

# The importance of seaweeds and shellfishes in Japan: Present status and history

Hisashi KUROKURA\*

---

**Abstract** Though many manufactured goods are produced from aquatic resources, people living in Japan consume them mainly as food. Among such sea foods, seaweeds and shellfishes have special religious meaning. Kombu (*Laminaria*), wakame (*Undaria*) and abalone or other shellfishes are commonly included in offerings to Shinto shrine. It was supposed from this fact that these foods were important for Japanese ancestor. In fact, many remains of seaweeds and shells were dug out from ruins of prehistoric age. In the 8<sup>th</sup> century, Yakamochi Ohtomo, a famous poet in Nara Period, transplanted a shell species from Kishyu to Echyu. This is the oldest record of propagation of shellfish. Nori (*Porphyra*) is now indispensable for sushi. Its culture started from the 17<sup>th</sup> century. Aquaculture of wakame, oyster, pearl oyster, and many other seaweeds and shellfishes had begun by the end of 19<sup>th</sup> century. Aquaculture technology has been improved and the production has increased rapidly in the latter half of last century. Now seaweeds and shellfishes aquaculture encounter various difficult problems such as changes in coastal environment by pollution and land reclamation. On the other hand, the function of these aquaculture for water purification attracts attentions of people together with the increase of interest to environment issues.

**Key words:** shellfishes, seaweeds, Aquaculture, history

---

## Importance of Seaweeds and Shellfishes in Japanese Daily Life

In 2000, the average family income and expenditure for consumption were 6,371,000 yen/year and 3,806,000 yen/year in Japan (Ministry of Public Management, Home Affairs, Posts and Telecommunications, Japan, 2001). Within the expenditure for consumption, 972,000 yen/year was consumed for foods including 174,000 yen/year for dining out (Fig. 1). Total amount of the expenditure for livestock products, such as beef, pork, chicken, including hum, sausage, milk, and egg was 119,000 yen/year, and same money (118,000 yen/year) was paid for fresh aquatic food. Besides the expenditure for fresh aquatic foods, 49,000 yen was consumed for

processed aquatic food, such as dried fish and "surimi" products. From these data, it can be supposed that an average Japanese family pays 1.5 times larger amount of money for aquatic foods than livestock products, and that the expenditure for aquatic foods reaches 21% of total expenditure for foods excluding dining out (Fig. 2).

In expenditure for fresh aquatic foods, more than half of it was occupied by fin fish (67,000 yen/year) and major parts of the remainder were expenditures for crustacean and cephalopod. Only one tenth of the expenditure for finfishes was paid for shellfishes (6,400 yen/year). "Asari" (Manila clam, *Ruditapes philippinarum*), Pacific giant oyster (*Crassostrea gigas*) and scallop (*Patinopecten yessoensis*) are

main shellfishes consumed in Japan. Nori (*Porphyra spp.*), konbu (*Laminaria spp.*) and wakame (*Undaria pinnatifida.*) are major seaweeds eaten in Japan. They are consumed as processed aquatic food (dried, salted, or boiled etc.) and the total amount of expenditure for seaweeds (6,200 yen/year) was same as that for shellfishes (Fig. 3).

In protein base, daily protein intake by Japanese was 86.8g/day/individual in 2000 (Minister's Secretariat, Ministry of Agriculture, Forestry and Fisheries, Japan, 2001). Within 86.8g of daily protein intake, 20.9g and 7.5g were from cereals and beans. Live stock products provided 28.4g of protein. Within that, 14.4g, 5.7g and 8.3g were by meats, eggs and milk and milk products, respectively. Total volume of protein supplied by aquatic animal including fish, molluscs, crustaceans and echinoderms was 19.4g. Only 1.1g was supplied from seaweeds (Fig. 4).

Though the contributions in the family expenditure and protein supply are not so high when compared with fishes and squids, shellfishes and seaweeds are very important food materials for Japanese cuisine. They provide delicate taste, flavor and trace nutrients to the cuisine. For example, "sushi" can not be completed without these materials. The notable importance of shellfishes and seaweeds are supported by Japanese environment and history.

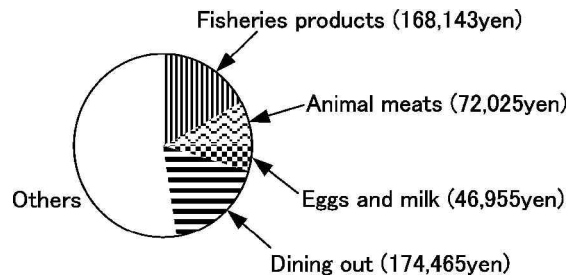


Fig. 2. Expenditure for each food item in 2000

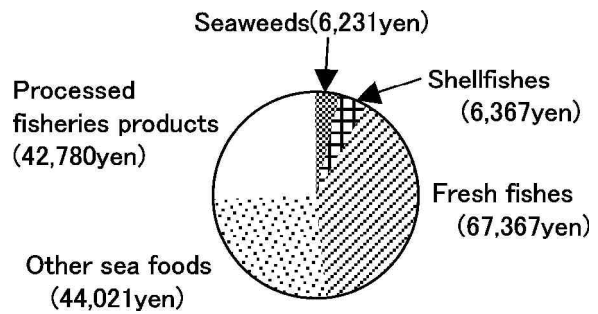


Fig. 3. Expenditure for fisheries products in 2000

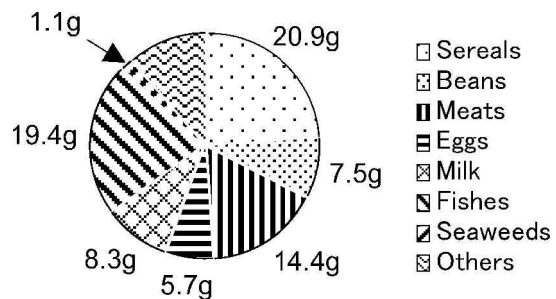


Fig. 4. Protein intake of average Japanese (g/individuals /day) in 2000

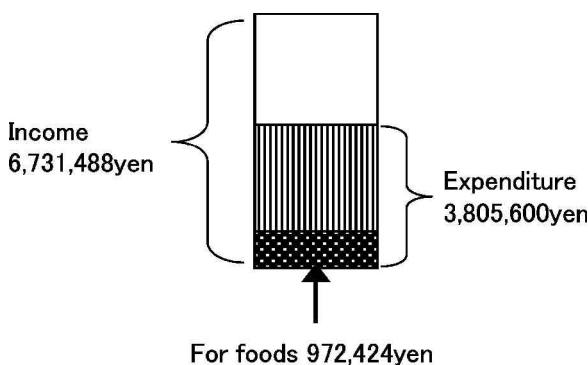


Fig. 1. Average family income, expenditure and expenditure for foods in Japan in 2000

### History of Aquaculture of Shellfishes and Seaweeds

Shinto is basically ancestor worship in Japan, and the offerings in Shinto shrines originally were dinner of the ancestors. The other side of the offering is promotion of local industries and they have been modernized and standardized twice in modern era. However, several old shrines such as Kamo Shrine and Ise Shrine keep old style in their offerings. We can

find abalone, hard clam and other shellfishes and various kind of seaweeds in those offerings. This fact shows Japanese have been eating shellfishes and seaweed as daily food from prehistoric age.

In 764, Yakamochi Ohotomo, a poet in the Nara period, the last editor of Manyoshu, transplanted a species of bivalve from Kishyu (Pacific coast of Honshu island) to Ecchyu (Sea of Japan side). This is the oldest record of transplantation of bivalve and attempt for propagation of aquatic animal. First record of artificial propagation of seaweed was also transplantation. In 1081, a kind of seaweed was transplanted from Kouzu-shima, an island in Izu archipelago, to Izu peninsula. Nori and oyster culture were supposed to be started in 1670s. In 1892 Koukichi Mikimoto started pearl oyster culture. Oyster culturists began to use rafts for hanging culture in 1925. Floating net culture of nori started in 1934 in Tokyo bay and other modern "nori" culture techniques, such as artificial spat collection, and cryopreservation of nori seeds, were established in the 1950s and early 1960s. These modern techniques enabled expansion of area and season of nori culture. As the result, production of nori in Japan increased 40 times from 1940s to 1990s (Fig. 5) (Ministry of Agriculture, Forestry and Fisheries, 2001). On the other hand, pollution of costal environment became considerable from 1950s on because of rapid economic growth in Japan, and coastal aquacultures often sustained heavy damages (e.g. oil pollution in Tokyo bay in 1954, in

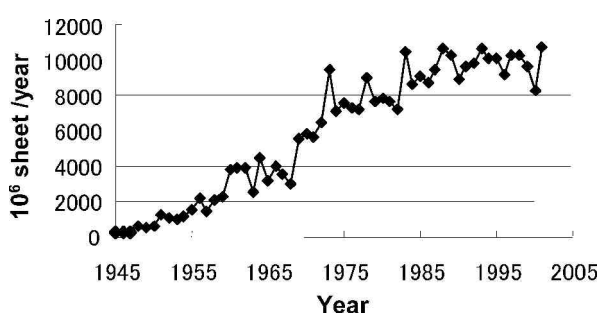


Fig. 5. Changes in production of Nori

Wakayama in 1955). In 1997, Ishaya Bay, an accessory bay of Ariake Bay, was closed by water gates for land reclamation. Nori production in Ariake Bay prominently decreased in the culture season of 2000. Several fishermen's cooperations in Ariake Bay claimed that the poor harvest of nori had been caused by alteration of environment of Ariake Bay which was brought on by the close of Isahaya Bay. After that, sustainability of coastal aquaculture has been thought to be an indicator of health of coastal environment (Table 1).

### Contemporary Importance of Shellfish and Seaweed Culture in Japan

Through the discussions about the relationship between the alteration of coastal environment and fisheries production, people understand the importance of aquaculture as a monitoring system of coastal environment and functions of shellfish and seaweed culture on the conservation of coastal environment. Fuyou Kaiyou Kaihatsu Co. Ltd. estimated the function of fisheries of asari on the environment in Hamana Lake, a brackish lake on the Pacific coast of Honshu Island. Total influx of carbon, nitrogen and phosphate to Hamana Lake, were 2,411, 1809 and 899 t/year respectively, and total catch of asari was 2,200 t/year in 1990. When we calculate the magnitude of the catch to the values based on carbon nitrogen and phosphate, they are 572, 132, 8.8 t/year. These magnitude mean that 26, 7.9, 1.3 % of carbon, nitrogen and phosphate introduced to Hamana Lake were removed by catch of asari. Similar effect can be expected to shellfish and seaweed culture. Now Japanese people has begun to notice the function of shellfish and seaweed culture on the conservation of coastal environment and they expect systematic approaches to utilize aquaculture for conservation of coastal environment.

**Table 1.** History of shellfish and seaweeds culture in Japan

year	
764	Transplantation of bivalve by Yakamochi Ohtomo
1081	First record of transplantation of seaweeds
1596	Name of " Asakusanori " began to be used for Nori harvested in Tokyo-bay.
1615	Transplantation of oyster from Wakayama to Hiroshima
1674	Beginning of oyster culture
1673-81	Beginning of nori culture
1781	Transplantation of abalone from Bousou to Shrahama
1853	Use of bamboo stick as structure for nori culture
1870	Beginning of nori culture in Kanagawa
1878	Transplantation of konbu from Hokkaido to Aomori
1881	Beginning of asari culture in Chiba
1882	Beginning of nori culture in Aichi
1890	Koukichi Mikimoto began pearl oyster culture
1900	Damage of pearl oyster by toxic algal bloom <i>Gonyaulax</i> in Ago Bay
1912	Cleaning of rocky shore for the propagation of seaweeds
1920	Nets were firstly used as the substrata for nori attachment
1925	Start of hanging oyster culture
1926	Success in using net as the substrata of nori
1934	Floating culture of nori using floating net started in Tokyo Bay
1936	Beginning of spat collection of scallop in Lake Saroma
1942	Asari poisoned in Hamana Lake
1942	Success in artificial seed collection of wakame
1949	Discover of conochocelis Success in artificial seed collection of konbu
1954	Success in artificial seed collection of nori Leakage of heavy oil in Tokyo bay. ( Nori culture was damaged)
1955	Nori culture in Wakayama was damaged by waste oil
1960	Mass mortality of cultured oyster in Hiroshima bay
1963	Invention of freezing preservation method of nori seed
1964	Invention of spat collection method of scallop
1974	Success in artificial inducement of spawning of abalone by UV radiation
1997	Isahaya Bay, an accessory bay of Ariake Bay, was closed by water gate for land reclamation.
2000	Production of nori in Ariake Bay prominently decreased. The relationship between aquaculture production and alteration of costal environment became a national dispute

Cited from Ohshima, Y. (1994) with several modification by author

## References

- Ministry of Agriculture, Forestry and Fisheries, Minister's Secretariat 2001: Table of foods supply and consumption.
- Ministry of Agriculture and Forestry, Statistics and Survey Division, 1941-2001: Annual report of catch statistics on fisheries and Aquaculture.
- Ohshima Y., 1994: *Suisan zouyoushoku gizyutsu Hattatsushi* (History of development in aquaculture and propagation techniques) , Midorishobo, Tokyo, 476pp.
- Ministry of Public Management, Home Affairs, Posts and Telecommunications, Statistic Bureau and Statistic Center, 2001: Annual report on the Family Income and Expenditure Survey.