

# RELEVANCE OF THE SCIENTIFIC WORK ON CETACEANS OF DR. SEIJI OHSUMI

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Dr. Seiji Ohsumi, ‘Seiji’ as he was known by colleagues and friends, passed away on 2 November 2019 at the age of 89 years. It was a sad day for his family, friends and for all of us who knew and worked with him; without a doubt it was a sad day for cetacean science as well. During his memorial service held on 23 December 2019, many messages were received from colleagues and friends from both Japan and abroad. Most of those messages mentioned Seiji as a kind and true gentleman, a person that enjoyed meeting people at social events, a great cetacean scientist, and a person whose energy and enthusiasm for research remained undiminished until the end. We agree with that characterization of Seiji very much.

Seiji was a skilled debater with a deep command of the scientific issues. His opinions were always based on updated knowledge and good scientific information, and he strongly defended his ideas. During the meetings, people could have passionate discussions and disagreements with him over some issues. However, he never became angry and it was common to see Seiji outside the meetings displaying great courtesy to those same colleagues. Seiji enjoyed social events including parties very much, and saw those events as opportunities to hear and learn from people from different research areas, cultures or countries. At the very domestic level he saw the small parties as an opportunity for younger people to express their opinions, knowing that they were unable to express such opinions in more formal meetings.

Here we would like to focus on the scientific work conducted by Seiji. First, we briefly outline his professional career and then we highlight some of his most relevant scientific contributions.

## **Brief outline of professional career**

- Born on 12 July 1930 in Gunma Prefecture, Japan.
- Graduated in 1948 from the Science Course at the Niigata Public High School under the former educational system.
- Completed pre-graduate studies in 1951 at the Faculty of Agriculture, the University of Tokyo.
- Published his first study in English in 1954 in collaboration with some colleagues. The study was titled ‘On the sexual maturity of the sei whale of the Bonin waters’ under his original name Seiji Kimura (Nishiwaki *et al.*, 1954).
- Completed post-graduate studies in 1958 at the Faculty of Agriculture, the University of Tokyo. The title of his doctoral dissertation was ‘A study on age determination of the fin whale’ (Ohsumi, n.d.).
- Became a member of the Whale Research Institute (WRI) in 1958. In his early days at the WRI, Seiji was mainly engaged in field work at numerous places where commercial whaling occurred as well in laboratory work and analyses of samples he collected. In this period, he worked under the supervision of the late Prof. Masaharu Nishiwaki and Dr. Hideo Omura.
- Became a member of the Population Dynamics and Statistics Division of the Tokai Regional Fisheries Research Laboratory in 1966.
- Became Head of the Unit for Cetacean Population Studies at the government’s Far Sea Fisheries Research Laboratory (FSFRL) in 1967.
- Became Director General of the FSFRL between 1988 and 1991.
- Became a member of the board of directors of the Institute of Cetacean Research (ICR) in 1991.
- Became Director General of the ICR between 1995 and 2003.

- Became a Senior Scientific Adviser of the ICR in 2004.
- Became Adviser Emeritus at the ICR from 2015 until he passed away in 2019.

### Scientific contributions

Seiji was a prolific researcher with over 700 scientific articles and publications on cetacean biology and ecology, conservation and management, and whaling issues, among other subjects. He regularly presented his work at scientific meetings as well as in public forums.

Apart from his specialized scientific publications and lectures in the field of natural and applied science that targeted scientists, he considered it important that the general public was aware of cetacean conservation and management, and consequently spent considerable time preparing articles and talking to the general public on those topics. He was especially skilled at writing and talking in a way that was understandable for different kinds of audiences. This is reflected in the large number and diversity of his written publications and articles on cetaceans, whaling, whale conservation and management, and whale food culture, prepared during his productive life (see also his bibliography in this issue):

- Specialized papers published or presented at scientific meetings: 286
- Books and book contributions: 58
- Reports and booklets: 40
- Geiken Tsushin (Whales Research Institute/Institute of Cetacean Research (WRI/ICR) Quarterly Newsletter published in Japanese since 1948): 100
- Miscellaneous: 257

### Some relevant studies

The scientific work of Seiji was mainly focused on the assessment and management of large whales as well as with the natural history of this group of animals.

Seiji conducted the work on assessment and management largely in the context of the work of the Scientific Committee of the International Whaling Commission (IWC/SC), the international organization in charge of the conservation and management of the large whales. The IWC/SC is recognized as the most skilled group of specialists in the field of whale assessment and management, and Seiji was one of its leading members for over five decades. Seiji was engaged in the assessment and management of several large whale species, including fin (*Balaenoptera physalus*), sei (*B. borealis*), Bryde's (*B. edeni*), common minke (*B. acutorostrata*), Antarctic minke (*B. bonaerensis*), and sperm (*Physeter macrocephalus*) whales of both hemispheres. Seiji's contributions to the biological knowledge and assessment of these species were enormous, and these contributions are reflected in many publications in the specialized journal of the IWC.

As in other groups of marine living resources, age and reproductive data are essential for assessment through the application of population dynamic models. Seiji not only applied models to assess different populations and species of large whales but also investigated the scientific basis of some of the essential data used in those models. One of the most remarkable examples is the work he conducted to determine the age of fin whales based on their earplugs (Ohsumi, 1964).

By the time of the publication of this work, several approaches were available to estimate the age of the fin whale, namely body length, stage of growth, number of ovulations, white scars (Mackintosh and Wheeler, 1929); baleen plates (Ruud, 1940); crystalline lens (Nishiwaki, 1950), and earplugs (Purves, 1955). Seiji believed that the laminations found in the core of earplugs were the best approach to determine age because the laminations were considered to form periodically and were present in both males and females throughout the whale's lifespan and earplugs are relatively easy to collect and prepare for reading (Ohsumi, 1964).

The main scientific question at that time was on the frequency of deposition of the earplug lami-

nations, which was considered to be biannual (Laws and Purves, 1956). Seiji examined this matter in further detail by using biological material of a number of fin whales taken in both the Antarctic and the North Pacific. He used three approaches to address the question above: examination of age characters from recaptured whales (mark-recaptured whales), comparison of results among different approaches, and an examination of the population dynamics on the age composition based on earplug laminae readings.

After detailed analyses and examination he stated the following: that ‘it will be concluded that the annual accumulation rate of earplug lamination must be less than two, probably near one, and average annual ovulation rate will be under one, probably near 0.5, although there are individual and racial variations. In addition, the average age at sexual maturity will be older than 5 years, probably 9–11 years. Of course, there are individual variations in the age of sexual maturity’ (Ohsumi, 1964).

The conclusions above regarding the annual deposition rate of earplug laminations had strong implications for the assessment and management not only of fin whales but of several other balaenopterid species where earplugs were subsequently used for determining the age, e.g., Antarctic minke whales. In his 1964 publication, Seiji recommended that ‘the standardization of the reading of earplug lamination should be established...’. Subsequent work on Antarctic minke whales and other species have benefited from the early studies of Seiji, and standardization has been conducted thoroughly in recent years. Age data based on earplugs have also been very useful in the calibration of molecular methods being developed to determine age in the Antarctic minke whales.

In the field of natural science there are many contributions from Seiji not only on large baleen whales but also on odontocetes. Here we would like to highlight the investigation he made on the school structure of sperm whales (Ohsumi, 1971).

Ohsumi (1971) studied the structure of sperm whale using biological information obtained from three complete schools taken in coastal waters of Japan (1) and pelagic waters of the Southern Hemisphere (2). Information examined included the number of whales forming a school, size distribution, sex ratio, sexual maturity, physical maturity, age distribution and sexual condition of whales which form a school.

Based on detailed analyses, Seiji proposed the following hypothesis on the formation of sperm whale schools, in which the behavioral foundation of sperm whales is considered to be a maternal family group.

- The fundamental form of a sperm whale school is the ‘nursery school,’ which is composed of mature females and calves nursed by mature females.
- Immature males and females are also nursed by mature females until the time of sexual maturity.
- The average size of school was estimated to be 27.1 whales, and half of them are mature females.
- A nursery school moves as a tightly united school and remains as a family for long time.
- Some immature whales leave the nursery school after weaning to form ‘juvenile schools.’
- After attainment of puberty, all males gradually leave the nursery school. Males at puberty form ‘bachelor schools.’
- Socially mature males or bulls form a small ‘bull school’ or live alone. Most bulls are considered to live as solitary animals.
- Bulls struggle with each other to join a nursery school in the breeding season, and the winning bull and the nursery school form the so-called ‘harem.’

Seiji also estimated that the number of mature females served by a bull in a harem was 14 on average.

This study was not only important in understanding the natural history of sperm whales but it was also useful for their assessment. In particular, parameters important for assessment include the number of mature females with which a bull mates and the ratio of number of males/mature females; information on both was obtained in Seiji’s study (Ohsumi, 1971).

### Special awards

His scientific and dissemination work on cetaceans and whaling was recognized with numerous awards including the following:

- The Order of the Sacred Treasure, Gold Rays with Rosette (2002).
- The Royal Norwegian Order of Merit (2006).
- Special Award of the Mammal Society of Japan (2011).

### Some final thoughts

Seiji's scientific contribution to the knowledge of cetaceans is enormous. He made contributions not only in the field of basic biology and ecology of cetaceans but also contributed substantially in the assessment of several species, which was translated into appropriate policies of conservation and management. He was a hard worker in the field, in the laboratory (Fig. 1), in the analyses, and in the preparation of scientific communications. He was very skilled at expressing his ideas and studies through written and oral presentations, which were understandable to different audiences. We were fortunate not only to share with him the same institute and discuss together research plans and results, but also share social events that Seiji enjoyed very much. In particular many colleagues and friends with Japanese knowledge appreciated his beautiful Japanese sentence expressions. His enthusiasm for the study of cetaceans was evident throughout his life as he was assisting the ICR until the very last moment before his death. His enthusiasm, energy, productivity and courtesy should be an example for the younger cetacean scientists, especially for those working at the ICR.

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**Fig. 1.** Dr. Seiji Ohsumi counting growth laminae in a whale earplug at ICR (August 5, 2010).