Report from the external Panel requested to review the proposal from Japanese scientists for catch limits of fin whales for Japanese commercial whaling

Background

After withdrawal from the International Convention for the Regulation of Whaling (ICRW), Japan resumed commercial whaling from July 2019 within Japan's territorial waters and Exclusive Economic Zone (EEZ).

Under the Act for Ensuring Sustainable Use of Whales, enacted in 2017, the Government of Japan (GOJ) is required to support the sustainable development of whaling. For this purpose, based on the best scientific information available, GOJ specified that the western North Pacific fin whale (*Balaenoptera physalus*) is appropriate as a further baleen whale species to be targeted by commercial whaling. The proposed sea area of operations for fin whales will remain within Japan's territorial waters and its EEZ (hereinafter both together are indicated by "EEZ").

Japanese scientists have developed a detailed proposal for such management procedures for the commercial catch of North Pacific fin whales in these waters. The Japanese government has indicated that the catch limits for these North Pacific fin whales have been calculated along the lines of the International Whaling Commission's (IWC's) Revised Management Procedure (RMP), based on the Norwegian Catch Limit Algorithm (CLA) computer code and for a tuning level of 0.6.

Their application of the CLA was based on the best and latest available scientific information on stock structure, which is essential to define management areas (*Small areas*) and estimate abundance.

Two *Small areas* were developed based on the best information on stock structure. *Small area (i)* is defined as Okhotsk Sea and western North Pacific, north of 35°N and between the eastern coast of Japan and the 175°E longitudinal line. *Small area (ii)* extends to the 160°W longitudinal line, but with less latitudinal coverage (see Figure 1). The Bering Sea is excluded from both *Small areas*.

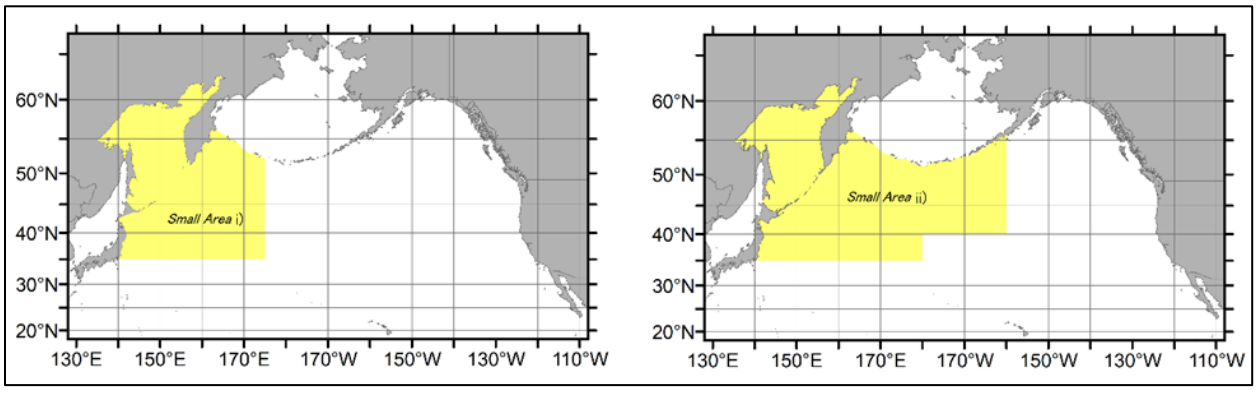

Figure 1 Definition of *Small Areas (i)* and (ii) for CLA calculations and *Implementation Simulation Trials (ISTs)* for western North Pacific fin whales

The latest (2020) estimate of abundance for *Small area (i)* is 6,722 and for *Small area (ii)* is 19,734.

Japan indicated that implementation of this RMP-based approach will continue, founded on the

best available science; hence, the catch limit will be revised from time to time to take account of the latest scientific information.

The following Panel of scientists external to and independent of Japan were asked to comment on this proposal:

Lars Walløe, University of Oslo, Norway (Chair)
Doug Butterworth, University of Cape Town, South Africa
Samba Diallo, Centre National des Sciences Halieutiques de Boussoura, Conakry, Guinea
Bjarki Elvarsson, Marine and Freshwater Research Institute, Hafnarfjörður, Iceland (remote part-time participation)
Thomas Nelson, Department of Fisheries, Castries, Saint Lucia
Ralph Tiedemann, University of Potsdam, Germany

The Panel's specific mandate was to review:

- the technical aspects of the work conducted by Japanese scientists on the calculation of catch limits for North Pacific fin whales along the lines of the IWC's RMP;
- the hypotheses on stock structure used to define management areas; and
- the *Implementation Simulation Trials (ISTs)* developed and run to capture uncertainties deemed to be the most important for the stocks involved.

Finally, the Panel was asked to provide technical recommendations on how to improve these catch limit calculations and *ISTs* in the future.

The members of the Panel received the Japanese proposal on July 10, 2023, and met in Tokyo for a three-day meeting September 6 – 8, 2023. Bjarki Elvarsson had earlier received a virtual presentation of the scientific material, and participated in parts of the meeting remotely using Zoom.

Evaluation

The documents submitted by Japanese scientists for the Panel's consideration all focus on a single eventual aim – the application of an IWC RMP-based approach to calculate a catch limit for fin whales in the North Pacific, with those catches to be taken in the Pacific-side EEZ of Japan.

These documents were presented and discussed in turn, with a few issues arising. Recording of those issues was accommodated, where necessary, by small amendments to the documents' abstracts. All these (sometimes slightly amended) abstracts are given in the Appendix, so that the detailed contents of these documents by Japanese scientists need not be summarised in this main section of the report's text as well.

The documents covered the four key components of applying an RMP-based approach:

1) Use of genetics and non-genetic approaches to provide a basis for assuming stock structure and specifying geographical boundaries;
2) Developing estimates of abundance for various areas within the North Pacific from past

and recent sighting surveys;
3) Specification of annual historical catches in pertinent areas; and
4) Developing and implementing *ISTs* to ascertain whether various candidate versions for a Management Procedure (MP) provided sufficiently robust performance to be acceptable for use to recommend catch limits.

A few issues arose in discussion in relation to these components. For example, it is possible that some of the fin whales to be found in the Okhotsk Sea belong to the Sea of Japan rather than to the Western North Pacific stock, though this number is considered unlikely to be sufficiently large to need specific attention in the calculations already reported. (Four stocks of fin whales are indicated by the available data to be present in the North Pacific: Sea of Japan; Western North Pacific; Eastern North Pacific; and Sea of Cortez.)

Overall, the Panel found that the documents submitted provided a fully adequate assessment, as is needed to support the application of the RMP-based MP to North Pacific fin whales. The catch limit calculations were shown to be robust to the major uncertainties of alternative historical catch series, alternative additional variance values, alternative productivity, alternative natural mortality and alternative g(0) values. Consequently, the results suggesting a catch limit of 60 whales for *Small area (i)* and 205 for *Small area (ii)* (see Figure 1) were completely sound.

Nevertheless, there are further aspects that also need to be considered, given that catches are to be restricted to the Pacific-side of the EEZ of Japan only (which reflects an area that constitutes about 10% only of *Small area i)*), rather than being spread throughout the range of either of the two "*Small areas*" put forward as options for the catch limit calculations. This raises the possibility of local depletion if the whales in these regions do not mix (move) sufficiently rapidly, in particular into the EEZ of Japan. This would be potentially problematic for two reasons:

a) Undue depletion of a possible small local aggregation, which the evidence available may have been too coarse to detect.
b) Reduction of local fin whale density close to Japan to the extent that the industry would struggle to find fin whales to make their catches in future years.

Current information on mixing (movement) rates is limited (especially close to Japan): mainly some mark recapture data (primarily available for the eastern North Pacific) and more recently a few satellite tag results. Analysis of the mark recapture data (see Figure 2) indicated average annual longitudinal movements of 2.6 degrees west to east and 3.0 degrees east to west. These are coarse summary measures, but given that the longitudinal extents of the two *Small areas* under consideration are 35 and 60 degrees, they do suggest that mixing within these regions is not "immediate", but rather on a time scale of the order of a decade. Hence, the possibility of local depletion, given catches restricted to the (Pacific side of) the Japanese EEZ, has to be considered.

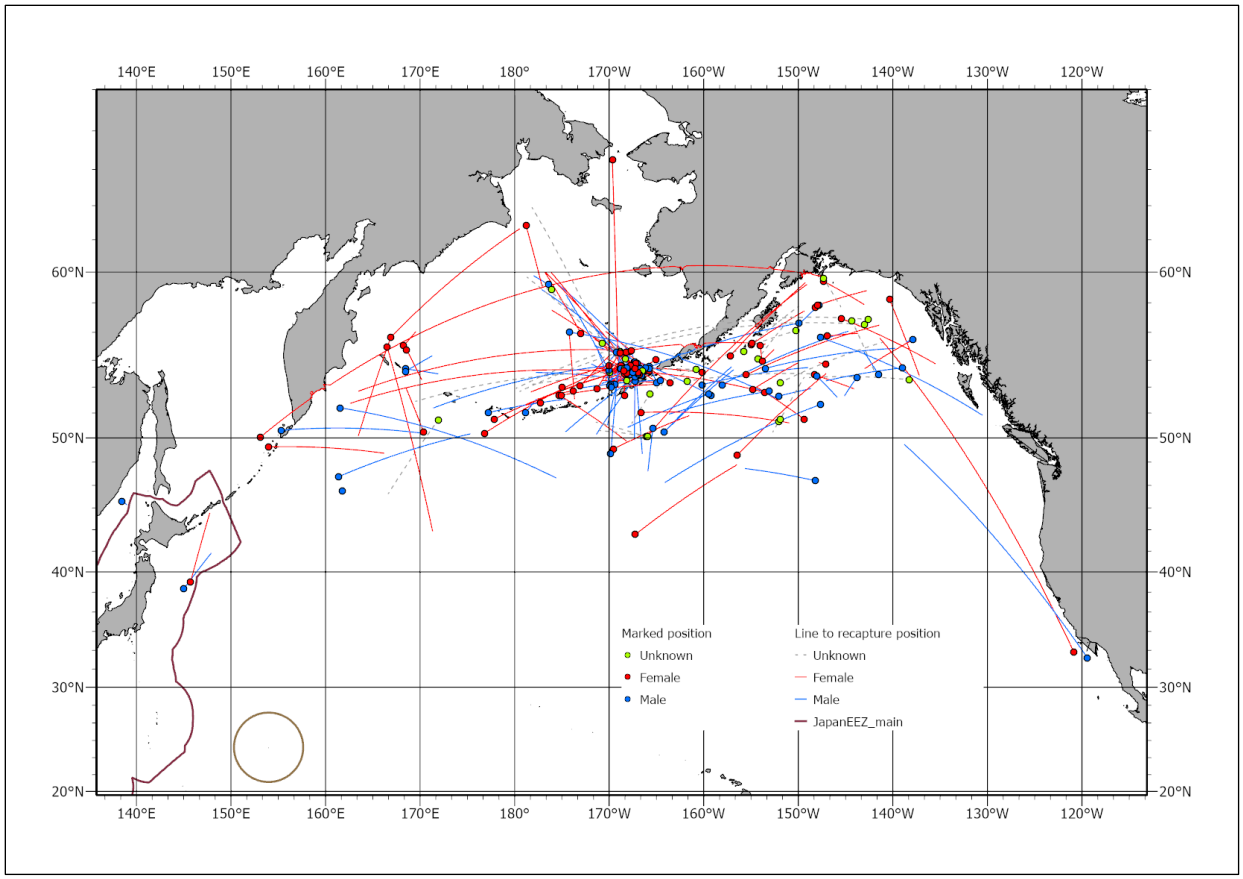

Figure 2 Mark and Recapture results available for fin whales in the North Pacific. The curve around Japan indicates the Japanese EEZ.

To investigate this, the Panel considered the limiting case of virtually no spatial mixing, and the impact of an annual catch of 60 whales in the Japanese EEZ, which constitutes some 10% of the extent of *Small area (i)*. In this limiting case, over a period of four years, this catch would reduce abundance in this region near Japan by about 40% - not desirable, but also not so large as not to be potentially reversible in the medium term. In contrast, an annual catch of 205 whales certainly would not meet this reversibility criterion, and hence cannot be recommended by the Panel at this time.

Accordingly, the Panel recommends that annual catches of fin whales, taken from within the Pacific side component of the Japanese EEZ, be limited to a maximum 60 whales at this time.

This recommendation is subject to certain caveats:

i) The matter is reviewed within no longer than four years, in particular to check whether there is evidence for local depletion close to Japan.

ii) Research as indicated below to provide better information on mixing (movement) rates is implemented with high priority.

Research recommendations

While clearly existing programs of work (such as genetic studies), which allow improvements of this RMP-based approach for calculating fin whale catch limits, should continue, there are two areas which need to be accorded particularly high priority.

A) The most important information needed at the moment is that on mixing (movement) rates of fin whales into and out of the Pacific-side of the Japanese EEZ, for which such information at present is particularly sparse (see Figure 2). Satellite tagging provides the best prospect to increase this information meaningfully in the short-to-medium term, so that tagging in the 10-15 degrees of longitude to the east of Japan should be accorded especially high priority.

B) Simple population models incorporating dispersion should be investigated to attempt to better quantify the extent of mixing (movement) and how this impacts the possibility of localised depletion (and consequently on what are appropriate catch limits if whaling is restricted close to Japan). Appropriate values for dispersion parameters could be estimated by tuning so that model outputs are in broad agreement with the summary movement rates indicated by mark recapture results (see above).

Closure

The report was agreed by all Panel members on Friday September 8, 2023.

Appendix

Abstracts or summaries of papers

RW/S23/02: This document summarized all the information of the analytical documents below and provided details of the sub-areas, management areas and CLA and *ISTs* calculations.

RW/S23/03: The stock structure of fin whales in the North Pacific and adjacent waters was investigated using a total of 613 mitochondrial control region sequences (mtDNA) and 311 microsatellite genotypes (msDNA) at 16 loci. Firstly, exploratory analyses were performed using both markers and arbitral sample groups, which resulted in a setting of the five sample groups: the Sea of Japan (SOJ), the western North Pacific plus the Okhotsk Sea (WNP), the Bering Sea (BRS), the offshore eastern North Pacific plus Gulf of Alaska (ENP), and the coastal eastern North Pacific (C-ENP). The analysis of genetic diversities and the heterogeneity test as well as F_{ST} comparisons were run based on this sample grouping. Spatial Principal Component Analysis (sPCA) and a high-resolution analysis of genetic statistics were also conducted. The heterogeneity test showed genetic divergence of SOJ and C-ENP for both markers and further differentiations among WNP, ENP and BRS at least for mtDNA. Given this finding, together with the geographical features of SOJ, samples in SOJ were excluded from the sPCA analysis to detect a possible weak structure in other areas. The F_{ST} estimates also suggested that the degree of differentiations is different among the pairwise comparisons. The sPCA analysis showed a genetic structuring with two clusters: one cluster mostly occurring in the North Pacific, west of 175°E and the Okhotsk Sea, and the other distributes mainly in the North Pacific, east of 175°E as well as in the Bering Sea. This finding was also favored by the high-resolution analysis the genetic statistics, which switched between the western and eastern North Pacific. Overall, the present genetic analyses demonstrated the existence of the three stocks in the research area. Two of them, with management relevance, were found in the North Pacific: (1) 'WNP' stock distributed mainly in the North Pacific, west of 175°E and in the Okhotsk Sea and (2) 'ENP' stock distributed mainly in the North Pacific, east of 175°E and in the Bering Sea. The third stock (SOJ), with no management relevance, is distributed in the Sea of Japan. The sPCA analysis suggested mixing between 'WNP' and 'ENP' stocks in different localities at different proportions, which was consistent with the results of F_{ST} estimates showing different degree of differentiations.

RW/S23/04: The geographical positions of commercial catches and sighting survey data showed no separation in the stock structure in the North Pacific, while a clear separation of the Sea of Japan and Eastern China Sea from the Pacific was evident from the commercial catch locations. Movements of fin whales revealed by Discover-type mark-recapture records and recent satellite-monitored tags showed movements of fin whales among eastern and western North Pacific, Bering and off the California coast, but no movements from and into the Sea of Japan from other regions. Frequent movements of tagged fin whales were observed between the Okhotsk Sea and western North Pacific. Studies based on commercial whaling samples showed differences in some biological features between fin whales in the East China Sea and other areas. Overall, non-genetic information suggested continuity in the distribution in fin whale throughout the North Pacific and its adjoining seas, while there is a separation of fin whales of the Eastern China Sea and the Sea of Japan from other sea regions. It is possible that Eastern China Sea and the Sea of Japan are inhabited by the same stock, but there are currently no data available to clarify this issue.

RW/S23/05: All the available information, both genetics and non-genetics were reviewed to identify a plausible stock structure hypothesis of North Pacific fin whales for management

purposes. The available information supports a four-stock structure hypothesis in the North Pacific and surrounding areas: Sea of Japan/ East China Sea (SOJ), Western North Pacific stock (WNP), Eastern North Pacific stock (ENP) and Sea of Cortez stock (SOC). The WNP and ENP stocks are relevant for management. The WNP stock distributes mainly in the North Pacific, west of 175°E and the Okhotsk Sea while the ENP stock distributes mainly in the North Pacific, east of 175°E and the Bering Sea (see summary of RW/S23/03 on 175°E definition). WNP and ENP stocks mix spatially in different regions of the North Pacific at different proportions.

RW/S23/06: This paper provides abundance estimates for fin whales in survey blocks and in the North Pacific Ocean and the Bering Sea, based on the Japanese dedicated sighting surveys and the IWC-POWER sighting surveys conducted in the summer season (July-September), in the period 2017-2022. Abundance estimates were estimated by the standard distance sampling methodology and the guidelines adopted by the IWC SC under the assumption of $g(0) = 1$. The abundance in the Bering Sea, the western North Pacific Ocean, and the eastern North Pacific Ocean were 9,885 (CV = 0.201), 4,405 (CV = 0.241) and 37,297 (CV = 0.181), respectively.

RW/S23/07: Abundance of fin whales in the Sea of Okhotsk was estimated from the sighting data collected by the Russia-Japan cooperative sighting surveys during 2015-2022 assuming g(0)=1. The perpendicular distance was truncated at 2.0 n. miles and covariates considered were wind force, visibility and school size. Half normal model with no covariate was the best fitted model selected by AIC, and the resultant abundance estimates was 2,715 (CV 0.269, 95% CI 1,616 – 4,560). Areal coverage was 92% in the Sea of Okhotsk. Year 2019 can be considered as the time stamp based on the weighted mean by research distance. Abundance estimates in this study can be used for the calculation for sustainable commercial whaling of fin whales being planned by Japan.

RW/S23/08: This paper provides preliminary estimates of $g(0)$ by applying mark-recapture distance sampling methods (MRDS) to sighting data obtained from Independent Observer (IO) mode surveys during Japanese dedicated sighting surveys and IWC-POWER surveys conducted in 2017-2022. The best overall model selected by Akaike's Information Criterion (AIC) includes the MR model with the covariate platform, school size, and visibility, and the DS model with the covariate school size. From the best fitted MR model, the probabilities of detection on the trackline by observers at one platform, given that it was detected by observers at another platform, were 0.864 (CV = 0.031) at TOP barrel and 0.773 (CV = 0.047) at IO platform. The probability of detection on the trackline by at least one observer was 0.967 (CV = 0.012)

RW/S23/09: To calculate catch limit of baleen whales based on the Revised Management Procedure's Catch Limit Algorithm (RMP/CLA), the catch series of the target species/stock is required. The series is also used in the *Implementation Simulation Trials* (*ISTs*). Time series of catches by sex shall be compiled, using the best available information. Catch series for fin whales in the North Pacific were made from the latest International Whaling Commission (IWC) individual and summary catch database Version 7.1, following the procedure used to make the catch series during the previous IWC's RMP *Implementation* for western North Pacific Bryde's whales. In some years, catch data of North Pacific fin whales are insufficient to allocate catches to species with sufficient reliability and/or to operational area. Unspecified catches of whales were allocated to species using the best available information on the species composition of the catch. Animals with no information on the operational area were allocated to the area using proportion of area of known animals. Where the sex ratio of catches was not accurately known, a 50:50 sex ratio derived from sex known animals was used to divide the unknown sex catches. The catch series also includes anthropogenic mortality animals recorded in the North Pacific. Lastly, catches

were allocated to each of sub-areas, using information on catch positions. Best and high catch series were made.

RW/S23/10: This document summarizes previously reported values on natural mortality and sexual maturity, which are biological parameters relevant for the *Implementation Simulation Trials* (*IST)* for North Pacific fin whales. The estimates of such parameters were made some 50 years ago so that they are considered dated. If the abundance is increasing since the end of commercial whaling in 1975, these parameters are expected to have changed. Biological parameters of North Atlantic fin whales have been estimated in more recent years and are considered more appropriate for the aim of *ISTs* for North Pacific fin whales.