Commentary

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The current utility of data and samples collected by former Japanese whale research programs under special scientific permit

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Japan, through the Institute of Cetacean Research (ICR), designed and implemented several whale research programs under special permits based on Article VIII of the International Convention for the Regulation of Whaling (ICRW). Those programs were implemented in both the Indo-Pacific sector of the Antarctic and in the western North Pacific as follow:

Antarctic

1. Japanese Whale Research Program under Special Permit in the Antarctic (JARPA): 1987/88–2004/05
2. Japanese Whale Research Program under Special Permit in the Antarctic-Phase II (JARPAII): 2005/06–2013/14
3. New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A): 2015/16–2018/19

Western North Pacific

4. Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN): 1994–1999
5. Japanese Whale Research Program under Special Permit in the western North Pacific-Phase II (JARPNII): 2000–2016
6. New Scientific Whale Research Program in the western North Pacific (NEWREP-NP): 2017–2019

Japan also conducted dedicated sighting surveys, which were independent from those research programs under special scientific permit. For example, a dedicated sighting survey was conducted in the Antarctic in the austral summer 2014/15.

Those six former whale research programs under special permits (FWRPs) above had research objectives related with the assessment and management of whale resources as well as to the role of whales in the ecosystem. The target species of the lethal sampling in the Antarctic FWRPs were the Antarctic minke whale (JARPA), Antarctic minke and fin whales (JARPAII) and Antarctic minke whale (NEWREP-A). In the western North Pacific, the target species of the lethal sampling were the common minke whale (JARPN), common minke, Bryde's, sei and sperm whales (JARPNII) and common minke and sei whales (NEWREP-NP).

An important characteristic of the Japanese FWRPs was the combination of lethal and non-lethal sampling. Among the former, a limited number of whales were taken as indicated above for the objective of collecting information on age, reproductive status, and stomach contents mainly. Among the latter, techniques such as systematic sighting surveys, photo-identification, and biopsy sampling were conducted for all large whale species distributed in the research area. Oceanographic and marine debris surveys were also conducted to understand the whale's physical environment.

The Japanese FWRP programs were duly reviewed by international specialists in workshops organized by the International Whaling Commission's Scientific Committee (IWC SC). Reports of the review workshops are available in IWC (2008) for JARPA; IWC (2015) for JARPAII; IWC (2001) for JARPN and IWC (2017) for JARPNII. These programs left behind unique data and sample sets that represent around 30 years of systematic research in both the Antarctic and western North Pacific. See IWC (2015) and IWC (2017) for examples of lists of samples and data obtained in the Antarctic and western North Pacific, respectively. All those samples and data were collected in a consistent and systematic way for the objectives of each research program.

Scientific outputs from the Japanese FWRPs are available in a substantial number of peer-reviewed publications (see the last section of this TEREP-ICR issue) and in scientific documents presented to national and international meetings, mainly to meetings of scientific committee of international organizations in charge of the conservation and management of marine resources including large whales.

In 2018, Japan announced its withdrawal from the

ICRW, which came into effect on 30 June 2019 (see Pastene, 2019). Because the Japanese FWRPs were conducted under Article VIII of the ICRW, Japan had to cease the NEWREP-A and NEWREP-NP from that same date. Instead, Japan, through the ICR started dedicated sighting surveys in the Antarctic and western North Pacific. These new surveys collect information like that obtained by the non-lethal component of the FWRP informed above. The most important data collected by recent non-lethal surveys are the sighting data for abundance estimate purposes.

Given the new whaling policy by Japan, a question emerges about the current utility of the existing samples[1] and data collected by the completed FWRPs (JARPA, JARPAII, JARPN, JARPANII) and by the FWRPs that ceased in 2019 (NEWREP-A and NEWREP-NP). To my view the samples and data collected by the Japanese FWRP have important future utilities on the following research topics:

i) Assessment and management of whale resources in Japanese waters
ii) Assessment of whale resources in the Antarctic
iii) Role of whales in the marine ecosystem
iv) Calibration of non-lethal techniques

i) Assessment and management of whale resources in Japanese waters

From 1 July 2019, Japan started commercial whaling on common minke, Bryde's and sei whales within its territorial sea and Exclusive Economic Zone (EEZ). Catch limits were calculated in line with the IWC-endorsed Revised Management Procedure (RMP) and the uncertainties evaluated through the process known as *Implementation Simulation Trials* (*ISTs*). The application of the RMP and *ISTs* are based on the best available scientific information for the target whale species. Relevant information is revised from time to time so that future catch limits can be adjusted by taking into consideration the most recent scientific information.

The most relevant information for the application of the RMP and *ISTs* are stock structure (important for defining management areas), catch history (available from

[1]Not all samples are still available. A substantial number of samples collected by the FWRPs were lost because of the earthquake and tsunami that occurred in Japan in February 2011. The tsunami destroyed the marine research station of Ayukawa where most of the samples collected until that year were stored.

the IWC database), abundance series, and reproductive information of the relevant whale species.

The analysis of genetic samples obtained during the Japanese FWRPs is essential for the application of the RMP and *ISTs* for two main reasons. The first is that, though valuable, genetic analysis of genetic samples collected by biopsy sampling during recent dedicated sighting surveys is not sufficient to elucidate stock structure. This is because the sample size is small, and the sampling is limited in geographical distribution. These new genetic samples should be analyzed in conjunction with genetic samples from the FWRPs to provide sound stock structure hypothesis for management purposes. Second, the genetic analysis on stock structure should be conducted considering the temporal factor as distribution and stock structure of a species can change with time due to environmental factors. In this context, genetic samples from FWRPs can be used as a reference in future studies on stock structure of the relevant whale species.

In the same way, sighting data obtained through the Japanese FWRPs should be analyzed in conjunction with sighting data from more recent dedicated sighting surveys to get time series abundance estimates for use in RMP and *ISTs*. Under the RMP a larger time series of abundance is preferred as it will increase the precision of the estimates and therefore will optimize the use of the RMP for calculating catch limits. In this context, the abundance estimates from the Japanese FWRPs have been and will be important for the Japanese RMP domestic process.

Information on natural mortality and age at sexual maturity is particularly important for the *ISTs*. Because such information cannot be obtained by the current dedicated sighting surveys, the use of parameters estimated from the Japanese FWRPs will continue in the future.

It should be noted here that the domestic application of the RMP and *ISTs* in Japan is responsibility of an *ad-hoc* group from different research organization. The Terms of Reference (TORs) and main works of this group were explained in Pastene (2019). One of the TORs of this group is 'the identification of biological data (e.g. age, reproductive data) and the process required to improve/optimize the use of the current RMP'. The research objectives of the NEWREP-NP were directly related to this TOR and therefore the samples and data from that program related to common and sei whales are relevant to fulfill this TOR in the near future.

ii) Assessment of whale resources in the Antarctic

The monitoring of the abundance and abundance

trends of large whales in the Antarctic is very important. For the cases of species that were heavily exploited by the middle of the 20th century, it is important to monitor their recovery and how this recovery is affecting other components of the marine ecosystem including those whale species that were not exploited substantially in the past.

Long-term abundance series can be obtained when sighting data collected by past surveys associated and not associated with FWRPs are analyzed in conjunction with more recent sighting data collected by current dedicated sighting surveys in the Antarctic, e.g. by the Japanese Abundance and Stock structure Surveys in the Antarctic (JASS-A) program.

Also, genetic samples from different baleen whale species collected by biopsy sampling under the FWRPs can be analyzed with those obtained by the JASS-A and contribute in this way to understand the stock structure of those species, which is essential to interpret abundance estimates.

iii) Role of whales in the marine ecosystem

Apart from the samples and data directly relevant for management under the RMP, the Japanese FWRPs collected important data to study the role and health of whales in the marine ecosystem in both the Antarctic and western North Pacific. For example, qualitative and quantitative data on stomach content, surveys of the prey species of whales, oceanographic surveys to understand the environment of whales, samples to examine the concentration of different chemical pollutants in both whales and prey species, and surveys on marine debris on both seas surface and whales, were collected systematically.

Only the information collected by the non-lethal component of the FWRPs can be obtained by recent dedicated sighting surveys, e.g. sighting, oceanographic and marine debris surveys. The time series of such data, constructed by combining FWRPs and recent sighting surveys, are very important to investigate changes in the environment surrounding the whales. This is very important in times of climate change. Changes in the oceanographic conditions will imply changes in whale's prey distribution and by implication, changes in the distribution of whales.

Information already obtained on feeding ecology and chemical pollution from the Japanese FWRPs will be important for comparative purposes when new data on those topics emerge in the future.

iv) Calibration of non-lethal techniques

Several non-lethal research techniques are being de-

veloped by the ICR. For example, the potential use of biopsy samples for epigenetic estimation of age, analysis of progesterone in biopsy samples to obtain information of reproductive status of female whales and stable isotope to obtain information on the feeding ecology of whales. The samples and data from Japanese FWRPs can be used to calibrate non-lethal methodologies, e.g. Goto *et al.* (2020) for epigenetic analyses, Takahashi *et al.* (2022) for stable isotope analyses and Inoue *et al.* (2019) for progesterone analyses.

Also, results on non-lethal techniques such as photo-identification and satellite tracking of whales used for studying the movement and distribution of whales, can be better interpreted in the context of the stock structure analyses conducted using genetic samples obtained during the Japanese FWRPs.

CONCLUSION

The samples and data collected under the Japanese FWRPs have been and will be important for studies on assessment and management of whales targeted by Japanese commercial whaling, assessment of large whales in the Antarctic, role of whales in the marine ecosystem and in studies of calibration of new non-lethal techniques. In addition, samples and data from the FWRPs can be used in worldwide comparative studies of a more academic nature, for example on taxonomy e.g. Milmann *et al.* (2021).

REFERENCES

Inoue, S., Yasunaga, G. and Pastene, L.A. 2019. Comparison of progesterone concentrations in blubber and plasma among female Antarctic minke whales of known reproductive status. *Fish Sci* 85 (6): 971–977.

International Whaling Commission. 2001. Report of the workshop to review the Japanese Whale Research Programme under Special Permit for North Pacific minke whales. *J. Cetacean Res. Manage.* (Suppl.) 3: 375–413.

International Whaling Commission. 2008. Report of the intersessional workshop to review data and results from special permit research on minke whales in the Antarctic. *J. Cetacean Res. Manage.* (Suppl.) 10: 410–445.

International Whaling Commission. 2015. Report of the expert workshop to review the Japanese JARPAII special permit research programme. *J. Cetacean Res. Manage.* (Suppl.) 16: 368–409.

International Whaling Commission. 2017. Report of the expert panel of the final review on the western North Pacific Japanese special permit programme. *J. Cetacean Res. Manage.* (Suppl.) 18: 527–592.

Goto, M., Kitakado, T. and Pastene, L.A. 2020. A preliminary study of epigenetic estimation of age of the Antarctic minke

whale *Balaenoptera bonaerensis*. *Cetacean Population Studies* 2: 5–14.

Milmann, L., Taguchi, M., Siciliano, S., Baumgarten, J.E., Oliveira, L.R., Valiati, V.H., Goto, M., Ott, P.H. and Pastene, L.A. 2021. New genetic evidence for distinct populations of the common minke whale (*Balaenoptera acutorostrata*) in the Southern Hemisphere. *Polar Biol* 44 (8): 1575–1589.

Pastene, L.A. 2019. Withdrawal of Japan from the International Convention for the Regulation of Whaling: implications for the whale research conducted by the Institute of Cetacean Research. *Technical Reports of the Institute of Cetacean Research (TEREP-ICR)* No. 3: 55–58.

Takahashi, M., Tamura, T., Bando, T. and Konishi, K. 2022. Feeding habits of Bryde's and sei whales in the western North Pacific inferred from stomach contents and skin stable isotope ratios. *Journal of Sea Research* 184: 102204.