*Strictly confidential until after the discussion of the Scientific Committee of the 47th IWC*

# The 1995/96 Research Plan for the Japanese Whale Research Program under Special Permit in the Antarctic

## The Government of Japan
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## INTRODUCTION

Japan has been conducting the research on minke whales under Special Permit in the Antarctic (JARPA) every year since the 1987/88 season in compliance with Article VIII of the International Convention for the Regulation of Whaling. Objectives of the research include "estimation of biological parameters on minke whales" and "elucidation of Antarctic ecosystem" which reasonably require a long-term continuous survey. The research incorporates collecting biological data for the whales, in particular age data, which are of vital importance to achieve these objectives and thus improve efficiency of the RMP when implemented for this minke whale resource. The value of age data for fisheries assessment is widely recognized by fisheries management agencies throughout the world; for example, statements by the highly respected International Council for the Exploration of the Sea (ICES) demonstrate its preference for having such data available as a basis for providing management advice for a marine resource.

Since the beginning of the research, a number of practical modifications have been made on the research in response to the comments made by the Scientific Committee (SC). In the Committee, although "several members commented on the high quality of certain aspect of the work" (IWC 1994, p61), the statistical precision with which it will be possible to estimate certain biological parameters has been in dispute.

Basically this estimation will be made at the final stage of the program, of which the entire duration is scheduled to cover sixteen years. Although the statistical performance of the estimation will improve as research is continued, data from JARPA surveys so far are not sufficient to conclude this dispute because the observation period to date is too short (Tanaka et al., 1995 in prep).

Also, concern was expressed in the SC last year that "despite efforts to obtain a representative sample of the age distributions", "the sampled age distributions do not appear to be representative of the population's age structure" (IWC 1994b). This point is reasonable at this moment, because so far there is almost no information about attributes and age distribution of animals which occur beyond the existing research areas. Therefore, it can be reasonably concluded that conducting feasibility study on the minke whale stock identification adjacent to the existing research area is a good starting point to address this concern.

In addition, a number of questions (for example, the implications of possible interactions between whale species and between whales and their prey species) were raised with regard to the establishment of the Southern Ocean Sanctuary (SOS) in the past several IWC meetings and the answers to these questions remain in dispute. Study of the Antarctic marine ecosystem is required to resolve these questions, and this relates directly to the second objective of the program, "ecosystem". Aside from the SOS, the importance of independent monitoring for collecting further data on cetacean species, including associated environmental variables, was also underlined by the SC on the basis of several papers presented on this matter (i.e. Swartz 1994, Smith et al 1994).

To cope with these situation, JARPA was fully reviewed this year and the Government of Japan proposes a modified JARPA in this document. These modifications include pollution studies and stock structure studies based on limited extension of the survey area and increase of minke whale samples.

## MODIFIED RESEARCH OBJECTIVES AND THEIR MANAGEMENT NEEDS

The research has the following three objectives:

(I) Estimation of biological parameters to contribute toward improved stock management of the Southern Hemisphere minke whales

(II) Elucidation of the role of whales in the Antarctic marine ecosystem

(III) Elucidation of the effect of environmental changes on cetaceans

The first two objectives are essentially what was specified by the Government when JARPA was initially planned (Government of Japan, 1987). The third objective is a new addition this year, and has been added in response to Commission resolutions regarding the environment and pollution (Resolution on research on the environmental and whale stocks in 1994 and Resolution on promotion of research related to conservation of large baleen whales in the Southern Oceans in 1994). These three objectives and their management needs can be explained as follows:

(1) Biological Parameters

Estimation of biological parameters is still important even after adoption of the RMP. For example, knowledge on natural mortality rates and recruitment rates contributes toward estimating maximum net recruitment rates which are the base for calculation of sustainable yields. Earlier, the shortness of the time series of age data from the population has caused the major difficulty in achieving this, and also in interpreting trends in age–at–maturity over time. The additional data provided by the continuation of JARPA can solve that problem. The RMP has been designed to be robust over a wide range of possible values of the maximum sustainable yield rate (MSYR). Refinement of this range for the Southern Hemisphere minke whale would allow even sounder management of this population under such a management procedure.

In addition to the mortality rate, verification or otherwise of the scientific relevance on the RMP's small management area can lead to a better management under the RMP. Although the small area under the RMP is presently set up with a 10 degree longitude sector, continuous research on the differentiation of stocks, and seasonal migration patterns, will allow for an improved choice. As "stock" definition is considered to be one of biological parameters, improving the knowledge on the stock with continuation of the special permit program can contribute towards improved implementation of the RMP.

### (2) Marine Ecosystem and (3) Environmental Changes

The second and the third objectives are interrelated and discussed simultaneously here. These objectives become more important as the establishment of Southern Ocean Sanctuary was passed by the Commission last year. Japan considers that the arguments advanced for establishing the Southern Ocean Sanctuary are incorrect; it hopes to settle many of the associated disputes raised at previous IWC meetings through scientific research.

At the Sanctuary Working Group in Norfolk Island in 1994 some delegations argued that "the Sanctuary could be used as a 'safety net' in case of the RMP, if applied, should proved to be flawed" and suggested that "the RMP had not been fully evaluated with regard to environmental impacts." Abiotic data on the environmental impacts along with biological data provided by JARPA can address the issue of environmental effects to reproductive capability of whales and achieve better management. Therefore, these objectives are relevant to the management under the RMP.

Further, study on inter-species interactions with regard to habitat and prey species is an essential step for a possible multi-species management. For example, the continued collection of age data in conjunction with sightings estimates of abundance (as in JARPA) has the potential to throw light on the hypothesized competition between blue and minke whales, by clarifying whether the minke whale population increased at a time when blue whale numbers declined considerably as a result of unsustainable harvest levels.

Also, in general, the research has to be continued so as to avoid the situation that the Sanctuary would render the Antarctic to be the Dark (Unknown) Ocean for a future management of this area.

### NUMBER, SEX, SIZE, SITE OF MINKE WHALES TO BE TAKEN

#### (1) Number, Sex, Size, and Site

In Area IV, three hundred (300) ordinary form minke whales with 10% allowances will be sampled. Sampling design within the Area IV remains unchanged to obtain data compatible to the past JARPA surveys, and the sample size is also retained to ensure maintenance of present levels of precision. All samples will be randomly sampled, using the same methodology as in the past.

In addition to this and for one year only at this stage, the existing survey area is to be expanded to take one hundred (100), with 10% allowances, ordinary form minke whales in

the area between 35 and 70 degree E (the eastern half of Area III).

(2) Necessity of the Area Expansion

The primary objective of the expansion is a feasibility study on stock identity. The study on stock identity using JARPA samples has been largely based on mtDNA analysis. Such analysis (Pastene et al 1994) has supported the hypothesis of the occurrence of more than one stock in Areas IV and V. MtDNA data also suggest that these hypothesized stocks could be distributed under complex geographical and temporal patterns. A recent analysis of mtDNA (Pastene and Goto, 1995 in prep) suggests the possibility of temporal and geographical interaction of stocks in the western part of Area IV. Another analysis, which used body proportion of minke whales obtained from JARPA, supported the above findings of the DNA analysis (Fujise, 1995 in prep). These hypothesized stocks could be distributed beyond the western boundary of the Area IV.

Independent analysis will play an important role to corroborate the hypothesis derived from the DNA analysis. For example, Wada (1984) examined the movement of marked minke whales in the Antarctic based on 64 recaptured animals and suggested that because movement across 80 degree East (western part of Area IV) are less frequent than in adjacent longitude, this line may represent a real biological stock boundary. Further studies about this hypothetical boundary (i.e. seasonal changes) is desirable. The relationship between the finding of Wada (1984) and those derived from mtDNA analysis will be examined in more detail.

Through DNA analysis provide important information to identify stocks, there are some cases where DNA analysis alone has not been able to differentiate separate stocks, so that other information with the potential to do this must be collected. A comprehensive study will be conducted with regard to stock identity based on existing samples from Area IV and V and from samples obtained during the feasibility survey in the extended area (Area III East). In addition to mtDNA, analysis on isozyme, morphometry, morphology, pollutants will be conducted. While DNA studies could be conducted using biopsy samples theoretically (although the feasibility for obtaining an adequate number of samples in the Antarctic minke whale is in dispute), the other approaches such as isozyme, morphometry and morphology, pollutants requires internal tissues. Parasites, which can be used as ecological marker, will be also collected to explore possible use for stock identification purpose. At the same time samples collected from Area III East will be examined for further studies on stock structure such as age composition, sexual and age segregation, etc. Stomach contents will be also collected for ecological studies.

(3) Sample Size and Need for Lethal Sampling in the Expanded Area

With regard to the sample number for DNA research, the Workshop on the Genetic Analysis of Cetacean Populations "recommends sample sized of 20–50 from each population are desirable and that these should be taken throughout the geological range" because cetacean populations are often structured into groups of closely related animals (p.8, Hoelzel(ed.)1991). Since two populations are to be analyzed, the recommended size comes to be 40–100. In the past practice of JARPA, analysis of mtDNA variation used a total of 1,800 samples, and

pairwise comparisons have used over 100 samples from each group of minke whales (with one exception for the Area V east in early season) to ensure reliability of the results.

Pollution analysis, which is another study for stock structure, reasonably requires 20–30 samples from one sex of a single population group for statistical evaluations such as analysis on pollutant accumulation by age. Since the both sex of two populations are to be analyzed, 80–120 samples are necessary.

Further, sample number of 100 are expected to provide a reasonable amount of information on age distributions, since analysis of existing JARPA data from Area IV suggests that migration patterns are related to age.

Information cannot be obtained by non–lethal research methods such as biopsy sampling. Comprehensive study on stock identity requires combined results of DNA analysis, allozime analysis, morphological analysis, age dependent pollution analysis, parasite analysis, and sexual/age segregation analysis. Many of the analyses use internal organs which cannot be collected by any of existing non–lethal methods.

The analysis of samples from this expanded research area also will include comparison with existing samples from Areas IV and V by JARPA.

(4) Availability of Existing Samples in Area III

Past samples, which were collected through commercial whaling in the Area III, do exist. However, these samples are limited to whales from the pack ice edge, and so do not represent population components which do not migrate so far south. It is concluded that these past samples are not sufficient to detect stock distribution and its structure due to the limited geographical range of the sampling site. In addition, the age data from the commercial samples are biased due to the selective nature of the operation and, therefore, are not suitable to qualitative analysis of stock structure such as segregation by age, etc.

(5) Environmental Studies

The Commission passed a Resolution on research on the effect of environmental changes on cetaceans (IWC, 1994, Resolution 13). The factors of environmental changes include: (1) warming of the Earth; (2) depletion of ozone layers; (3) pollution; (4) direct and indirect effect of fisheries; (5) noise. Studies on these factors require to take whales and analyze their body structures, particularly, internal organs in parallel to physical, chemical and biological research on the environment.

Chemical analyses on tissues requires age data to identify the age dependent accumulation of pollutants. Also it is necessary to study reproductive organs to understand the changes in reproduction rates caused by environmental changes and carry out a pathological examination on the function of various organs. Analysis on accumulation of heavy metals such as cadmium requires a long period monitoring. In terms of sea pollution analysis, whale samples are complement those available from other species such as seals or penguins. The particular advantage of whales is that they are not restricted by land based breeding sites, and so

integrate information over wide ranges, whereas these other predators may reflect only localized effects. Minke whales are recognized as an indicator species for the Antarctic by CCAMLR. The Scientific Committee of CCAMLR "noted that the minke whale was one of the original indicator species" under CCAMLR Ecosystem Monitoring Programme (Report of the 11th meeting of the CCAMLR).

(6) Considerations on the Research on the Existing Area

Data comparability from the past JARPA surveys will be fully considered in the existing research area. In order to at least maintain searching effort in per unit area, one additional sighting-sampling vessel will be employed.

Sighting data will be collected along with the biological samples. Major objective of the sighting survey is to provide information on the trend in abundance to improve the usefulness of the age data in analyses. The same searching method will be employed year by year to keep data compatibility. The level of searching effort which will maximize this usefulness (within overall operational constraints) will be investigated, and adaptations made in the future, if necessary, provided that this can be done without jeopardizing other important components of the research.

RESEARCH NEEDS ON TOOTHED WHALES

To strengthen the "ecological" and "environmental" objectives of JARPA, potential usefulness on analyzing toothed whales, such as beaked whales, will be examined prior to a possible research take of this species in the later years.

Stomach contents of stranded animals (Sekiguchi et al., 1992) have shown that beaked whales are in the higher trophic level than baleen whales. An estimate of abundance of the beaked whales, most of which are Southern bottlenose whales, was at least several hundred thousand animals (Ohsumi et al., 1994). In the Area IV, Kasamatsu (1993) estimated abundance of beaked whales (mostly Southern bottlenose whales) that was obtained by the IDCR sighting survey in the Antarctic is 115,100. These indicate beaked whales play a significant role in the Antarctic ecosystem.

These whales have not been much utilized in the past and little knowledge has been obtained on their biology. Due to the lack of past sampling experience, the degree of difficulty in obtaining specific samples is unknown. To include at least one sample from various sex and sexual stages from the animals which might be segregated by age or sex, an appropriate sampling methods will be considered. Also, further studies will be made in order to look into feasibility of using this species to elucidate Antarctic ecosystem and environment.

EFFECT ON STOCK

On the last occasion that calculations were carried out in the SC to evaluate the effect of such catches on stocks (IWC 1989), the Sub-Committee on Southern Hemisphere Minke Whales applied the HITTER procedure, together with the best estimate of abundance for the research Area in question, for a number of MSY rates.

This process has been updated (Butterworth and Geromont, 1995), using value of biological parameters as agreed in the Comprehensive Assessment of Southern Hemisphere minke whales (IWC 1991). The population estimates used were those selected at the time by the SC for assessments: the 1987/88 IDCR survey result for Area III, and the 1988/89 survey result for Area IV. For Area IV, the future catch scenario examined is a take of 300 animals every alternate year until the planned end of the program in 2002. Even for MSYR(mature) = 1%, which seems unrealistically low given the observed growth rates of other baleen whale populations, the population is projected to increase slightly under the level of catch proposed. This indicates no harmful effects on stocks.

For Area III, the proposal involves a take of 100 animals in the 1995/96 season only. An increase occurs even if MSYR(mature) = 1% only. However, since this take is proposed for the eastern half of Area III, it may be more appropriate to perform calculations for the population estimate and historic catches for that region only. Again, increases occur also if MSYR(mature)is only 1%. Once more, therefore, no harmful effect on stocks is indicated.

## 1995/96 SURVEY PLAN

Based upon the above considerations, the survey for 1995/96 will be carried out as follows:

(1) Number of vessels
One factory ship (research base), Four sighting/sampling vessels (one vessel is newly added to increase sighting and sampling efficiency).

(2) Survey period
From November 1995 to April 1996.

(3) Survey area
35–130 degree E (eastern part of Area III and entire Area IV), the area south of 60 degree S.

(4) Stratification of the research area
The entire research area is divided into six sub-areas. The sub-areas of IIIEN and IIIES are feasibility areas, while other sub-areas are designated as main research areas.

(5) Sightings Survey method
Survey will be conducted as in the past, except that the previous practice of 1 sighting–only and 2 sighting–and sampling vessels will be charged to 1 sightings–only and 3 sighting–sampling vessels.

(6) Sampling method
When survey vessels engaging in a sampling operation find a school of ordinary form minke whales, one such whale is taken from the school randomly according to the previous method to attempt to secure the fair representative of the samples.

(7) Survey items and samples to be collected
a.Research on minke whales;(see survey and sampling items of the previous cruises)
b.New research items on the effect of environmental changes;
     1.New items for oceanographic studies
     2.New studies on sampled animals


## OPPORTUNITIES FOR PARTICIPATION IN THE RESEARCH BY SCIENTISTS OF OTHER NATIONS

No change from the previous plan.

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