rationale for the sampling design is discussed in other papers (especially SC/J09/JR3 and JR4), it would benefit these evaluations to have a short discussion addressing how the design specifically addresses uncertainties related to stock structure e.g. whether the spatial and temporal coverage of samples of minke whales has been sufficient to test adequately the alternative stock structure hypotheses under consideration by the IWC.

Response:
The IEP suggestions above are valid for the genetic analyses on stock structure conducted for common minke, Bryde's and sei whales. Kanda *et al*. (2009a) (Document SC/61/JR8 in this meeting) and Goto *et al*. (2009) (Document SC/61/JR7 in this meeting) conducted additional analyses in common minke whale based on microsatellite and mtDNA, respectively, that took into considerations the suggestions above (except recommendation e) which is valid only for the analysis of microsatellites based on STRUCTURE). Additional analyses based on these recommendations were also conducted for the Bryde's and sei whales. A summary of results and conclusions for these two species are given below in this paper. Results of analyses conducted in response recommendation e) above are given in Kanda *et al*. (2009b) (Document SC/61/JR5 in this meeting).

It is important to emphasize that the results and conclusions of the original analyses on stock structure of common minke, Bryde's and sei whales presented to the review workshop, did not change with the new analyses conducted as shown below.

Kanda *et al*. (2009a) (Document SC/61/JR8 in this meeting) conducted additional analysis of microsatellite (taking into account the recommendations above) focused to evaluate the plausibility of the stock structure scenarios adopted by the IWC SC during the RMP *Implementation* for the western North Pacific common minke whales. Main results of the study were 1) whales from the J stock existed in the 7W with low but large enough number to cause genetic heterogeneity observed in the 7W samples as well as between the 7W and other samples, 2) except for the J stock whales, the survey area was mainly occupied by O stock; however some degree of genetic heterogeneity found in sub-area 9E should be further investigated in the context of scenario A, and 3) the baselines C and D were not supported because no other genetically distinct stock was observed in the survey area. Results of this revised paper that took into consideration the recommendations of the IEP confirmed the main conclusions in the original document SC/J09/JR30 presented to the JARPN II review workshop.

Goto *et al*. (2009) (Document SC/61/JR7 in this meeting) conducted additional analysis of mtDNA (taking into account the recommendations above) focused to evaluate the plausibility of the stock structure scenarios adopted by the IWC SC during the RMP *Implementation* for the western North Pacific common minke whales. Results and conclusions of this revised paper that took into consideration the recommendations of the IEP, were similar to those of the microsatellite analysis, and confirmed the main conclusion in the original document SC/J09/JR29 presented to the JARPN II review workshop. The additional Fst analysis suggested some degree of heterogeneity in the sample taken in sub-area 9W in 1995, which should be investigated further in the context of stock structure scenario A.

Kanda *et al*. (2009b) (Document SC/61/JR5 in this meeting) present additional microsatellite analysis (taking into account the recommendations of the IEP) focused to distinguish sampled minke whales into genetically distinct stocks using a combination of microsatellite analysis and a Bayesian clustering approach (*STRUCTURE*). Approximately 91% of the individuals were assigned into the either stocks based on their high membership probability (>90%) obtained from the program. Spatial distribution of these assigned individuals clearly indicated that these two stocks were the J and O stocks. In addition, it was also found that 1) the O stock individuals appeared to migrate, although rarely, to the Sea of Japan, 2) the J stock individuals migrated to the 7W of the North Pacific side and very rarely to further east, and 3) the SA2 (western side of North Pacific coast) was mainly occupied by the J stock. Temporal distribution of the assigned bycatches collected from the SA7 (eastern side of Japan, North Pacific coast) where both the J stock and O stock whales were contained in the samples in about 50:50 indicated seasonal movement of the whales with the number of the O stock increased in spring. The results of this revised paper that took into consideration the suggestion of the IEP confirmed the main conclusions of the original document SC/J09/JR26 presented to the JARPN II review workshop.

Regarding Bryde's and sei whales similar additional analyses were conducted in response to the recommendations and suggestions from the IEP above. Results of these additional analyses in these two species were similar to those originally presented to the JARPN II review workshop as Documents SC/J09/JR31 and 32, respectively.

Mid-term recommendations (More extensive matters–some of which might ideally be addressed in time for the 2009 Annual Meeting) (IEP report, page 18-19):

a) The original justification for considering hypothesis C (and to some extent D) for common minke whales was primarily based on results from the Boundary Rank analyses (Taylor and Martien, 2002)–it would be informative to redo those analyses using the new data (including taking into account information on assignment of animals to J-stock) to see if evidence for a narrow coastal stock remains; b) previous analyses of 1999 and 2000 Korean bycatch samples suggested that they differed from other J-stock samples. It is important to integrate these samples into the new datasets to see if this heterogeneity still exists; c) assessments of power using simulated data should be undertaken (see Annex G). It should be relatively straightforward to simulate data to evaluate power to detect a specified fraction of a putative stock (e.g. the hypothetical W stock of NP minke whales) in an overall sample. This analysis would require specifying a range of genetic divergence values (e.g. F_{ST} values) for the putative stock. More challenging but still feasible would be simulations to evaluate the power of *STRUCTURE* (Pritchard *et al.*, 2000a) to detect various mixture fractions of closely related stocks. Although strictly speaking power is a frequentist concept and *STRUCTURE* uses Bayesian methodology, it should be possible to construct a power analogue that reflects robustness to delivering what, with simulated data, is known to be the correct answer. In this case, the specific question could be: how large a proportion of the samples could be from another population and still result in a situation in which K=1 is favored with high probability? These simulations could be carried out using the programs *SimCoal* (Laval and Excoffier, 2004), *ms* (Hudson, 2002), EasyPop (Balloux, 2001) or other freely available software. The statistical power to detect a second stock that is under-represented in the sample will depend upon the fraction of these individuals in the total sample and how genetically divergent they are. This implies that simulations either are conducted as a sensitivity test (i.e., assessing a range of combinations of the sample proportion and degree of genetic divergence) or by deciding upon a minimum case (e.g. the minimum detectable fraction should be X% at a degree of divergence equivalent to a migration rate at Y migrants per generation); d) tests for population genetic (drift-mutation-migration) equilibrium should be undertaken. High haplotypic diversities coupled with low nucleotide diversities indicate deviations from such population genetic equilibrium; e) estimations of divergence between sample partitions should be undertaken using non-equilibrium approaches. An example of such an approach is IM by Hey and Nielsen (2004); the estimates of dispersal emerging from IM may be used in the power assessment simulations suggested below. It is probably advantageous to conduct initial estimations between the potentially most divergent sample partitions (e.g., most extreme parts of the range). These methods improve the approach previously used to estimate dispersal rates for the common minke whale *Implementation Simulation Trials* (Taylor and Martien, 2004)(JCRM 6 (suppl.): 138-9); f) with genotypes from 17 microsatellite loci in 2,500 individuals it may be possible to detect pairs of individuals that are related, as was the case among a smaller set of samples genotyped at the same number of loci in the North Atlantic fin whale (Skaug and Daníelsdóttir, 2006). The spatial distribution of related individuals can provide information directly relevant to stock structure considerations; Økland *et al.*, 2008) have demonstrated the use of such an approach. Notably, such analyses provide information about contemporary stock structure and do not rely upon assumptions of population genetic equilibrium; g) multivariate analyses of morphological data could be informative with respect to stock structure. Many multivariate classification methods (such as cluster analysis, discriminant analysis, *SIMPER*, and *ANOSIM*) now include permutation tests. Another option would be to use a principle components (or similar) analysis of individuals that does not require *a priori* decisions about group membership. PCA does not attempt to define groups but can reveal patterns in the data related to time or place of sampling; h) data on contaminants in western North Pacific minke whales have been reported (Fujise, 1996) and were used as further support for the baseline C stock structure hypothesis (Taylor and Martien, 2004). The use of past and present contaminant data should continue to be pursued as part of an integrative study of stock structure.

Response:

It should be noted that regarding recommendation b) above, some genetic analyses were prepared under research collaborations between Japanese and Korean scientists (Park *et al*., 2009, Document SC/61/NPMxx in this meeting; Kanda *et al*., 2009c, Document SC/61/NPM8 in this meeting).

Regarding recommendation c) above a simple power analysis exercise is presented by Kanda *et al*. (2009a) (Document SC/61/JR8 in this meeting) for the microsatellite analyses on stock structure of O stock common minke whale. In order to assess the statistical power for the tests of homogeneity, genotypic data were generated using computer software EASYPOP and heterogeneity tests were conducted with these generated data. Two or three populations were considered depending on the stock structure scenario tested (baseline A and D = 2 populations, baseline C = three populations), each of which consists of diploid individuals with a constant size and equal sex ratio with random mating. It was assumed a ratio of effective population size to census population size of 1/3 to 1/4. Unless the population sizes of the stocks are much larger than anticipated, the simulation study indicated that from genetics standpoint the statistical power for testing the baselines C and D was quite high. Based on these results it is concluded that the JARPN II survey area of the western North Pacific is primarily occupied by whales from the O stock. The stock structure scenarios C and D are highly unlikely.

The power analysis was also conducted for the heterogeneity tests based on microsatellite data on Bryde’s and sei whales. In the case of the Bryde’s whale the power analysis was focused to investigate the plausibility of the sub-stock scenario in sub-area 1 of the western North Pacific (stock structure hypothesis 4). The simulation study indicated that from genetics standpoint the statistical power for testing this stock structure hypothesis was quite high. This result supports the view of a single stock of Bryde's whales in sub-area 1. The sei whale case attempted to generate a genetic data set to test evidence of genetic differences between whales from east of 150° E and those from, say, west of 180°. The simulation showed statistical power not as high as in the case of the Bryde's whale. Several factors probably contributed to the lower power: small sample size from generated data set for genetic analysis, smaller number of the genetic loci analyzed, and larger effective population size. From the genetic perspective, however, the simulation still demonstrated reasonably high statistical power as a genetic data set.

Power of the *STRUCTURE* analysis conducted by Kanda *et al*., (2009b) (Document SC/61/JR5 in this meeting) on common minke whales is a more challenging issue but it will be considered in the next intersessional period.

Regarding recommendation d) above JARPN II scientists agreed with the IEP that mtDNA data suggest deviation from population genetic equilibrium. Tests have not been conducted using the data of common minke, Bryde's and sei whales presented at the review workshop, however, a previous published paper found a mismatched distribution in samples of common minke whale from the North Pacific, which is consistent with exponential population expansion (Pastene *et al*., 2007). Tests for population genetic equilibrium will be conducted for the other species in the intersessional period. Once completed the tests on population genetic equilibrium, estimation of divergence between sample partitions for the three species in the western North Pacific will be undertaken using non-equilibrium approaches as suggested in recommendation e) above.

JARPN II scientists have recognized the usefulness and importance of the analysis suggested in the recommendation f) and effort will be made to start such analysis in the next intersessional period. In addition to such analysis, they are already analyzing fetus samples for paternity analysis in an attempt to find the potential father from the samples. This is another way to observe movement pattern of the related individuals in the study area. They will hopefully present the results from such kind of analysis at a future IWC SC meeting.

In response to recommendation g) above, an additional morphometric analysis was conducted based on PCA, and results are presented in Hakamada and Bando (2009) (Document SC/61/JR6 in this meeting). Results of this analysis suggested significant difference in morphometrics between the 'J' and the 'O' stocks but no significant differences among 'O'-stock common minke whales from longitudinal sectors in the western North Pacific. Results from the PCA are consistent with those presented to the JARPN II Review Workshop (SC/J09/JR27) based on ANCOVA. The recommendation on contaminant data (h) above), will be considered in the future to complement and better interpret the genetic results on stock structure of common minke whale.

Long term recommendations (IEP report page 19):

a) Notwithstanding the practical difficulties associated with attaching satellite tags to minke whales, the increasing success of satellite tagging programmes for several whale species (e.g. see Weller, 2008) suggest that efforts should be made to establish such a programme for western North Pacific common minke whales. Information such a programme might produce could be very valuable in allowing the IWC to narrow the range of plausible stock-structure hypotheses.

Response:
JARPN II scientists agree that satellite tagging of common minke whales would provide important information on stock structure and movements of this species. JARPN II has conducted experiments on satellite tagging in the Bryde' whale with successful results in two cases (see Nishiwaki *et al*., 2009, Document SC/61/O7 in this meeting). It should be noted that all experiments of satellite tracking under the JARPN II are conducted from the research vessel's platform. In a gradual process JARPN II scientists have made technical modifications to allow the air gun to be fired from such a distance. Also the mechanism of the attachment in the body has been gradually improved. Common minke whales are a smaller species compared with Bryde's whales and their movements at the surface are faster and less predictible than in other species. Nevertheless efforts are being made to further modify the current system for the case of more 'difficult' species as in the case of common minke whale.

Other Results

Item 7.1 Oceanography

Documents SC/J09/JR11, 13, 19, 34, 35 and 36 including information on the relationship between environmental factors and whale distribution, were presented to the review workshop. The IEP made the following recommendations on the basis of the discussion of these documents.

Recommendations (IEP report, page 20-21):

a) To improve the approach in SC/J09/JR19, the IEP recommended that the authors incorporate into the index of density, the sightability of detected groups (e.g. effective strip half widths that include appropriate covariates such as weather conditions). As for all modelling exercises, it is important to test if the chosen model is an improvement over a null, uninformative model and to validate the model results. Approaches to such validation could include: comparison of the modelled results not only with index of densities from the present study but also with data that were collected from other years (e.g. JARPN or other survey data); and exploration of cross-validation type techniques. The IEP recommended that more of these types of analyses (including using other appropriate modelling techniques such as GAMs or logistic regressions) be conducted. The shipboard oceanographic data that were collected should be considered in future models, as was suggested by the authors of SC/J09/JR19. Potential additional oceanographic/biological features that could be investigated include modelling the satellite or *in situ* measurements of chlorophyll to estimate primary productivity; b) to further investigate oceanographic relationships, the Panel recommended that the JARPN II data be pooled or compared with other datasets (e.g. JARPN I or other historical surveys) when possible. This will increase the sample size and increase the possibility of data covering periods of changing relationships (e.g. previous regime changes) thus allowing patterns to be detected; c) the Panel also suggested that the Proponents consider conducting future oceanographic surveys over a area larger than at present, not only to further investigate oceanographic relationships, but also to improve abundance estimates for a variety of species; d) in summary, the Panel recommended that in the long term, to more fully understand the preferred habitat, prey preferences, niche separation of different species, functional response, and spatial and temporal trends in local abundance and other biological factors (such as blubber thickness, pollutants, presence of scars, and stock structure), the oceanographic data collected on the cruises (bottom depth, water column temperature, salinity, and density) and satellite derived data, such as SST, chlorophyll, and sea surface height be integrated into future analyses.

Response:
JARPN II scientists found all of these suggestions and recommendation reasonable. These recommendations will be taken into consideration in their plan for future work in this field. They note that some of the recommendations are similar or complementary to those offered regarding the work on prey preference, and therefore JARPN II scientists could consider all these recommendations together.

Item 7.2 Distribution of large whales

Recommendations (IEP report, page 21):

a) To investigate relationships with oceanographic relationships and improve abundance estimates of a variety of species, the Proponents could consider conducting future surveys that cover an area larger than the present JARPN II data; b) using the sightings data collected over the 1994-2007 period for the variety of large whales, the IEP recommended investigation of whether these data can be used to provide information on trends; c) it also recommended that the photo-identification data be worked up and comparisons made with catalogues elsewhere in the North Pacific.

Response:
JARPN II scientists found all of these suggestions and recommendation reasonable. These recommendations will be taken into consideration in their plan for future work in this field.

Item 7.4 Abundance

Recommendations (IEP report, page 23):

a) The confidence intervals for the abundances estimates are generally wide, especially in the coastal area; and the Panel recommended that increased effort to obtain better estimates should be a high priority.

Response:
Such recommendation has logistical and financial implications. However adequate consideration will be given in planning future sighting surveys.

The techniques used (lethal and non-lethal)

Recommendations (IEP report pages 26-27):

a) The Panel recommended that a full evaluation of the applicability of lethal and non-lethal techniques be undertaken as soon as possible after the relevant work recommended elsewhere in this report has been undertaken; b) the Panel therefore strongly recommended that Japan considers the addition of an objective to quantitatively compare lethal and non-lethal research techniques *if* it decides to continue a lethal sampling programme. Appropriate samples can be archived for future analysis if necessary. Whilst recognising the sensitivities surrounding this issue, the Panel respectfully requests that *if* lethal sampling programmes occur, the IWC or an appropriate scientific body or bodies may wish to consider collaborating in the design of a well specified study to fully evaluate lethal and non-lethal techniques.

Response:
Some relevant data have been collected during the JARPN II and the previous JARPN surveys, which could be used as a first step toward the evaluation suggested, at least for some of the research items. JARPN II scientists would be able to summarize the data obtained on the three research items below. Once these data have been appropriately summarized a study should be designed to evaluate lethal and non-lethal techniques for the research topics involved.

a) Biopsy sampling: information to be summarized from previous surveys involves the effort spent in the experiment, areas covered, species targeted, weather conditions at the time of the biopsy experiments and results of the experiments.
b) Observation of feces at sea: information to be summarized from previous surveys involves the observation effort, areas covered, whether conditions at the time of the observations and results.
c) Content of intestine: content of a number of whale intestine (for the four whale species targeted by JARPN II) is available for analysis. Information to be summarized involves number of intestine sampled, by species and storage conditions.

Regarding a) above biopsy samples can be used for analysis of genomic DNA and for some particular contaminants. The main issue here is whether or not biopsy sampling is an efficient method (in comparison to lethal sampling) for the different species sampled under JARPN II under high seas conditions.

Items b) and c) above are related to the research on prey consumption, which was recognized by the IEP as one of the information only available via lethal sampling (IEP report, page 26). The use of non-lethal techniques for investigating prey consumption of whales involves practical as well analytical consideration. The former can be addressed with the information summarized under item b) above, while the latter can be addressed with the information summarized under item c) above (e.g. DNA analysis of intestine content). Because information on stomach content is available for the same individual whales investigated for intestine contents, the information on prey consumption by lethal and non-lethal (intestine contents used as the alternative to feces), could be evaluated.

As recognized by the IEP, the quantitative comparison of lethal and non-lethal research techniques is not part of the present JARPN II programme. JARPN II scientists recognize the utility of a well designed study to evaluate lethal and non-lethal techniques, and that the JARPN II programme represents a unique platform to conduct such study. At the same time they note that the addition of such objective would imply a considerable extra effort and logistical arrangements to an already busy JARPN II programme. For this reason the addition of the new objective as proposed by the IEP is not possible at this time.

Appropriate sample size

Recommendations (IEP report, page 28):

a) The Panel recognises that a full evaluation of sample sizes for an integrated study is a major undertaking and provides the following guidance to the Proponents to assist in this process (see IEP report, page 28). In each case, the Panel recommended that the development of refined, more quantified sub-objectives for each component of the programme should be undertaken as a priority; this lack of such sub-objectives is a general weakness of the present JARPN II programme and limits the Panel’s ability to review it more thoroughly.

Response:
JARPN II scientists consider that this recommendation is important and consequently they have already started some relevant analyses. Elaboration of more quantified objectives will follow the completion of the relevant analysis recommended by the IEP under the three main objectives of the JARPN II.

As noted by the IEP, for the feeding ecology study determining the appropriate sample sizes is contingent on properly estimating the uncertainty surrounding the key parameters that are ultimately to be used in the modeling process. In fact JARPN II scientists plan to consider uncertainties in diet composition in the models, which will give insight on how precise the estimated diet composition should be to give robust results in Ecosim simulations. Also by using Ecoranger in EwE, the effect of uncertainties in various parameters on the results obtained will be explored. This will again give insight on how precise various key parameters should be estimated to give robust results in Ecosim simulations.

Tamura *et al*. (2009) (Document SC/61/JR2 in this meeting) summarized the prey composition of baleen whale species sampled by JARPN II by sub-area and month (their Table 3). They also summarized the composition of whales based on sex and reproductive status by sub-area and period in the research area (their Table 5). This information will be valuable in considering re-estimations of sample sizes in future. If prey composition and composition of sex and maturity status are estimated by season and sub-areas, sample size become considerably larger.

As noted by the IEP, for the stock structure determining the appropriate sample size and strategy will depend on the results of the power analyses. This will also inform on the geographical and temporal distribution of samples required. Progress in the power analysis was explained above (Kanda *et al*., 2009a, Document SC/61/JR8 in this meeting). It was estimated that high power has been obtained from existing samples of common minke whales. A similar conclusion was obtained for Bryde's whales and to a lesser extent for sei whales.

As noted by the IEP, for the pollutant studies it would be valuable to undertake power analyses to determine the relationship between sample size and the ability to detect changes at various levels should they occur. Further evaluation of covariates such as age and sex is important to determine which animals should be chosen for more extensive sampling. Power analysis for the pollutant studies will be conducted once covariates information such as age becomes available for the targeted whale species.

Effect on the stocks in light of new knowledge on status of stocks

General

Recommendations (IEP report, page 29):

a) The Panel recommended that calculations of the effect of catches should also include results for MSYR (mat) =1%, recognizing that the choice of MSYR (1+) or (mat) is an ongoing matter being discussed within the IWC Scientific Committee; b) the Panel further recommended that in circumstances where *Implementation Simulation Trials* (*ISTs*) have recently been developed for a species in a region, these provide the best basis for evaluating the effect of catches on stocks, as (1) they constituted the Scientific Committee's best appraisal of the range of plausible dynamics for the stocks, and (2) were based on all appropriate population abundance and related data.

Response:
For JARPN II scientists it is difficult to agree with recommendation a) above. The preference of JARPN II scientists is to keep the calculations only for MSYR (1+). This is exactly the same case as the assessments for bowhead and gray whales under the AWMP where only MSYR (1+) has been chosen (see IWC, 2005; 2008). The IWC SC should be consistent in the advice provided on different assessments of whale stocks. If the IWC SC agrees that MSYR (mat) is a more suitable index for using in the assessments, then it should recommends the use of this index in both the assessments of species under AWMP and those sampled under special scientific permit.

JARPN II scientists agree regarding recommendation b) above. However it is important that, prior to the use of the *ISTs* information for this purpose, the plausibility of different scenarios and parameters should have been discussed in depth, and agreed by the IWC SC.

Minke whale

Recommendations (IEP report, page 29-30)

a) SC/J09/JR36 considers only two of the four primary stock structure hypotheses of the ISTs for minke whales, arguing that the new genetic evidence excludes the other two. As discussed under Item 6.2, the Panel considered that further analyses needed to be tabled before such a definitive conclusion might be drawn. Until that work has been presented, the Panel recommended that the effect of catches is examined for all four hypotheses; b) the Panel thus recommended that a new full survey of the Okhotsk Sea is undertaken with a concerted effort being made to obtain biopsy samples of common minke whales for genetic comparison with the JARPN II samples (recognising the difficulties in obtaining biopsy samples); c) the Panel reiterates the general comment made earlier of the value in producing the results of runs for scientific permit catches = 0 for comparative purposes.

Response:
JARPN II scientists disagree regarding recommendation a) above because they consider that scenarios C and D are not supported by current scientific evidence (Kanda *et al*, 2009a; b; Goto *et al*, 2009). Stock structure scenarios C and D were adopted in 2003 with limited supporting information, under the assumption that the plausibility of the four stock structure scenarios would be discussed by the IWC SC before the completion of the RMP *Implementation* for North Pacific common minke whale. That discussion never happened. A considerable amount on new information on stock structure is now available from JARPN II. The IWC SC should carry out its work to assign plausibility to the different stock structure scenarios based on this new information, in the same way as it was done for North Pacific Bryde's whales.

JARPN II scientists agree on the importance of recommendation b) above to know the composition of J and O stocks in this sub-area recognizing that implementation of this recommendation will depend on permission from other States to carry our surveys in the Okhotsk Sea.

JARPN II scientists consider recommendation c) above as valuable. The analysis conducted in response to this recommendation is presented in Hakamada (2009) (Document SC/61/JR9 in this meeting). This author conducted additional HITTER calculations considering the option of JARPN II catches=0. Results suggested that future JARPN II catches have a negligible effect on future population trajectory of the J stock.

Sei whale

Recommendations (IEP report, page 30-31):

a) The Panel recommended that the Secretariat be requested to produce the corresponding catch series for sei whales based on the work conducted for the Bryde's whale series, and that this be used in the assessments of the sei whale stock; b) in the absence of recent survey data for the whole area, the Panel recommended that the assessment of the effect on stocks be repeated without the extrapolation, based on the JARPN II boundary at 170°E, using an assumed range for MSYR (mature) of 1-4%, recognising that this might be considered conservative. The catch series could be recomputed for this boundary, although this is not considered essential. The Panel is thus unable to provide a complete scientific review of the effects of catches upon western North Pacific sei whales until this additional work is undertaken; c) the Panel suggests that the sei whale sightings data be examined for evidence of trend, as has been done for Bryde's whales, while recognizing that resulting confidence intervals might be too wide to draw much inference

Response:
JARPN II scientists agree that recommendations a) and c) above are valuable. JARPN II scientists have already made an official request to the Secretariat for the updated catch series for sei whales and these new series will be used in future assessments. Regarding recommendation c) above effort will be made to examine trend in the near future.

JARPN II scientists disagree on recommendation b) above as the IWC SC has not agreed yet about MSYR (1+) or MSYR (mat). As noted above for the assessment of stocks under AWMP *Implementation*, only MSYR (1+) has been chosen (see also previous comment on this topic). Furthermore for the cases of bowhead and gray whales *Implementation,* values of MSRY (1+) of 2.5% and 3.5%, respectively, have been agreed for the best case scenario (IWC, 2005; 2008). This is important as some of the calculations on the effect of the catches on the J-stock common minke whale based on conservative assumptions e.g., lower 90% confidence limit for abundance and MSYR (1+)=1%, showed a decline in the abundance. However an increase in the abundance was observed when a MSYR (1+)=2% or over was used in the calculations.

Regarding abundance extrapolation in the case of the sei whale the issue is not whether whales distributed in the sector 170ºE-180º belong to the same stock but on the extrapolation factor. Genetic data showed no significant heterogeneity in the North Pacific sei whale. Therefore the abundance estimated within the JARPN II research area can not represent the abundance of sei whale stock targeted in JARPN II, and the assessment without extrapolation can not provide meaningful information on the effect on the stock. JARPN II scientists are conducting new analyses on distribution based on GAM in order to further justify the extrapolation and determine the extrapolation factor.

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Hakamada, T. 2009. Additional analyses on the effect on J-stock of future JARPN II common minke whale catches. Paper SC/61/JR9 presented to this meeting.

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Kanda, N., Goto, M., Kishiro, T., Yoshida, H., Kato, H. and Pastene, L.A. 2009a. Further microsatellite analysis of common minke whales in the western North Pacific. Paper SC/61/JR8 presented to this meeting.

Kanda, N., Goto, M., Kishiro, T., Yoshida, H., Kato, H. and Pastene, L.A. 2009b. Update of the analyses on individual identification and mixing of the J and O stocks around Japanese waters examined by microsatellite analysis. Paper SC/61/JR5 presented to this meeting.

Kanda, N., Park, J.Y., Goto, M., Kim, Z.G. and Pastene, L.A. 2009c. Update of the microsatellite analysis of common minke whales from Korean and Japanese waters. Paper SC/61/NPM8 presented to this meeting.

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Yasunaga, G and Fujise, Y. 2009a. Additional analyses of temporal trends and factors affecting mercury levels in common minke, Bryde's and sei whales in the western North Pacific. Paper SC/61/JR3 presented to this meeting.

Yasunaga, G and Fujise, Y. 2009b. Additional analyses of temporal trends and factors affecting PCB levels in baleen whales from the western North Pacific. Paper SC/61/JR4 presented to this meeting.

Table 1: Summary of scientific recommendations from the JARPN II Review Workshop and status of works. IER= Independent Expert Panel.

Recommendations	Source (IER Report, pp)	Status (This report, pp)
Feed. ecol. and ecosystem studies		
Several recommendations on consumption rates	6	Addressed in SC/61/JR2 (3-4)
Several recommendations on prey preference	7	Will be addressed in the medium-to long term (5)
Generic and specific recommendations on modelling	8-9	Will be addressed once recommendations on relevant input parameters have been completed (5-6)
Pollutant monitoring		
Specific recommendations to JR/J09/JR23	11-12	Addressed in JR/61/JR3 (7)
Specific recommendations to JR/J09/JR24	12	Addressed in JR/61/JR4 (7)
General recommendations	12-13	Some responded in this paper; others will be considered in the near future (8-9)
Stock structure		
Short-term recommendations	18	Addressed in SC/61/JR5, 6, 7 and 8 (9-10)
Mid-term recommendations	18-19	Some addressed in SC/61/JR5, 6, 7 and 8; others will be addressed in the near future (11-12)
Long term recommendation	19	Addressed partially in SC/61/O7 (12)
Other research		
Several recommendations on oceanography	20-21	To be addressed in the near future (13)
Several recommendations on large whale distribution	21	To be addressed in the near future (13)
Recommendation on abundance estimation	23	To be addressed in the near future (13)
Techniques used		
Consider the addition in JARPN II of an objective to quantitatively compare lethal and non-lethal techniques	26-27	Summary of some relevant already collected data is proposed. Due to logistical reason addition of such objective is not possible; (14)
Sample sizes		
Guidance offered by each JARPN II objectives	28	Some work already conducted and presented in SC/61/JR2, 7 and 8, following these guidance Others will be addressed in the near future. Once these are completed refined, more quantified sub-objectives will be developed (14-15)
Effect on the stocks		
General recommendation on MSRY (mat)	29	Will not be addressed (15)
Recommendation on minke whale to use stock structure scenarios C and D in the analysis	29-30	Will not be addressed (16)
Recommendation on minke whale to conduct biopsy sampling in the Okhotsk Sea	29-30	Will be considered but it will depend on authorization by a different State (16)
Recommendation on minke whale to repeat the analysis considering scientific permit catches=0 for comparative purposes	29-30	Addressed in SC/61/JR9 (16)
Recommendation on sei whale to use catch series based on the work conducted for the Bryde's whale	30-31	New catch series officially requested to the Secretariat (16)
Recommendation on sei whale to repeat the analysis without abundance extrapolation	30-31	Will not be addressed (16-17)
Recommendation on sei whale to use sighting data for examining trend	30-31	Will be considered by relevant scientists in the near future (16)

Appendix 1

List of Primary and For Information papers presented to the JARPN II Review Workshop

SC/J09/JR1. Pastene, L.A., Hatanaka, H., Fujise, Y., Kanda, N., Murase, H., Tamura, T., Miyashita, T. and Kato, H. The Japanese Whale Research Program under Special Permit in the western North Pacific Phase-II (JARPN II): origin, objectives and research progress made in the period 2002-2007, including scientific considerations for the next research period. 73pp.

SC/J09/JR2. Kiwada, H., Kumagai, S. and Matsuoka, K. Methodology and procedure of the dedicated sighting surveys in JARPN II –Offshore and coastal component of Sanriku and Kushiro-. 16pp.

SC/J09/JR3. Kishiro, T., Yoshida, H., Goto, M., Bando, T. and Kato, H. Methodology and survey procedure under the JARPN II – coastal component of Sanriku and Kushiro-, with special emphasis on whale sampling procedures. 27pp.

SC/J09/JR4. Tamura, T., Matsuoka, K. and Fujise, Y. Methodology and survey procedure under the JARPN II - offshore component- with special emphasis on whale sampling procedures. 16pp.

SC/J09/JR5. Yonezaki, S., Nagashima, H., Murase, H., Yoshida, H., Bando, T., Goto, M., Kawahara, S. and Kato, H. Methodology and procedures of surveys of prey of common minke whales JARPN II - Coastal component of Sanriku. 6pp.

SC/J09/JR6. Watanabe, H., Yonezaki, S., Kiwada, H., Kumagai, S., Kishiro, T., Yoshida, H. and Kawahara, S. Methodology and procedures of common minke whale's prey surveys in JARPN II –Coastal component of Kushiro-. 12pp.

SC/J09/JR7. Murase, H., Watanabe, H., Yonezaki, S., Tamura, T., Matsuoka, K., Fujise, Y. and Kawahara, S. Methodology and procedures of cetacean prey surveys in JARPN II –Offshore Component-. 11pp.

SC/J09/JR8. Hakamada, T., Matsuoka, K. and Miyashita, T. The number of western North Pacific common minke whales (*Balaenoptera acutorostrata*) distributed in JARPN II coastal survey areas. 12pp.

SC/J09/JR9. Tamura, T., Konishi, K., Goto, M., Bando, T., Kishiro, T., Yoshida, H., Okamoto, R. and Kato, H. Prey consumption and feeding habits of common minke whales in coastal areas off Sanriku and Kushiro. 18pp.

SC/J09/JR10. Murase, H., Kawahara, S., Nagashima, H., Onodera, K., Tamura, T., Okamoto, R., Yonezaki, S., Matsukura, R., Minami, K., Miyashita, K., Yoshida, H., Goto, M., Bando, T., Inagake, D., Okazaki, M., Okamura, H. and Kato, H. Estimation of prey preference of common minke whales (*Balaenoptera acutorostrata*) in a coastal component (off Sanriku) of JARPNII in 2005 and 2006 . 15pp.

SC/J09/JR11. Watanabe, H., Yonezaki, S., Kiwada, H., Kumagai, S., Kishiro, T., Yoshida, H. and Kawahara, S. Distribution and abundance of prey species and prey preference of common minke whale *Balaenoptera acutorostrata* in the coastal component of JARPN II off Kushiro from 2002 to 2007. 37pp.

SC/J09/JR12. Yoshida, H., Kishiro, T., Goto, M., Bando, T., Tamura, T., Konishi, K., Okamoto, R. and Kato, H. Relationship between body size, maturity, and feeding habit of common minke whales off Sanriku in spring season, from 2003-2007 whale sampling surveys under the JARPN II coastal component off Sanriku. 20pp.

SC/J09/JR13. Kishiro, T., Yoshida, H., Tamura, T., Konishi, K., Kanda, N., Okamoto, R. and Kato, H. Relationship between body size, maturity, and feeding habit of common minke whales off Kushiro in autumn season, from 2002-2007 whale sampling surveys under the JARPN II coastal components off Kushiro. 25pp.

SC/J09/JR14. Okamura, H., Nagashima, H. and Yonezaki, S. Preliminary assessment of impacts on the sandlance population by consumption of minke whales off Sanriku region. 20pp.

SC/J09/JR15. Hakamada, T., Matsuoka, K. and Miyashita, T. Distribution and the number of western North Pacific common minke, Bryde's, sei and sperm whales distributed in JARPN II Offshore component survey area. 18pp.

SC/J09/JR16. Tamura, T., Konishi, K., Isoda, T., Okamoto, R. and Bando, T. Prey consumption and feeding habits of common minke, sei and Bryde's whales in the western North Pacific. 36pp.

SC/J09/JR17. Tamura, T., Kubotera, T., Ohizumi, H., Konishi, K. and Isoda, T. Feeding habits of sperm whales and their impact on neon flying squid resources in the western North Pacific. 22pp.

SC/J09/JR18. Murase, H., Tamura, T., Isoda, T., Okamoto, R., Yonezaki, S., Watanabe, H., Tojo, N., Matsukura, R., Miyashita, K., Kiwada, H., Matsuoka, K., Nishiwaki, S., Inagake, D., Okazaki, M., Okamura, H., Fujise, Y. and Kawahara, S. Prey preferences of common minke (*Balaenoptera acutorostrata*), Bryde's (*B. edeni*) and sei (*B. borealis*) whales in offshore component of JARPNII from 2002 to 2007. 31pp.

SC/J09/JR19. Konishi, K., Kiwada, H., Matsuoka, K., Hakamada, T. and Tamura, T. Density prediction modeling and mapping of common minke, sei and Bryde's whales distribution in the western North Pacific using JARPN II (2000-2007) data set. 20pp.

SC/J09/JR20. Konishi, K., Tamura, T., Goto, M., Bando, T., Kishiro, T., Yoshida, H. and Kato, H. Trend of blubber thickness in common minke, sei and Bryde's whales in the western North Pacific during JARPN and JARPN II periods. 4pp.

SC/J09/JR21. Mori, M., Watanabe, H., Hakamada, T., Tamura, T., Konishi, K., Murase, H. and Matsuoka, K. Development of an ecosystem model of the western North Pacific. 49pp.

SC/J09/JR22. Kawahara, S. A minimum realistic model in the JARPNII offshore survey area. 22pp.

SC/J09/JR23. Yasunaga, G. and Fujise, Y. Temporal trends and factors affecting mercury levels in common minke, Bryde's and sei whales and their prey species in the western North Pacific. 13pp.

SC/J09/JR24. Yasunaga, G. and Fujise, Y. Temporal trends and factors affecting PCB levels in baleen whales and environmental samples from the western North Pacific. 10pp.

SC/J09/JR25. Yasunaga, G. and Fujise, Y. Accumulation features of total and methyl mercury and selenium in tissues of common minke, Bryde's and sperm whales from the western North Pacific. 11pp.

SC/J09/JR26. Kanda, N., Goto, M., Kishiro, T., Yoshida, H., Kato, H. and Pastene, L.A. Individual identification and mixing of the J and O stocks around Japanese waters examined by microsatellite analysis. 9pp.

SC/J09/JR27. Hakamada, T. and Bando, T. Morphometric analysis on stock structure in the western North Pacific common minke whale (*Balaenoptera acutorostrata*) . 13pp.

SC/J09/JR28. Goto, M., Kanda, N., Pastene, L.A., Bando, T. and Hatanaka, H. Differences in cookie cutter shark-induced body scar marks between J and O stocks of common minke whales in the western North Pacific. 7pp.

SC/J09/JR29. Goto, M., Kanda, N., Kishiro, T., Yoshida, H., Kato, H. and Pastene, L.A. Mitochondrial DNA analysis on stock structure in the western North Pacific common minke whales. 10pp.

SC/J09/JR30. Kanda, N., Goto, M., Kishiro, T., Yoshida, H., Kato, H. and Pastene, L.A. Microsatellite analysis of minke whales in the western North Pacific. 14pp.

SC/J09/JR31. Kanda, N., Goto, M. and Pastene, L.A. Stock structure of Bryde's whales in the western North Pacific as revealed by microsatellite and mitochondrial DNA analyses. 8pp.

SC/J09/JR32. Kanda, N., Goto, M., Yoshida, H. and Pastene, L.A. Stock structure of sei whales in the North Pacific as revealed by microsatellite and mitochondrial DNA analyses. 14pp.

SC/J09/JR33. Kanda, N., Goto, M. and Pastene, L.A. Genetic characteristics of sperm whales sampled during JARPNII from 2000 to 2007 as revealed by mitochondrial DNA and microsatellite analyses. 5pp.

SC/J09/JR34. Okazaki, M., Inagake, D., Murase, H., Watanabe, H., Yonezaki, S., Nagashima H., Matsuoka, K., Kiwada, H. and Kawahara, S. Oceanographic conditions of the western North Pacific based on oceanographic data collected during the JARPN II. 13pp.

SC/J09/JR35. Matsuoka, K., Kiwada, H., Fujise, Y. 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 sighting surveys (1994 to 2007) . 12pp.

SC/J09/JR36. Hakamada, T. Examination of the effects on whale stocks of future JARPN II catches. 51pp.

For Information papers

1- Murase, H., Tamura, T., Kiwada, H., Fujise, Y., Watanabe, H., Ohizumi, H., Yonezaki, S., Okamura, H. and Kawahara, S. 2007. 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.

2- Niimi, S., Watanabe, M.X., Kim, E.Y., Iwata, H., Yasunaga, G., Fujise, Y. and Tanabe, S. 2005. Molecular cloning and mRNA expression of cytochrome P4501A1 and 1A2 in the liver of common minke whales (*Balaenoptera acutorostrata*). *Marine Pollution Bulletin* 51(2005): 784-793.

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4- Kanda, N., Goto, M., Kato, H., McPhee, M.V. and Pastene, L.A. 2007. Population genetic structure of Bryde's whales (*Balaenoptera brydei*) at the inter-oceanic and trans-equatorial levels. *Conservation Genetics* 8:853-864.

5- Kanda, N., Goto, M. and Pastene, L.A. 2006. Genetic characteristics of western North Pacific sei whales, *Balaenoptera borealis,* as revealed by microsatellites. *Marine Biotechnology* 8:86-93.

6- Watanabe, H., Mogoe, T., Asada, M., Hayashi, K., Fujise, Y., Ishikawa, H., Ohsumi, S., Miyamoto, A. and Fukui, Y. 2004. Relationship between serum sex hormone concentrations and histology of seminiferous tubules of captured baleen whales in the western North Pacific during the feeding season. *J. Reprod. Dev*. 50:419-427.

7- Watanabe, H., Tateno, H., Kusakabe, H., Matsuoka, T., Kamiguchi, Y., Fujise, Y., Ishikawa, H., Ohsumi, S. and Fukui, Y. 2007. Fertilizability and chromosomal integrity of frozen-thawed Bryde's whale (*Balaenoptera edeni*) spermatozoa intracytoplasmically injected into mouse oocytes. *Zygote* 15: 9-14.

8- Urashima, T., Kobayashi, M., Asakuma, S., Uemura, Y., Arai, I., Fukuda, K., Saito, T., Mogoe, T., Ishikawa, H., Fukui, Y. 2007. Chemical characterization of the oligosaccharides in Bryde's whale (*Balaenoptera edeni*) and Sei whale (*Balaenoptera borealis*) milk. *Comparative Biochemistry and Physiology, Part B* 146: 153–159.

9- Fukui, Y., Iwayama, H., Matsuoka, T., Nagai, H., Koma, N., Mogoe, T., Ishikawa, H., Fujise, Y., Hirabayashi, M., Hochi, S., Kato, H. and Ohsumi, S. 2007. Attempt at Intracytoplasmic sperm injection of *in vitro* matured oocytes in common minke whales (*Balaenoptera acutorostrata*) captured during the Kushiro coast survey. *Journal of Reproduction and Development*. 53(4): 945-952.

10- Birukawa, N., Ando, H., Goto, M., Kanda, N., Pastene, L.A. and Urano, A. 2008. Molecular cloning of urea transporters from the kidneys of baleen and toothed whales. *Comparative Biochemistry and Physiology*, Part B 149:227-235.

11- Nishida, S., Goto, M., Pastene, L.A., Kanda, N. and Koike, H. 2007. Phylogenetic relationships among cetaceans revealed by Y-chromosome sequences. *Zoological Science* 24:723-732.

12- Onbe, K., Nishida, S., Sone, E., Kanda, N., Goto, M., Pastene, L.A., Tanabe, S. and Koike, H. 2007. Sequence variation in the *Tbx4* gene in marine mammals. *Zoological Science* 24:449-464.