

# Eels and Japan

For the Sustainable  
Use of  
Eel Resources



# The Relationship Between Japanese and Eels

## A Relationship of over 5000 years

The fragrant aroma of kabayaki is dear to the hearts of many Japanese.

Kabayaki is a unique Japanese cooking method in which the eel is cut and boned. Then it is dipped into sweetened sauce made from soy sauce and Mirin (rice wine) and char-grilled.

“Unaju” and “Unadon” in which kabayaki is served on top of rice, are popular with men and women of all ages, and kabayaki has come to be one of the foods that symbolizes Japanese cuisine.



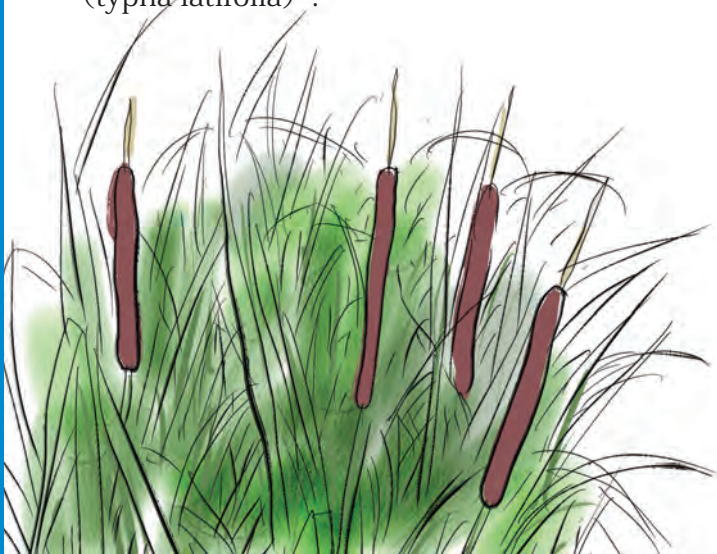
The relationship between Japanese and eels is an ancient one. Eel bones have been found in the shell mounds of the Jomon period, so it is thought that Japanese have been eating eels for over 5000 years.

## In the Kamakura period, eel was cut into chunks

The word “kabayaki” appeared around 700 years ago in the Kamakura period. The way that eel was eaten in the Kamakura period was quite different to the way it is eaten now. Whole eels were cut into chunks and grilled on skewers. The only seasoning was salt, or maybe miso or vinegar. These eel-chunks on skewers were the “ancestral form” of kabayaki, and the theory is that they were given the name “kabayaki” because of their resemblance to the tips of the broadleaf cattail plant (*typha latifolia*) .



Image of a meal of the Jomon period



"Big kabayaki in the Edo style"  
Shuntei Katsukawa (1807)



## From Gama-no-hoyaki (Cattail-shaped eel skewers) to Kabayaki

So when did the kabayaki that we eat today first appear?

An eel seller with a street stall appears in an illustration of the popular novel “Ubugoe”, written around 300 years ago in the Genroku era of the early Edo period (1688 - 1703) . The illustration depicts cooked eel that is the same shape as modern day kabayaki, as well as lanterns bearing the labels “Unagi-sakiuri” and “Kabayaki” . From this we can determine that people in the Osaka and Kyoto areas were eating eel that had been sliced open at this time.

How about in Edo? 30 years after “Ubugoe” was published, Kiyoharu Kondo's collection of Kabuki Pictures “100 famous places of Edo” (1728) includes pictures of street stalls selling kabayaki that is identical in appearance to that sold today. So the method of cooking eels by cutting them open can be assumed to have spread to Edo (modern day Tokyo) by the middle of the Edo period.

The kabayaki of this period does not appear particularly different to modern day kabayaki. However, the seasonings were much simpler. Apparently the only seasonings available were soy sauce and sake. It was only some time after this that the familiar sweet and spicy sauce, combining soy sauce and mirin, made its first appearance.



## The Harmony of Soy Sauce and Mirin

The delicious tastes of soy sauce and mirin are essential to the creation of the kabayaki sauce.

The appearance of soy sauce that was refined using the same methods as today, first came in the Muromachi period (Sengoku era) around 500 years ago. For a long time, the main production center of soy sauce was the Osaka and Kyoto areas and the province of Senshu Sakai (today part of Osaka Prefecture) . However, from the middle of the Edo period, around the second half of the 1700's, the center of production shifted to Noda and Choshi in Chiba, in order to supply the massive demand from the growing consumer city of Edo, and production of soy sauce exploded as a result. The Noda and Choshi areas were blessed with a highly favorable location in the middle of a fertile plain (the Kanto Plain) where the raw materials of soy beans and wheat could be grown, and the rivers such as Tonegawa river and Edogawa river were available to transport the finished product (by water) to Edo. The soy sauce produced in Noda and Choshi was called "local soy sauce" , to distinguish it from soy sauce made in Kansai, and it spread in popularity throughout the region centered on Edo.

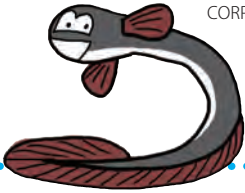
Mirin was originally a beverage. Until refined sake was developed in the Edo period, it was a sweet high-class drinking sake. Mirin first appears in texts as a seasoning used in cooking in the later half of the Edo period, where it is mentioned in the cookbook "Manpo Ryori Himitsubako" (A treasury of 10,000 recipes) published in 1785.

In this book mirin appears as a seasoning for the first time. Subsequently, mirin appears frequently in the pages of cookbooks as a seasoning to be added together with soy sauce.

From the above, it can be assumed that the sweet and spicy sauce made by combining the flavors of soy sauce and mirin first appears in the latter half of the Edo period.



Material provided by: YAMASA CORPORATION



### The Beginnings of Unadon

The history of "Unagimeshi" and "Unadon" , in which kabayaki is served on top of rice, is an interesting one. The person who thought up this way of eating eel was a person named Imasuke Okubo, who was not an Unagi seller, but the financial backer of a theater in Edo's Sakaimachi (current Nihonbashi Ningyocho in Tokyo's Chuo Ward) . Imasuke was a huge lover of eel, and during the plays he had eel delivered from a local eel shop. However if kabayaki is not eaten straight away, it gets cold. So, he had the delivery person carry a container full of hot rice, with the kabayaki placed on top of the rice. This was an excellent way of keeping the kabayaki warm, and proved so popular that imitators of this method emerged, until finally the shop from which Imasuke bought his kabayaki "Onoya" in Fukiyacho (also located in what is today Ningyocho) started selling it as "Unagimeshi" . This increased its fame and before long every eel shop in Tokyo was selling "Unagimeshi" .

"Origins of Mundane Affairs and Crafts and Arts (1865)" written by Seiun Miyagawa



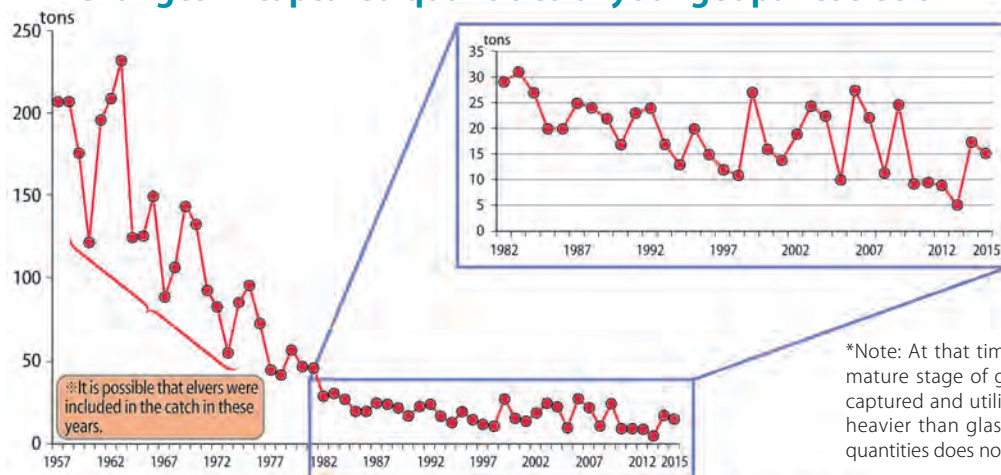
Material provided by: KOKONOE MIRIN Co, Ltd



## Concerns about Dwindling Eel Resources

Kabayaki, which was born in Japan, has now become a food that is loved by people all over the world. However in recent years, the volume of Japanese glass eels caught has been at a low level, and in June 2014, they were listed as Endangered on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species.

### Changes in captured quantities of young Japanese eels

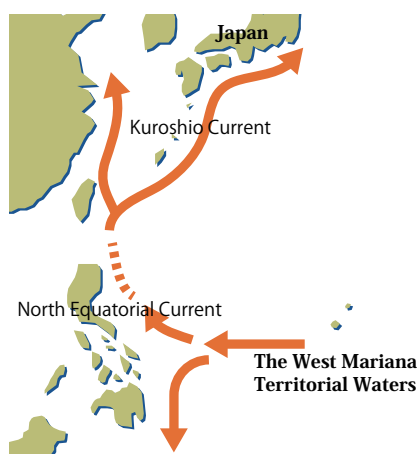


Source: Ministry of Agriculture Forestry and Fisheries "Fishing and Aquaculture Industry Production Statistics" (1957-2002) conducted by the Fisheries Agency

However, when looking at the reason for the decline in the volume of the eel catch, it is important to remember that many aspects relating to the biology of eels remain unclear. Nevertheless, the major causes has been identified as the following: changes in the ocean environment, habitat degradation, or overfishing.

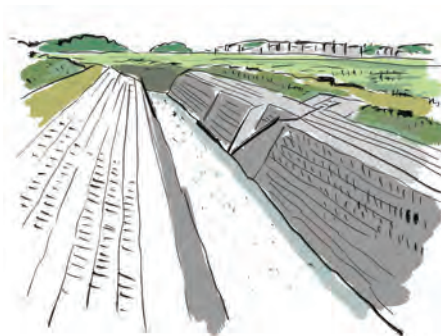
### Causes of Decline in the Population of Japanese Eels

#### ○ Changes in the Ocean Environment



Effects are being felt from shifts occurring in the marine environment on a worldwide scale, such as changing ocean currents and changes in the salinity of sea water due to El Nino.

#### ○ Habitat Degradation



One reason for this is believed to be the deterioration of environments suitable for eels to inhabit and swim upstream, resulting from development in coastal areas, the construction of estuary weirs and dams, and other causes.

#### ○ Overfishing



Although the scale of these effects is not clear since the amount of resources is not well known, the fishing of eel resources is also believed to be a contributing factor.

**How can we use eel resources sustainably and at the same time maintain Japan's proud tradition of eating kabayaki? Let's think about this together.**

# Glass Eels caught – Eel Farming – Processing –

## Method of Catching Glass Eels



Glass eels for aquaculture are caught between December and April in rivers and along the coastline.

On the night of the new moon, the glass eels, which are attracted to the light, are scooped up in hand nets or caught in fixed nets strung up in the rivers.

## Glass eels are put into aquaculture ponds (farms)



The glass eels have transparent bodies around 6cm long, around the length of a toothpick, and weight about 0.2g. Eel aquaculture has a history of over 150 years, however the aquaculture and the capture of the glass eels is still conducted using 100% natural methods. The glass eels that are captured are then put into aquaculture ponds to be raised.

## Turned into kabayaki at the processing plant



## The eels are transported live to the specialty restaurants





# Consumption

## Farming



The producers take the freshly caught glass eels, which have been captured sometime during the period between winter and spring and raise them for a period lasting between 6 months to one and a half years. During this time, the eels go from weighing 0.2g to adults weighing 200g or 300g each. The eel farms are ponds roofed with transparent plastic insulation, which maintains a water temperature of 28°C at all times. The eels are provided with a feed made from fish meal, which is combined with water and supplied to the eels in a paste-like form.

## Shipping

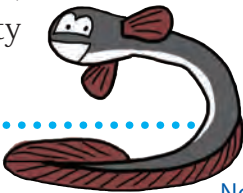


Eels intended for shipment are transported to preparation areas of related associations and distributors. Here they are sorted by size, and in order to remove the smell of the food they have consumed, they are placed in tub-like containers that have holes punched in them, with water continually flowing in from above. After roughly 2 days have passed while standing erect, they are shipped while still alive to kabayaki specialty restaurants, processing plants, and other destinations.

## Size Grading

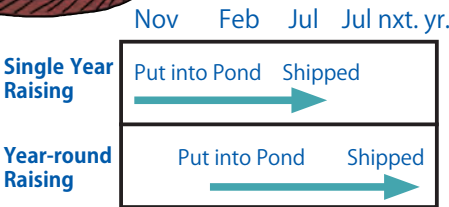


At regular intervals, the eels are taken out of the pond and graded by size, so that all of the fish in a single pond are the same size.



### How long does it take to raise an eel?

Glass eels are caught and put into the ponds at the relatively early period of November – January. In the case of “single year raising” where they are to be shipped in time for the period of prime demand in July, the eels are raised to a marketable size in about 6 months. Glass eels that are caught at the relatively late period of February - April are raised for a whole year or more in “year-round raising” .

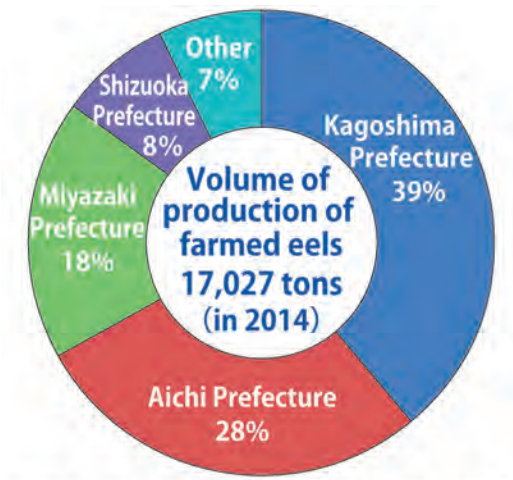


# History of production of eel and use and the current state

## Eel Farming originated in Tokyo

Eel farming in Japan was originally started in the Fukagawa area of Tokyo by Kurajiro Hattori in 1879. Later, from around 1897, it was introduced to Lake Hamanako and then spread from the Tokai region across the entire country. In the decade after 1965, eel farming began to be carried out in Shikoku and Kyushu as well. In recent years, the greatest volume of production has come from Kagoshima Prefecture.

Thanks to the enhancement of farming technologies a stable supply of eels has been achieved and nowadays 99% of all eels supplied to the market are farmed eels.



Source: Ministry of Agriculture Forestry and Fisheries "Fishing and Aquaculture Industry Production Statistics"

## Chronology of Eel Farming in Japan

<b>1879</b> Kurajiro Hattori was the first person to attempt eel farming, creating a 2ha aquaculture pond at Sendashinden in the Fukagawa area of Tokyo	<b>After 1965</b> Progress is made in developing better artificial feed with the popularization of heat treatment to prevent the occurrence of fish diseases.	<b>1989</b> Production of farmed eels in Japan reaches a record 39,704 tons.	<b>2013</b> Because of a poor catch of glass eels and other reasons, the supply of eels falls by 40,000 tons.
<b>After 1955</b> Eel farming is flourishing in Shizuoka, Aichi and Mie Prefectures.	<b>After 1975</b> Eel farming is flourishing in Kagoshima and Miyazaki Prefectures.	<b>2000</b> Increased imports of European eels sees the supply of eels reach a record 160,000 tons.	

## The Resource Management Required of Japan as a Major Eel Consuming Country

The domestic supply of eels in Japan increased from about 1985 onward, with the increase in the number of imported eels from China, Chinese Taipei and Europe, and reached the record volume of 160,000 tons in the year 2000. After that, a decline in European eel stocks saw the volume of supply also decrease and in recent years has seen the number of eels available return to the level of the 1970' s with an annual supply of around 40,000 tons.

Further, in order to protect the species from overfishing, European eels were listed on the Washington Convention in 2007, and commercial trade in European eels has been restricted since 2009.

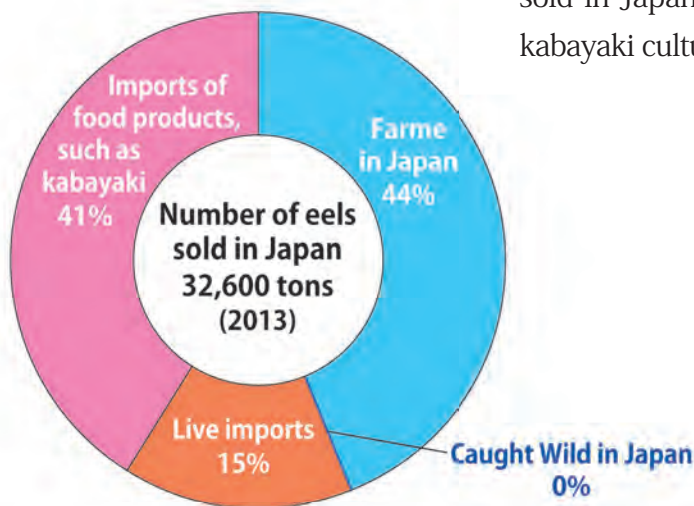
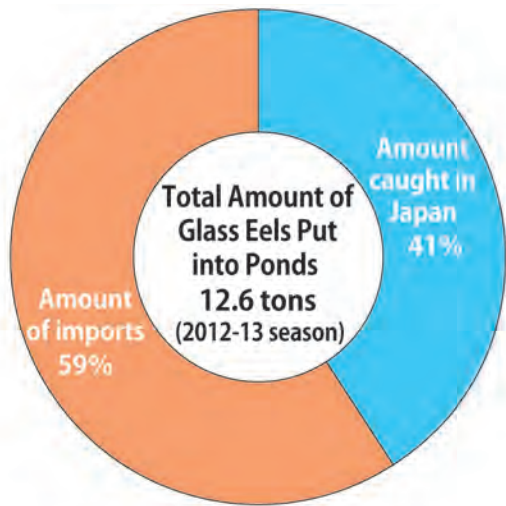
As a major eel consuming country, Japan is required to display leadership in managing resources to ensure the sustainable use of eel populations.



## Japan's kabayaki culture is also supported by imports.

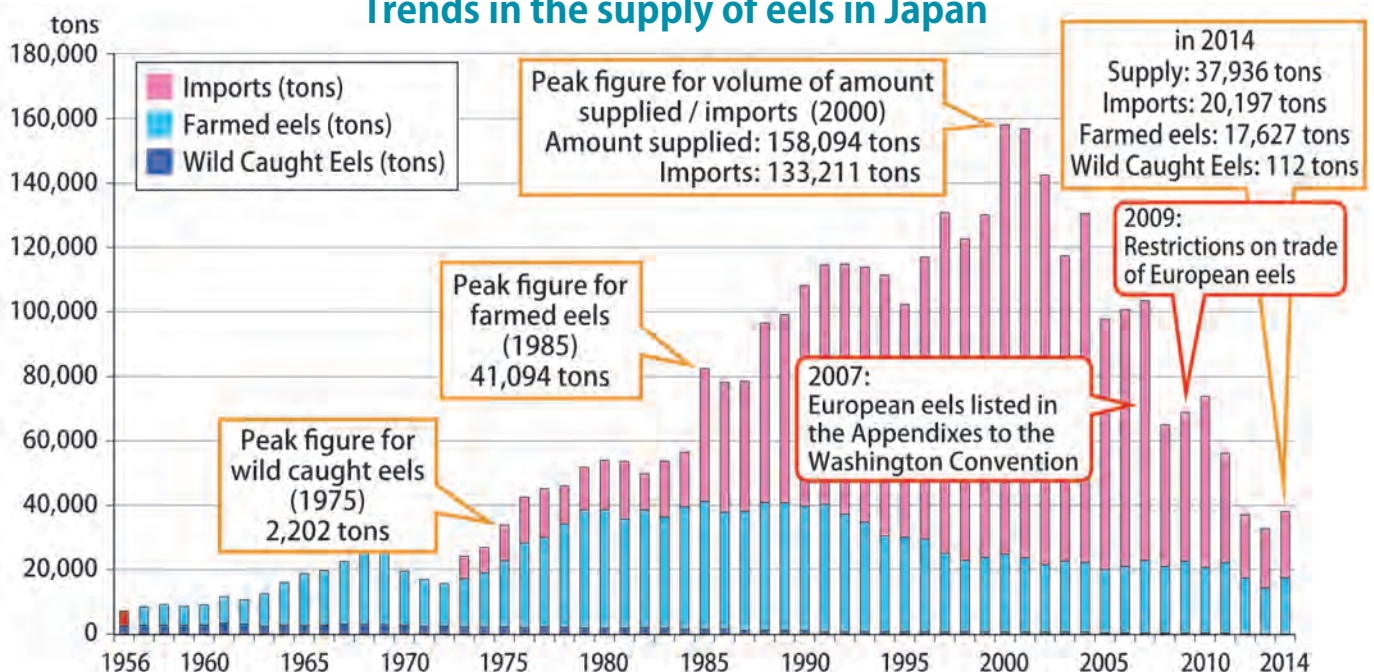
The supply of Japanese eels to the Japanese market is supported not only by eels raised in Japan, but also by those imported from China and Chinese Taipei.

In particular, when the number of glass eels caught in Japan falls, the market is supported by the importation of eels from overseas, which usually accounts for around 60% of the eel supply. In addition, many eels are processed into kabayaki in China and imported in that form. Around half of all eels sold in Japan are imported, so it is fair to say that Japan's kabayaki culture is supported in part by these imports.



Sources: Ministry of Agriculture Forestry and Fisheries "Fishing and Aquaculture Industry Annual Production Statistics" and Ministry of Finance "International Trade Statistics"

## Trends in the supply of eels in Japan



Sources: Ministry of Agriculture Forestry and Fisheries "Fishing and Aquaculture Industry Annual Production Statistics" and Ministry of Finance "International Trade Statistics"

\*The import quantities of "prepared eel products" are divided by 0.6 to convert them to the sizes of live eels.

# What kind of creatures are eels?

## Eels Make a Great Migration

There are 19 species of eels in the world. Nihon Unagi or Japanese Eel (Scientific Name: *Anguilla japonica*) is mainly used in East Asia.

The biology of Japanese eels is not so well known, however, recent research has revealed that after spending 5 to 15 years of their lives in rivers or estuaries, the eels return to the sea and spawn in waters near the Mariana Islands.

## The same resources are used by four Asian members.

The elvers (glass eels) that hatch are carried by the Kuroshio Current and reach the coast of East Asia around November to April in the following year. Then they are captured by Japan, Chinese Taipei, China, and South Korea and used in eel farms.

As all of the members and regions in East Asia are using the same resources, it is necessary for those members and regions to work together on eel resource management in order to use eel resources sustainably.



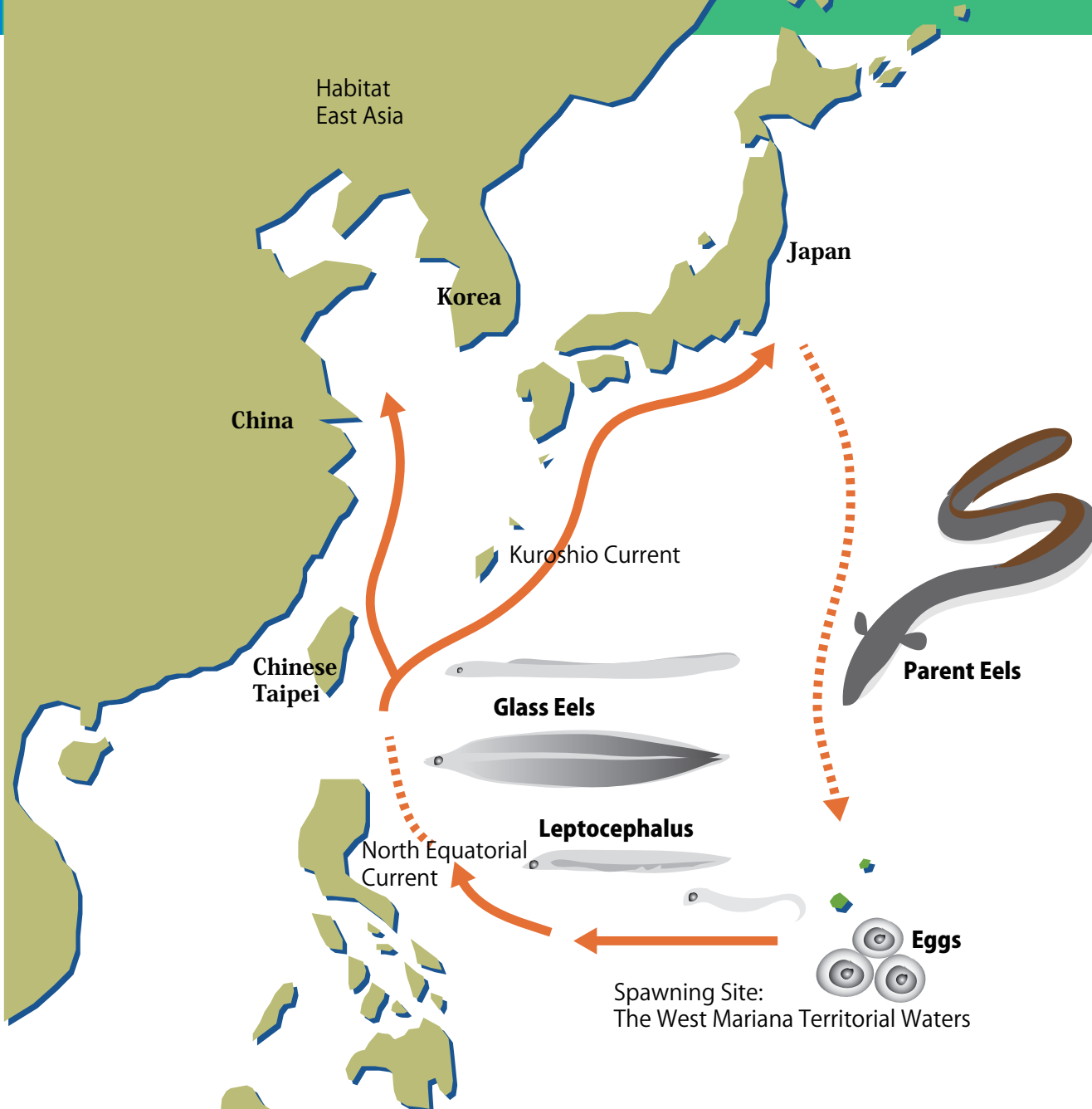
## World's first discovery of a Japanese eel spawning area

In 2006, a team from the Behavioral Ecology Laboratory of Tokyo University's Ocean Research Institute located a spawning area for Japanese eels at a seamount off the Mariana Islands in the northwestern Pacific Ocean.

The research team analyzed past collection records, ocean current data, and seabed topography to approximate the location of the spawning area. They then carried out investigations with a research ship, successfully collecting approximately 400 baby eels 2 days after they had been hatched (up to 7 mm in size), and determined their spawning area from the speed of surrounding ocean currents and other data. Since then, the team has continued its studies, with the hopes of discovering information that can be useful in applications for full-life cycle aquaculture by understanding the conditions occurring at the time of spawning, including water temperature, brightness, and the diet of the eels.

**There are many things we don't know about eel biology, but it is important for all four members, and the rest of the region, to work together to carry out the implementation of resource management.**





**Katsumi Tsukamoto**  
Professor of Nihon University College of Bioresource Sciences (Emeritus professor of Tokyo University)

Tokyo University's original ship, HAKUHO-MARU, first set sail in 1973, and the eggs of Japanese eels were found in 2009, so it took 36 years to come this far. During this time, in the 14 years from 1991 through 2005, we did not make great progress, making it a hard time. In 2006, we found a two day old preleptocephalus which

was a monumental discovery. We could have made this the goal, but we continued our research and in 2009 finally found the eggs, 36 years after the first journey across the seas. However, this is not the goal after all. We have just reached a milestone. Currently we are continuing our research and studies toward our new goal to record the spawning scene. During July to October in 2016, we will conduct the research of Tropical eels in the South Pacific Ocean. To deeply understand Japanese eels, it is essential to study Tropical eels, the root of the Japanese eel. The study of eels is far from over.

# International Framework for Resource Management

## Japan Leads East Asia in Resource Management

Because of the decreasing size of the Japanese eel catch, as a major eel consuming country, Japan is working together with the other members of East Asia and promoting discussion with the goal of improving cooperation in resource management.

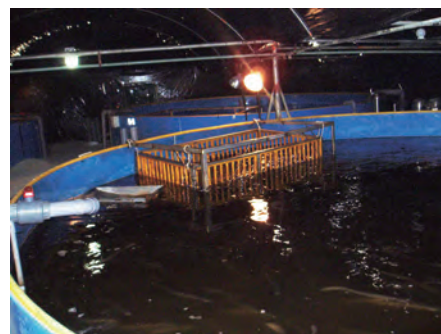
## Restriction of the Number of Japanese Eels in Farming Ponds

In September 2012, Japan, China, Korea and Chinese Taipei commenced cooperation, and released the following joint declaration in September 2014.

- (1) In the 2015 fishing season (November 2014 – October 2015) the number of Japanese eels put into farming ponds was reduced by 20 percent compared to the 2014 fishing season and all possible measures were taken to avoid increasing the number of other species of eel beyond the average figure for the three years of 2012 – 2014.
- (2) In order to ensure effective implementation of preservation measures, each country shall set up an eel aquaculture management organization. The eel management organizations from each individual country shall come together to establish an international eel aquaculture management framework.
- (3) The members shall investigate the possibility of a framework that contains effective legal restrictions. Additionally, the upper limit on the quantity of Japanese eels put into farming ponds in the 2016 fishing season shall be the same as that for the 2015 season.



Open field pond culture in China



Tank culture in Korea



Open field pond culture in Chinese Taipei

## Restriction of the Number in Farming Ponds ( 2016 fishing season)

	Japanese eels	other eels
Japan	21.7tons	3.5tons
China	36.0tons	32.0tons
Korea	11.1tons	13.1tons
Chinese Taipei	10.0tons	10.0tons



## Implementation of Industry Based Resource Management - Establishment of an Alliance for Sustainable Eel Aquaculture



Based on the joint declaration, the Japanese eel aquaculture management organization “All Japan Association for Sustainable Eel Aquaculture” was established in October 2014.

This organization was established as the umbrella organization for the management of eel aquaculture in Japan in which all eel farmers in Japan would participate. Accordingly, it is working at an industry level to promote management of eel stocks and appropriate use of

farmed eels under responsible management.

Additionally, the eel aquaculture management organizations from each country came together to establish an international organization that would be a forum for industry-based discussions about resource management in the region: the Alliance for Sustainable Eel Aquaculture (ASEA) .

In June 2017, the first meeting of the organization was held and representatives from each country attended and exchanged information about resource management measures in each country, and measures implemented to comply with limits on the number of eels in farming ponds.

### Alliance for Sustainable Eel Aquaculture (ASEA)

Japan	All Japan Association for Sustainable Eel Aquaculture Incorporated
China	China Fisheries Association Eel Industry Work Committee
Korea	Eel Farming Fisheries Cooperative Association
Chinese Taipei	Taiwan Eel Farming Industry Development Foundation

### Chairman of the All Japan Association for Sustainable Eel Aquaculture Incorporated, Torami Murakami

The All Japan Association for Sustainable Eel Aquaculture Incorporated was established as a producer centered organization designed to protect eel resources and sustainable use. In addition, parties involved in feed production and imports, wholesalers and Kabayaki restaurants have also joined the organization and all parties involved in Japan's eel industry are united through this organization in creating a framework for engaging in resource management.

Japan must also continue to play a leadership role in the international framework of the Alliance for Sustainable Eel Aquaculture (ASEA) and further strengthen the framework

for resource management. Further, it is important that we demonstrate our capacity for responsible management to international society through our attitudes, initiatives and practical actions.



# Resource Management Initiatives in Japan

The following three factors have been identified as causes of the reduced size of the glass eel catch: “Changes in the Ocean Environment” , “Habitat Degradation” and “Overfishing” .

Also there are many things we still do not know about eel biology and it is impossible to determine with any certainty what needs to be done in order to increase stocks again. Nevertheless, in order to use eel stocks sustainably, it is important to press ahead with measures we are capable of implementing now.

The Association aims to unite all industry participants and incorporate initiatives that address, as much as possible, the position of all stakeholders, including the people who catch glass eels, the people who raise eels on farms, and the people who catch wild eels.

## Initiatives by people who catch glass eels

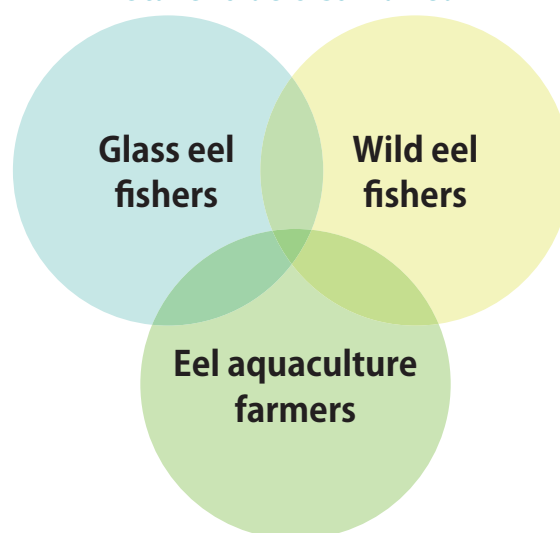
Glass eels may only be caught by those who have received special permission from the Governor of Tokyo. Also, the times, fishing methods and locations at or by which glass eels can be caught are strictly regulated.

In addition to these regulations, various other measures, such as shortening the glass eel catching season, and increasing the number of glass eels that enter rivers and streams, have been tried to increase the numbers of the next generation of eels.



Glass eels fishing

## Resource Management by all Stakeholders Combined



## Chairman of the Kagoshima Prefectural Council on Measures for the Propagation of Eel Resources, Masakaze Takasaki



The "Kagoshima Prefectural Council on Measures for the Propagation of Eel Resources" has been established by eel farming organizations, young eel fishing organizations, inland fishery cooperative associations, and other parties in Kagoshima Prefecture for the purpose of recovering eel resources. Specifically, the council is involved in prohibiting the fishing of parent eels on their way to spawn, and shortening the fishing period compared to previous years by delaying the fishing of glass eels, to induce healthy glass eels which are the first to swim upstream to do so. Also, as Japan's premier breeding area for cultured eels, it is leading the country in carrying out measures such as laying out gravel in three-sided waterways to increase the number of eel habitats.



## Initiatives by eel farmers

At the international conference in September 2014, Japan, China, Korea and Chinese Taipei established an upper limit on the number of eel seeds of Japanese eels and other species of eel that could be put into farm ponds.

In order to ensure that these limits are complied with, in June 2015, the eel aquaculture industry became a specified farming operation that requires the permission of the Ministry of Farms Forests and Fisheries, and in accordance with laws relating to the support of fishing in inland waterways, accepts restrictions on the number of eel seeds that each eel farm operator could put into ponds.

- **Number of eel farms that have received permits: 543 (as of November 1, 2015)**
- **Volume of eels under cultivation in accordance with the permits: Japanese Eels 21.7 tons: Other species of eel 3.5 tons**
- **Period of Validity of Permits: November 1, 2015 – October 31, 2016**

Operation of an eel farm without permission shall be liable to incur a fine in accordance with the appropriate laws for the promotion of fisheries in inland waterways (Imprisonment for up to 3 years or a fine of up to 2 million yen) .

### **Makihara Eel Farm (Kagoshima Pref.) Representative, Hirofumi Makihara**

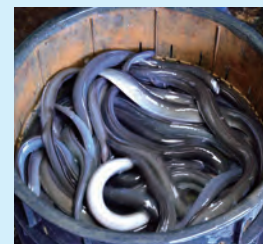
As eel culture ponds started to become empty due to the poor catch of whitebait over the past few years, I started to think how I could utilize them effectively and tried stocking juvenile catfish four years ago. As a result, catfish grew using the eel culture equipment already in place. Then with Kinki University's offer, a joint development started. We are using our ingenuity to induce the catfish to put on richer fat, and for its meat to taste richer than a normal eel. We are doing our best, hoping that providing delicious catfish will lead to the preservation and restoration of eel resources.



### **Tenpo Fish Farm (Shizuoka Pref.) Representative, Masaaki Yamashita**

In Showa 39 (1964) , our eel farming started with my father's generation. 28 years ago, we opened an eel restaurant. In April last year, we started a tour as a response to the desire of our customers from the eel restaurant to look at the eel farm. First we explain at the store about things like the history of eel farming and eel migration, then move on to show the house.

Through quizzes and having a hands-on experience of eels on this tour, we want all to understand the importance and actual initiatives of resource protection in an enjoyable way.



## Initiatives by fishermen who catch wild eels in rivers and streams

In October – around December of each year, eels that have grown large and reached sexual maturity return downstream to the sea to lay their eggs. These eels are called “Silver Eels” because of the oxidized silver of their bodies and their black pectoral fins.

Talks between fishermen who catch eels about increasing the number of eggs laid by refraining from catching these silver eels, have made great progress.

The result of these negotiations is that regulations have been put in place prohibiting the catching of eels during the period between October and March of the following year, as well as the expansion of voluntary initiatives.



Yellow Eel (Full sized adult eel in the wild)



Silver Eel (Wild eel that has reached sexual maturity)  
Photographs: Noritaka Mochioka, Associate Professor  
Kyushu University

## Prefectures that have imposed prohibitions on catching eels or other initiatives such as voluntary restrictions

### Kumamoto Prefecture

Catching eels prohibited in inland waterways or at sea between October and March of the following year by orders of the Fisheries Commission.



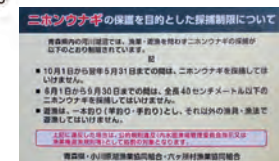
### Aichi Prefecture

Voluntary restrictions on catching eels returning to the ocean and release program implemented.



### Aomori Prefecture

Catching eels prohibited in inland waterways between October and May of the following year by orders of the Fisheries Commission.



### Tokyo

Implementation of release program for eels returning to the ocean

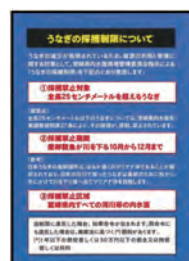
### Kagoshima Prefecture

Catching eels prohibited in inland waterways or at sea between October and December by orders of the Fisheries Commission.



### Miyazaki Prefecture

Catching eels prohibited in inland waterways between October and March by orders of the Fisheries Commission.



### Shizuoka Prefecture

Initiative to buy back and release spawning eels in Lake Hamana conducted with financial contributions of eel fishers, eel farmers, processing companies, sellers and operators of restaurants. Initiative period: October to November

### Fukuoka Prefecture

Voluntary restrictions on catching eels returning to the ocean and release program implemented.

### Kochi Prefecture

Catching eels prohibited in inland waterways between October and March of the following year by orders of the Fisheries Commission.





# Measures to Protect the Eels' Habitat

## Encouraging Efforts to Improve River Environments

In order to create a river environment in which eels can freely pass through the rivers without restrictions, fish ladders have been installed and adjustments have been made to water quality and flow rates. Also, an environmental infrastructure has been set up to allow eels to freely travel through rivers and rice fields and efforts to create healthier river ecosystems with concern for the living organisms in them have been progressing.



Fish way

## Creating eel abodes

Efforts have commenced to create stone weirs (constructions of rocks bound together by mesh netting) in order to increase both the presence of prey species (shrimp etc.) and the number of places where eels can live.

It has been found that crevices between rocks are utilized as eel habitats, and also as feeding grounds since the shrimps and crabs that are their food gather in such places, so the expansion of such efforts and their application in river improvements are highly anticipated.



Eels adobe (Ishikura)



Eel living in the stone weir

## Releasing caught eels to the wild

Fishers who catch adult eels, as well as eel farmers have been carrying out a release program in order to increase the number of eels that are living wild in rivers and lakes. Also in order to increase the effectiveness of these measures, trials were conducted of breeding and released females, which are normally difficult to breed in captivity.



Releasing caught eels from a bank



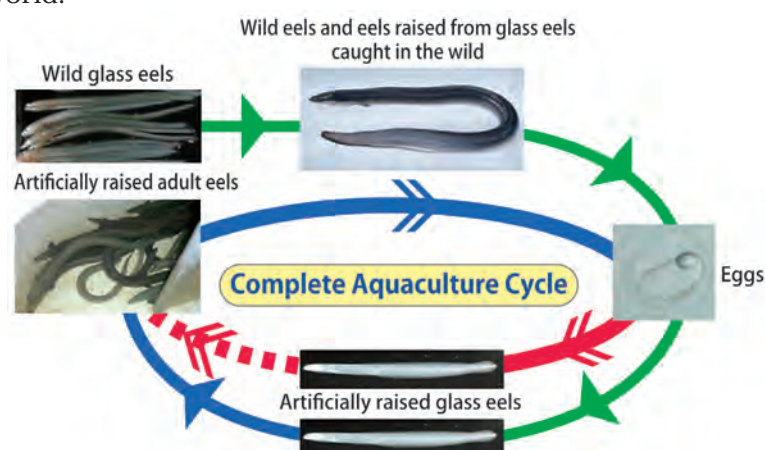
# Towards achieving artificial cultivation by artificial seeding

## Realizing complete aquaculture

The best hope for achieving a stable supply of eels is commercialization of artificial seeding. The supply of glass eels for aquaculture is at present entirely dependent upon natural resources.

For that reason, research into artificial seeding has been conducted since around 1965 but there are still a lot of things that remain unclear about eel biology, and without knowing the environmental conditions necessary for sexual maturity and spawning and the appropriate food for eel larvae, it was difficult for this research to make much progress.

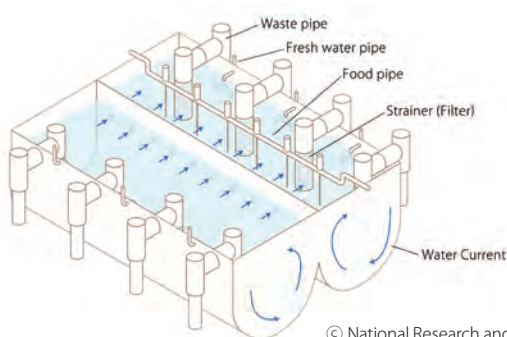
The result of continued research was that in 2002, a research center at Incorporated Administrative Agency Fisheries Research Agency (National Research and Development Agency Japan Fisheries Research and Education Agency) succeeded in removing fertilized eggs from artificially inseminated parents and raising the hatched larvae by feeding them shark eggs until the larvae grew into glass eels. Further, in 2010, the adult eels raised from those glass eels themselves spawned and the resulting larvae were successfully raised until they became glass eels. This was the first “Complete Eel Aquaculture” in the world.



## Towards Commercialization

Complete aquaculture has been achieved but research continues toward commercialization and increased efficiency such as through development of new feeds and the farming infrastructure that would make commercial production possible.

At present, trial farming is conducted using a large (1000 liter tank) similar to that used to create kamaboko, semicircular column shape, but in reverse.



1000 liter tank

© National Research and Development Agency Japan Fisheries Research and Education Agency

## [Summary]

# In order to use eel resources sustainably

As we have seen from the above information, the history of Japanese and eels extends back over 5000 years and the culture of kabayaki that originated in the Edo period has been passed down without interruption to the present day.

Japanese eels are caught and farmed not only in Japan, but also in other parts of East Asia, primarily China, Chinese Taipei and Korea. The bulk of the farmed eels raised in those members are exported to Japan. Japan is not only an eel producing country but also the major consumer of eels in the region. For that reason, it is essential for us to display leadership in relation to the international efforts to preserve and manage eel resources.

International management efforts involve cooperating with the governments of China, Chinese Taipei and Korea to set limits on the number of glass eels that can be put into aquaculture ponds, and carrying out efforts at an industry level to make sure that concrete restrictions are actually put in place.

Also within Japan, eel farm operators, people who catch glass eels, and fishers who catch wild eels, have come together to institute resource management.

We hope that through this pamphlet, you now know more about the current state of our eel resources and the importance of carefully protecting those resources so that it will be possible to continue to use them in the future. We also hope that this will be an opportunity for you to develop an interest in the activities undertaken by the stakeholders to protect our eel resources.

### Shigeto Hase, Deputy Director-General, Fisheries Agency

Japanese eels in their glass eel stage make their way to the coastal areas of East Asia, where they are caught and cultured in Japan, People's Republic of China, Chinese Taipei, and the Republic of Korea. Japan, the largest Japanese eel consuming country, called out to these four members and arranged a system for all of them to take steps toward eel resource management together.

Although it has been so even in the past, it will be vital for Japan to sufficiently prepare itself in order to successfully move forward. Efforts are being made primarily by the Fisheries Agency and the All Japan Association for Sustainable Eel Aquaculture to ensure the sustainable use of resources and to protect food culture

related to eels. Thorough resource management measures that include protecting parent eels on their way to spawn, and restricting the amount of glass eels put into aquaculture ponds, are being carried out. It has also been indicated that fund-raising activities will begin at "kabayaki" restaurants in order to contribute to research on resource protection.

It is our wish for you to become familiar with activities such as these, and we ask for your understanding and cooperation with them.





Issued By: All Japan Association for Sustainable Eel Aquaculture Incorporated  
Sankaido Building B1, 1-9-13 Akasaka Minato-ku, Tokyo, Japan  
Phone: +81 (0) 3-5797-7690

Cooperation: Japan Federation of Broiled Eel Dealers' Unions

Created by: The 100 Best Eels