

# Why Whale Research?



make possible the orderly development of the whaling industry. The purpose of the international whaling commission is to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry.



THE INSTITUTE OF CETACEAN RESEARCH





# Why does Japan conduct whale research?

## The purpose of Japan's whale research

**1** The purpose of Japan's whale research is to collect data to provide information on the following items necessary for the sustainable use of whales. Research catches do not adversely affect the stocks:

- Distribution of breeding groups (stock structure)
- Resource abundance trends
- Resource composition (sex, age composition, etc.)
- Effects of the habitat environmental changes on cetaceans

**2** Data are also collected on the feeding habits of whales, since their numbers have increased considerably in recent years, and they consume large quantities of other marine species. This situation has led to competition with fisheries and could be affecting the balance of the marine ecosystem.

To obtain the necessary data we must collect ear plugs and teeth (to find out age), reproductive tissues, stomach contents, and various organs, measure and weigh various body parts, and make observations on parasites and diseases, if any. Since most of the data are impossible to obtain without the take of whales Japan has been conducting whale research programs in the Antarctic from 1987/88, and in the western North Pacific from 1994, in accordance with the International Convention for the Regulation of Whaling.

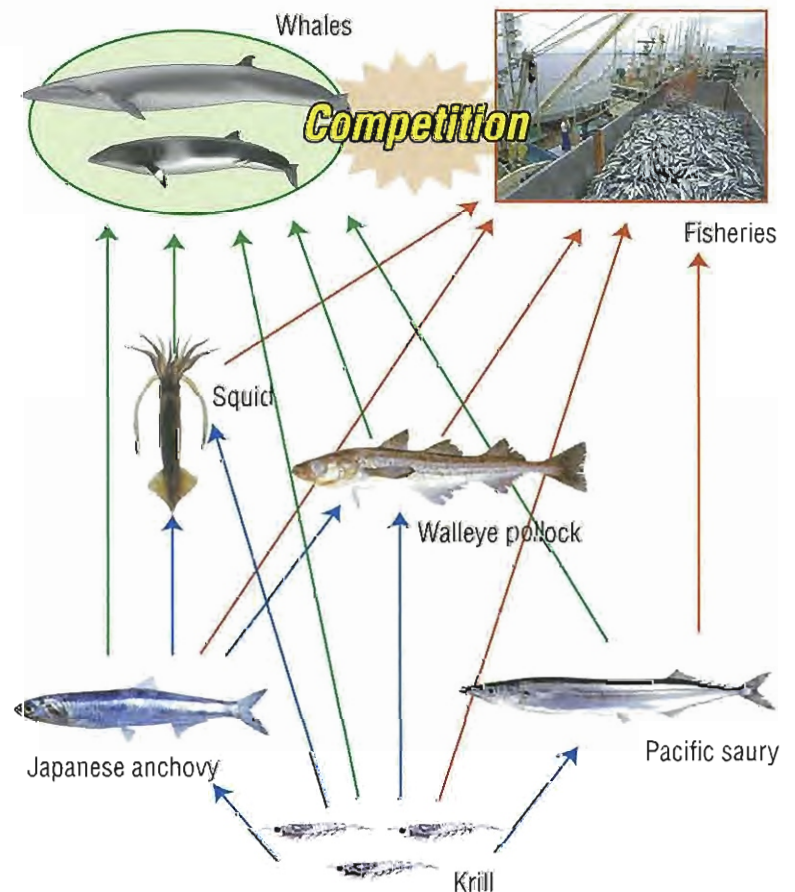
## POINT-1 To elucidate the possible competition between whales and fisheries

### Whales are at the top of the food web

Whales are the largest marine mammals and are at the top of the food web in their ecosystem, where plankton is eaten by fish, which in turn are eaten by whales. The balance of the marine ecosystem will be affected if whales alone increase excessively in number.

### Competition between whales and fisheries

Research results show that whales feed on Japanese anchovy, Pacific saury, walleye pollock, salmon, squid, and many other commercially important fishery resources. As whales are increasing in number, their feeding behavior could be severely affecting fisheries, which poses a grave problem.



The world's population is expected to increase to more than nine billion by the mid twenty-first century. Food produced on land is not sufficient to feed that many people, so we need to make use of the living resources in the vast oceans that take up three-quarters of the earth's surface. The data obtained through the Japanese research take of whales and their scientific analyses will, as its primary purpose, eventually lead to the resumption of whaling. The research programs also make valuable contributions to the proper management and utilization not only of whales, but all marine living resources.

## POINT-2 To understand the trends in abundance of whale resources

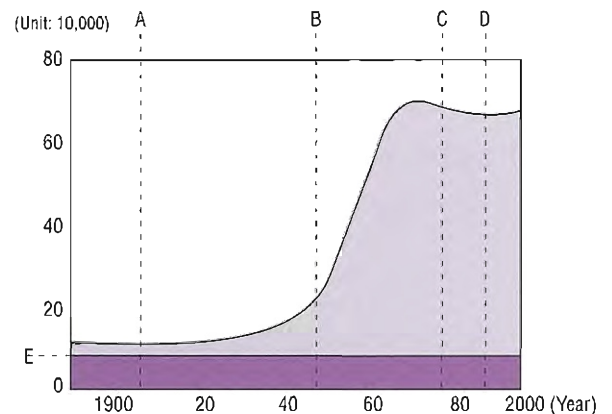
### Whales are increasing

Since the moratorium on commercial whaling was established, many whale species are showing an increasing trend. Research has shown that some whale resources, including minke whales, are abundant enough for human utilization. It is essential to collect scientific data on the trends in the abundance of whale resources to achieve sustainable whaling.

Note:

- A: Beginning of whaling in the Antarctic Ocean (1904)
- B: International Whaling Commission inauguration (1948)
- C: Introduction of the New Management Procedure (1975)
- D: Moratorium placed on commercial whaling (1986)
- E: Appropriate abundance level

Changes in minke whale abundance in the Antarctic Ocean



## POINT-3 To elucidate stock structure

Wild animals of the same species separate into individual groups in different breeding grounds. Such groups of whales are called stocks. We need to understand the range of distribution and boundaries of whale stocks by collecting and analyzing genetic, morphological, and ecological information for the proper management of whale resources.



School of sperm whales

## POINT-4 To monitor the marine environment

It is possible to learn about the marine environment and oceanic pollution by studying whales because they are top predators and live for a long time. This means that we can monitor the effects of changes in the marine environment on cetaceans, which will also contribute greatly to the management of all marine living resources.



Oceanographic observations



Collection system and determination of Pollutants in sea water (aboard RV Kyoshin Maru No.2)







# POINT-1 Competition between whales and fisheries

Whale research in the western North Pacific and the North Atlantic has revealed that in each region whales consume huge amounts of various fish species.

## Whales consume a colossal amount of fish

The Japanese research programs have found that whales eat an amazing amount and variety of fish. Among their prey are Pacific saury, salmon, walleye pollock, and other fish that humans utilize as fishery resources. The amount consumed by whales is three to five times as much as the world's total marine fisheries catch. The possible consequences to fishery resources as food for humans are tremendous.

## Year by year whales increase while fish stocks dwindle

Prey consumption by whales has seriously affected fisheries, and could have consequences on the overall balance of the marine ecosystem. Whales are known to have increased at an annual rate of 4% since the moratorium was placed on commercial whaling in 1986. This means that their population has doubled in the seas around Japan since then. During this time, the catch of Japanese fisheries has gone down from twelve million tons in the 1980s to less than six million tons today. As for major species caught near Japan, they have dropped to less than two million tons.

## Whales consume fish in their best season

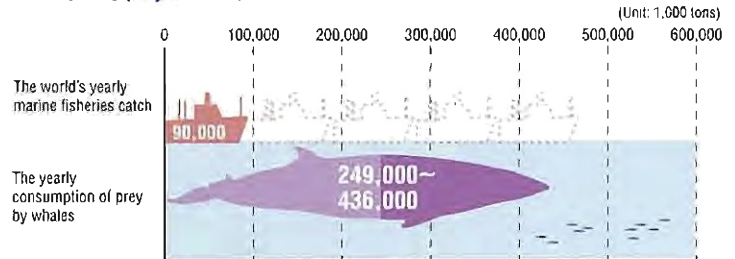
The Japanese Whale Research Program under Special Permit in the Western North Pacific has revealed that minke whales feed on Japanese anchovy in May and June, Pacific saury in July and August, and a large amount of walleye pollock in the coastal seas off eastern Hokkaido. Bryde's whales were found to eat Japanese anchovy in August and September, and sperm whales to prey on squid and fish from May to September. Whales feast on fish according to their best season. It is a point that Japan as a fishing nation cannot overlook.

## Ecosystem approach for the management of marine living resources

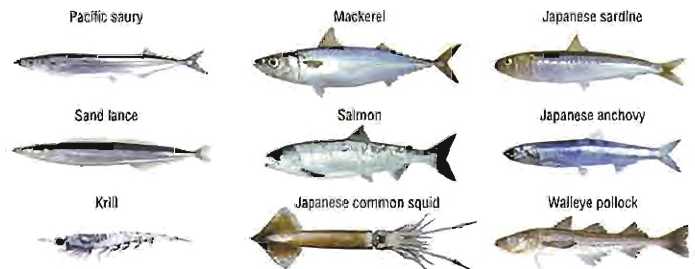
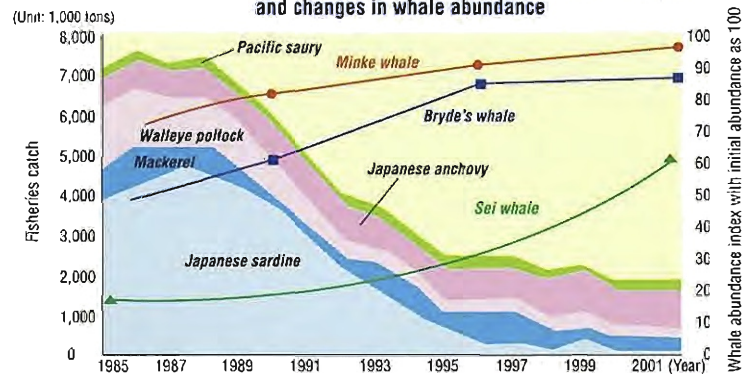
The Ecopath model, one of the ecosystem models, mathematically illustrates the prey-predator (food web) relationships of thirty marine species living in the western North Pacific. We can estimate the effect of increasing whales on fishery resources by running simulations on the Ecopath model. The scientific data from Japanese research programs have greatly contributed to the construction of this model. Ecosystem models are essential for the sustainable use of marine living resources while maintaining the balance of the ecosystem, including the top predators, cetaceans.

□ JARPN II research target species

The yearly prey consumption of whales and the world's marine fisheries catch

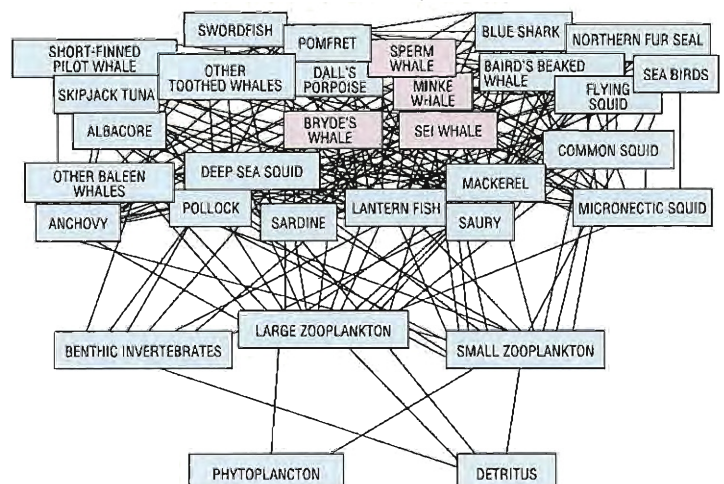


Changes in the catch of major fish species in the seas around Japan and changes in whale abundance



Source: The Fishes of Northern Japan; Cephalopods from Continental Shelf and Slope around Japan

Western North Pacific Ecopath Model

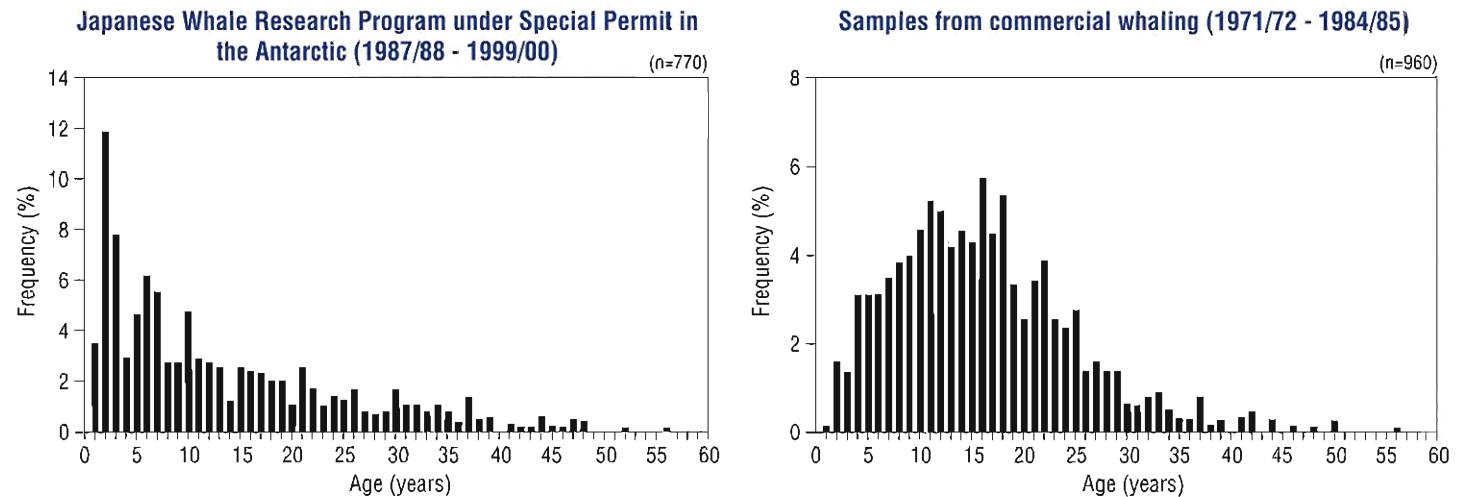


# POINT-2 Abundance trend of whale resources

## High reproductive rate of Antarctic Ocean whale resources

### The Antarctic minke whale resource has many young animals

Analysis of age composition by random sampling of Antarctic minke whales has revealed that there are many young animals from two to ten years of age, which is evidence of the high reproductive rate of the stock. This information could not be obtained in the days of commercial whaling which targeted only large whales.



Comparison of age composition of female Antarctic minke whales (Area IV)  
Source: The Institute of Cetacean Research

## Many whales sighted in the seas around Japan

Many large whales were sighted during the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific.

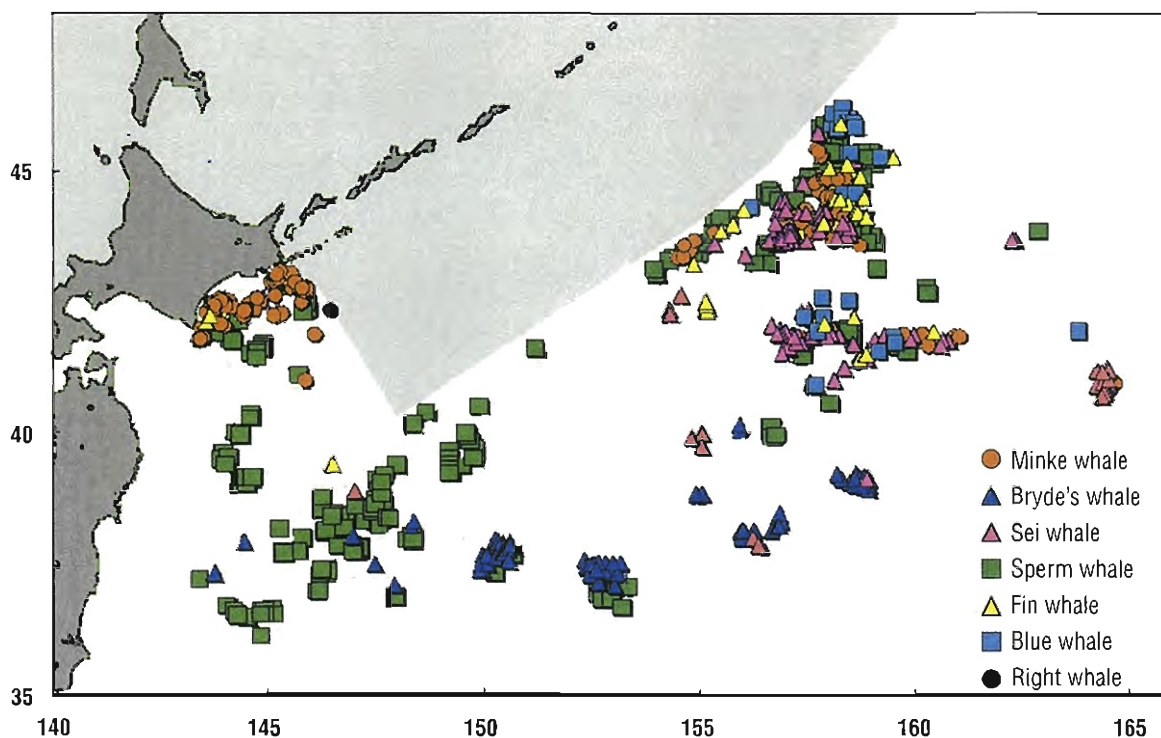


Illustration of 2002 survey sightings. The above are the sighting results of the three sighting/sampling vessels along the survey track line, and not the distribution of whales over the entire survey area.



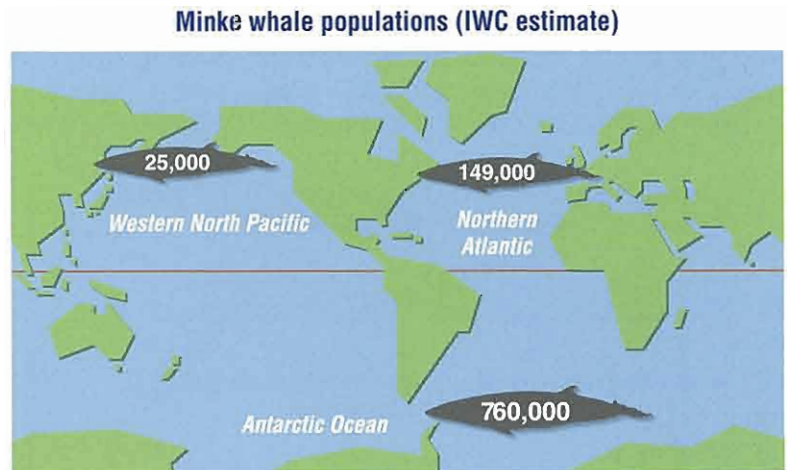




The research programs that Japan is carrying out have gradually shown that many of the whale stocks have recovered. It is important that we utilize minke whales, which number as many as 760 thousand in the Antarctic Ocean alone, and to understand that this can be done without adversely affecting the resource.

## There are 760 minke whales in the Antarctic Ocean

The International Whaling Commission (IWC) Scientific Committee acknowledged in 1990 that there were 760 thousand minke whales in the Antarctic Ocean. It also agreed in 1991 that there were 25 thousand minke whales in the Okhotsk Sea-West Pacific stock in the North Pacific. Further, in 1992, the IWC Scientific Committee calculated that an annual take of two thousand Antarctic minke whales for one hundred years would not affect the stock.



## Lethal and non-lethal research

There are two kinds of methods employed in whale research. The non-lethal, such as sighting surveys that are conducted without killing any animals, and the lethal, for surveys on age, stomach contents, body measurements, and others that would be impossible without taking whales. Japan's whale research programs are constructed so as to employ both methods according to data needs.

### Comparison of lethal and non-lethal research methods

Items	Lethal methods	Non-lethal methods
<b>Size of resource</b>	Unsuitable for scarce resources	Suitable for scarce resources
<b>Whale behavior</b>	Sampling possible irrespective of swimming speed	Limited to slow-swimming species
<b>Sample material</b>	Can be obtained in quantities	Only a small amount can be obtained
<b>Specimens</b>	Can be obtained from whole whale	Can be obtained only from part of body surface
<b>Survey field</b>	Possible to carry out in poor conditions	Can be carried out only in favorable conditions
<b>Survey time</b>	Can spend plenty of time	Must be done in short time
<b>Survey period</b>	Results can be obtained in short time span	Requires long-term research
<b>Continuity</b>	Can study only one stage of the animal	Continued observation of individual possible
<b>Expenses</b>	Small	Requires much money
<b>Utilization of sampled resource</b>	Possible	Not possible

### Examples of lethal and non-lethal research



#### Blood sampling

**Lethal research** is useful to investigate age, growth rate, pollutant accumulation, feeding habits, pregnancy rate and other important information.



#### Sighting survey

**Non-lethal research** is useful to investigate the distribution, abundance, migration, movements, behavior of whales and other important information.



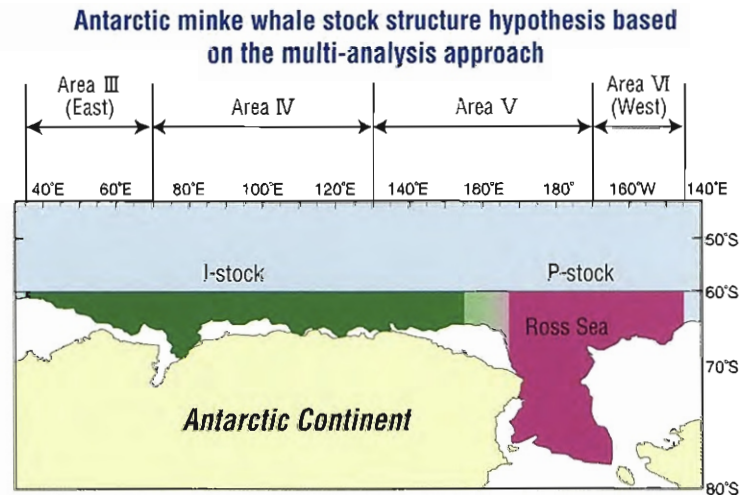
# POINT-3 Elucidation of stock structure

Breeding groups of whales of the same species that share similar genes are called stocks. For the management of whale resources, it is necessary to consider separately each breeding group or stock. One objective of the Japanese research programs is to collect biological information to find out how many stocks there are and how they are distributed, and to estimate how they may change in the future.

## Elucidation of minke whale stock structure

### Antarctic Ocean (Antarctic minke whale)

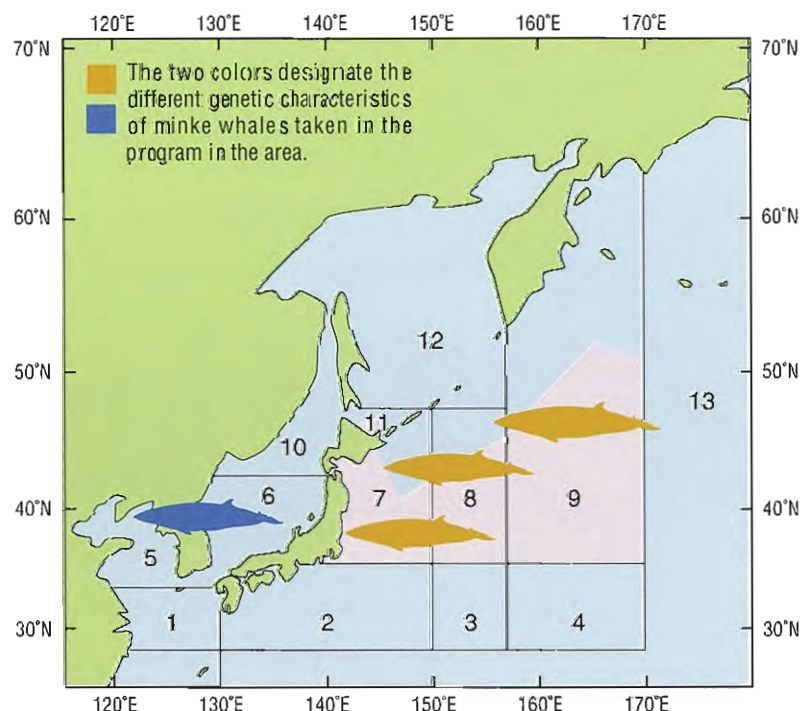
Initially, it was believed that several independent stocks migrated into the JARPA research area, but the results of multi-analysis approach (ecological, genetical and biological analysis) strongly support a two-stock hypothesis. These two stocks are the Eastern Indian Ocean Stock (I-stock) which migrates to Areas III (East), IV and V (West), and the Western South Pacific Stock (P-stock) which migrates to Areas V (East) and VI (West).



### Western North Pacific (Common minke whale)

Scientists from anti-whaling nations claimed that there were numerous stocks and sub-stocks of minke whales in the western North Pacific to make the catch quotas smaller. In response, we have conducted research in these waters, finding as a result that there are basically only two stocks, one in the Pacific and the other in the Japan Sea.

**Areas covered by the minke whale research program in the western North Pacific**





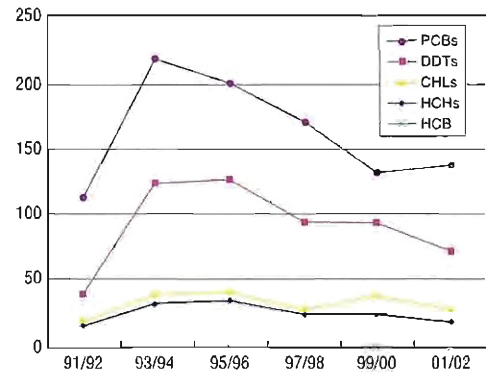
# POINT-4 Monitoring the environment

Whales are top predators in the food web. Pollutant concentration in whales therefore serves as an indicator of marine contamination. The life span of large whales is fifty to a hundred years, and even small whales live to an average age of thirty, which makes them very good indicator species.

## The whale research programs are useful as marine contamination surveys

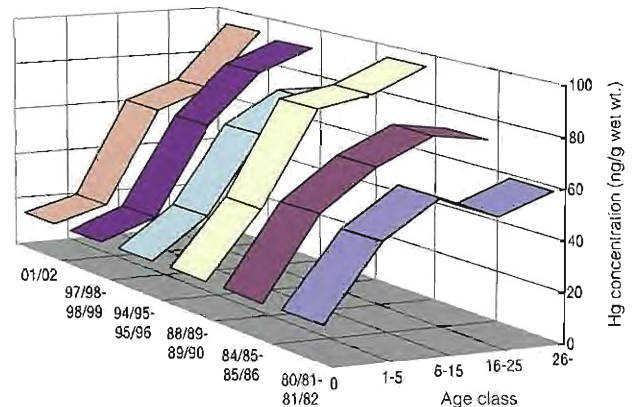
### Yearly change in organochlorine concentration in mature male Antarctic minke whale blubber

The Antarctic Ocean can be said to be one of the least affected seas in the world by organochlorines. Their concentration level has shown a downward trend in recent years.



### Yearly change in mercury (Hg) accumulation curve in Antarctic minke whale liver

It is generally known that mercury (Hg) concentration in the liver increases with age, but analysis of samples does not show this tendency. The accumulation curve changes depending on the year. It is believed that this reflects the changes in the feeding environment of Antarctic minke whales.



### Pollutant presence in the Antarctic minke whale is extremely small

Analysis of internal organs of Antarctic minke whales taken by the research programs indicates that there is almost no accumulation of organochlorines and heavy metals. All samples clear, by a large margin, the restriction standard set by the Japanese government.

### Japan's whale research programs are absolutely legal in terms of international law.

According to Article VIII of the International Convention for the Regulation of Whaling, IWC member countries have the right to conduct research programs that involve the take of whales for scientific purposes. They are permitted to carry out research whaling, although commercial whaling is banned. Article VIII also stipulates that the research by-products must be used as far as practicable. In Japan, the whale research by-products are sold in a fair manner, and the proceeds are used to fund part of the next year's research.

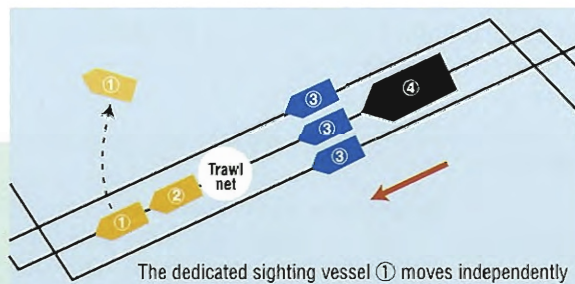
### Article VIII, International Convention for the Regulation of Whaling

1. *Notwithstanding anything contained in this Convention, any Contracting Government may grant to any of its nationals a special permit authorizing that national to kill, take, and treat whales for purposes of scientific research subject to such restrictions as to number and subject to such other conditions as the Contracting Government thinks fit, and the killing, taking, and treating of whales in accordance with the provisions of this Article shall be exempt from the operation of this Convention. Each Contracting Government shall report at once to the Commission all such authorizations which it has granted. Each Contracting Government may at any time revoke any such special permit which it has granted.*
2. *Any whales taken under these special permits shall so far as practicable be processed and the proceeds shall be dealt with in accordance with the directions issued by the Government by which the permit was granted.*



# Survey vessel makeup in Japan's whale research programs

Six research vessels carry out a combination of coordinated sampling and sighting surveys



**Dedicated sighting vessel, Kyoshin Maru No. 2**

Conducts sighting surveys to determine whale abundance, carries out oceanographic surveys and echo-sound research on the abundance and distribution of prey.



**Trawl research vessel, Shunyo Maru**

Conducts surveys using trawl nets to determine the abundance and species of organisms in the sea.



**Sampling/sighting vessels, Yushin Maru (shown above), Yushin Maru No. 2, and Yushin Maru No. 3**

Conduct sighting surveys to determine whale abundance, and sampling of whales to study their diet, etc.



**Research base vessel, Nisshin Maru**

Collects more than one hundred data items and samples of tissues, organs, and stomach contents from each whale taken by the sampling/sighting vessels. By-products are also processed on board.

## Prey species survey (trawl)



### Net sampling

Prey species are collected using a trawl net, to determine the distribution and abundance of fish and squid in order to investigate the prey preference of whales.

## On board research and sampling



### Taking measurements of various parts of the whale

Biological material is gathered on board the research base vessel as specimens for biological research on stocks, age, maturity, reproductive status, diet, pollutants, sex hormones, parasites, and other items.

## Oceanographic observations and environmental surveys



### Collecting data using EPCS (Electronic Particle Counting and Sizing System), which monitors the biological environment of the surface water

Distribution of fish, squids, and zooplankton, which are prey of whales, are affected by water temperature and salinity. State-of-the-art devices are used to collect oceanographic data.

## Sighting surveys



### Scanning the seas for whales from the upper bridge

Sighting surveys are conducted to determine the species and number of animals. They are done with great patience and concentration so as not to miss the smallest sign of swimming whales.







# Japan's whale research programs

## JARPN and JARPN II

### Japan's Whale Research Program under Special Permit in the Western North Pacific (JARPN, 1994 - 1999)

In the IWC Scientific Committee discussions to establish catch quotas of minke whales in the seas off Japan, anti-whaling nations' scientists claimed that there were numerous stocks (small breeding groups within the same whale species) of minke whales in the Western North Pacific, in order to complicate the calculations in a way that would produce lower quotas. JARPN was launched to disprove this theory.

#### Objectives:

- 1) To clarify the stock structure of minke whales in the Western North Pacific
- 2) To study the feeding ecology of minke whales in the Western North Pacific

**Research area:** Of the thirteen Sub-areas established by the IWC Scientific Committee, Sub-areas 7, 8, 9 and 11.

**Sampling method:** Individuals are selected from the school of whales found along the preset courses, using a table of random numbers (random sampling method).

**Sample size:** 100 minke whales

**Main research organization:** The Institute of Cetacean Research

### The Second Phase of Japan's Whale Research Program under Special Permit in the Western North Pacific (JARPN II, 2000 - )

The first phase of the program found that the Japanese scientists' theory on the distribution of minke whale stocks was more or less correct. It also revealed that minke whales consumed a huge amount of fishery resources. Thus, the second phase was planned for a more detailed study of the feeding ecology of various whales and with emphasis on gathering data for the overall management of the marine ecosystem.

#### Objectives:

- 1) Feeding ecology and ecosystem studies
- 2) Monitoring environmental pollutants in cetaceans and the marine ecosystem
- 3) Elucidation of stock structure

**Research area:** Of the thirteen Sub-areas established by the IWC Scientific Committee, Sub-areas 7, 8 and 9

**Sampling method:** Individuals are selected from the school of whales found along the preset courses, using a table of random numbers (random sampling method).

#### Planned number of samples:

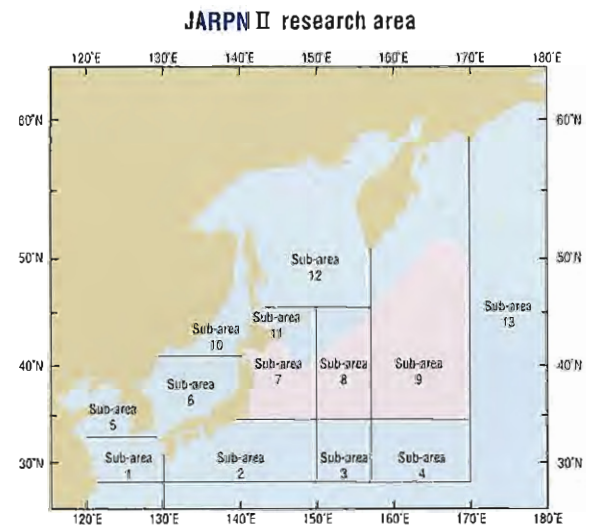
220 minke whales, 50 Bryde's whales, 100 sei whales and 10 sperm whales

#### Numbers sampled (2007 cruise):

217 minke whales, 50 Bryde's whales, 100 sei whales and 3 sperm whales

#### Main research organizations:

The Institute of Cetacean Research;  
National Research Institute of Far Seas Fisheries, Fisheries Research Agency



## The IWC Scientific Committee highly evaluates Japan's whale research programs

### Major points of the 1997 JARPA review\*

- The results of the JARPA program have the potential to improve the management of minke whales in the Southern Hemisphere as well as in other seas. It will especially be useful in reducing the current set of plausible scenarios for the RMP, and will contribute to increasing the allowed catch without increasing the depletion risk.
- The program has the potential to provide answers to various questions concerning the trend of stock fluctuation of minke whales in Areas IV and V. The Japanese surveys have made great contributions to elucidating the biological parameters for Areas IV and V, and the results need to be analyzed in connection with the newly discovered stock structure.
- The program is useful for elucidating the role of whales in the Antarctic Ocean ecosystem. The collected data should be used to verify hypotheses such as the "krill surplus model".

\* Note: A five-day review meeting was held by the IWC in Tokyo in May 1997, in which forty-four IWC Scientific Committee scientists from about a dozen countries, including the U.S., New Zealand, Australia, and Norway participated.



# JARPA and JARPA II

## Japan's Whale Research Program under Special Permit in the Antarctic (JARPA, 1987/88 - 2004/05)

JARPA was aimed to study the abundant Antarctic minke whales. Feasibility studies were begun in 1987/88 and the full-scale research planned for sixteen years began in 1989/90.

### Objectives:

- 1) Estimation of biological parameters useful for resource management
- 2) Elucidation of the role of whales in the Antarctic marine ecosystem
- 3) Elucidation of the effect of environmental changes on cetaceans
- 4) Elucidation of the stock structure of Antarctic minke whales

**Research area:** Of the six Antarctic management areas established by the IWC, Areas IV and V.

Area IV: 70°E - 130°E ; Area V: 130°E - 170°W

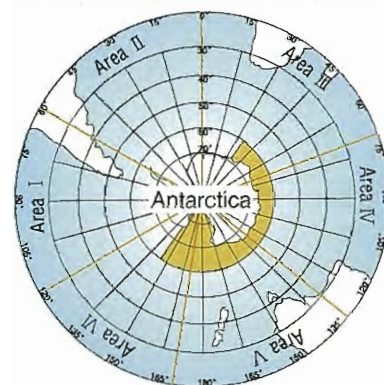
Eastern Area III and western Area VI were added from the 1995/96 research expedition to investigate the distribution stocks to the east and west.

**Sampling method:** Individuals were selected from the school of whales found along the preset courses, using a table of random numbers (random sampling method).

**Numbers sampled:** 1987/88 - 1994/95: 300 Antarctic minke whales  $\pm 10\%$   
1995/96 - 2004/05: 400 Antarctic minke whales  $\pm 10\%$

**Main research organization:** The Institute of Cetacean Research

JARPA and JARPA II Research Area



## The Second Phase of Japan's Whale Research Program under Special Permit in the Antarctic (JARPA II, 2005/06 - )

In JARPA it was pointed out that not only the resource status analysis of individual species is necessary for understanding baleen whale population dynamics in the Antarctic ecosystem in order to make future resource projections, but that it is also important to consider altogether the relation among whale species as components of the ecosystem. JARPA II was started in order to address this matter, and monitor the Antarctic ecosystem including whale resources.

Besides the Antarctic minke whale, JARPA II research plan focuses on two other species, the fin whale and the humpback whale. The first two years (2005/6 and 2006/7) a feasibility study was conducted to verify the practicability of sighting survey methods, increment of sampling size (850  $\pm 10\%$  minke whales and 10 fin whales) and sampling methods in the expanded research area. No humpback whales were sampled during the first two years' feasibility cruises.

### Objectives:

- 1) Monitoring the Antarctic ecosystem
- 2) Modeling competition among whale species and developing future management objectives
- 3) Elucidation of temporal and spatial changes in stock structure
- 4) Improving the management procedure for the Antarctic minke whale stocks

**Research area:** Of the six Antarctic management areas established by the IWC, eastern part of Area III, Area IV, Area V and a part of Western part of Area VI (South of 60°S, 35°E-145°E). Two years are required to investigate the whole research area.

**Sampling method:** Individuals are selected from the school of whales found along the preset courses, using a table of random numbers (random sampling method).

**Planned number of samples:** 850 Antarctic minke whales  $\pm 10\%$ , 50 fin whales, 50 humpback whales

**Numbers sampled (2006/07 cruise):** 505 Antarctic minke whales, 3 fin whales

**Main research organization:** The Institute of Cetacean Research

**At the 1997 intersessional review meeting, the IWC Scientific Committee acknowledged that the JARPA program had made significant contributions, although some points to be improved were pointed out**

**On January 2005 a JARPA review meeting\* was hosted by Japan with the participation of scientists from the IWC Scientific Committee**

- The 2005 JARPA review meeting agreed that consistent results suggesting competition among baleen whales over krill, the main prey species, are being obtained in the JARPA survey.
- In addition, the review meeting agreed that the JARPA results clearly show the need to consider the interspecific relationships (ecosystemic relations), in order to understand the population dynamics of baleen whales in the Antarctic ecosystem and to be able to make future projections of resource abundance and stock structure.

**Also, at a workshop held in December 2006 in Tokyo to review the JARPA data and results, the IWC Scientific Committee agreed, among other things, the following:**

- The JARPA data set provides a valuable resource to allow investigation of some aspects of the role of whales within the marine ecosystem.
- With appropriate analyses, the JARPA data set has the potential to make an important contribution to the Scientific Committee's work in this regard, as well as the work of other relevant bodies such as CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources).
- The results from the JARPA program have the potential to improve management of minke whales in the Southern Hemisphere.

\* A JARPA review meeting was held in Tokyo in January 2005 with the participation of thirty-nine IWC Scientific Committee scientists from eight countries (South Africa, Grenada, St. Lucia, Gabon, Norway, Iceland, Korea and Japan).

\*\* A JARPA review workshop was held in Tokyo in December 2006 with the participation of 56 IWC Scientific Committee scientists from fourteen countries including Australia, Germany, Grenada, Iceland, New Zealand, Norway, South Africa, South Korea, St. Lucia, United States and Japan.







The world's production from capture fisheries and the food fish supply is currently the highest on record and remains very significant for global food security. Against this backdrop, whaling itself should no longer be the bone of contention between pro- and anti-whaling nations. It is now an issue of competition between whales and human beings over marine living resources. Overprotection of a particular component of the ecosystem (with the exception of those stocks that are at a low level of abundance), especially whales which are the top predators in the food web, would upset the balance of the ecosystem and could lead to instability of the entire ecosystem.

### Stomach content of whales taken in the research programs



Walleye pollock



Pacific pomfret and chum salmon



Pacific saury



Mackerel



Japanese common squid



Japanese anchovy



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