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The Present State of Carp Fisheries and Aquaculture in Japan

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Abstract

Carp (*Cyprinus carpio*), which is thought to have originated from central Asia, is the world's oldest aquacultured fish. In Japan, farmers have cultured carp in paddy fields for nearly two thousand years, particularly in inland areas, such as in Nagano, Gunma and Akita Prefectures, which have been traditionally characterized by a lack of animal protein resources. Since the 1960s, carp production, particularly in Lake Kasumigaura in Ibaraki Prefecture, has been accelerated by new developments in artificial feed and net-pen aquaculture technology. Culture levels peaked in 1977, when total annual production was about 30,000 tons. Subsequently, with the diversification of people's food preferences and product availability, total production decreased gradually in accordance with lower demand and depressed prices. As a consequence, total annual production of cultured carp reached a low of 9,949 tons in 2001.

While, nishikigoi (koi) have been bred as ornamental fish since the Edo Era in the 18th century. Nowadays, koi shows and contests are important activities inside of Japan, and koi traded is conducted throughout the country. International trading is also being actively promoted, and these fish are well-known and admired in many foreign countries. Nishikigoi farms are located in many areas of Japan; 48% of the farms are found in Niigata Prefecture, followed by Gifu (8%) and Hiroshima (6.5%) Prefectures.

Key words: carp, nishikigoi (koi), Lake Kasumigaura, KHV infection

Introduction

The Koi Herpes Virus (KHV) disease that occurred in the Lake Kasumigaura area of Ibaraki Prefecture in October 2003 destroyed most of the cultured common carp present in the lake, and KHV infection was subsequently induced into many new locations such as carp culture ponds and natural rivers in association with transportation of carp from Lake Kasumigaura. One of the reasons for which this large-scale infection of KHV occurred so rapidly in Japan is that the supply of carp seeds depended mostly upon the Lake Kasumigaura region, and KHV disease first arose there. In order to further our understanding of the current status and problems relating to KHV in Japan, in this manuscript, the history and present state of carp fisheries and aquaculture are reviewed.

History of common carp production in Japan

Carp (*Cyprinus carpio*), which is thought to have originated from central Asia, is the world's oldest aquacultured fish. In Japan, farmers have cultured carp in paddy fields for nearly two thousand years, particularly in inland areas, such as in Nagano, Gunma and Akita Prefectures, which have been traditionally characterized by a lack of animal protein resources.

After World War II, paddy field aquaculture declined with the beginning of wide-spread usage of pesticides, while at the same time, irrigation reservoir aquaculture and high density flow-through pond aquaculture became predominant. As a result, carp production began to increase in response to increasing demands. Since the 1960s, carp production, particularly in Lake Kasumigaura in Ibaraki Prefecture, has been accelerated by new developments in artificial feed and net-pen aquaculture technology. Culture levels peaked in 1977, when total annual production was about 30,000 tons (Fig. 1).

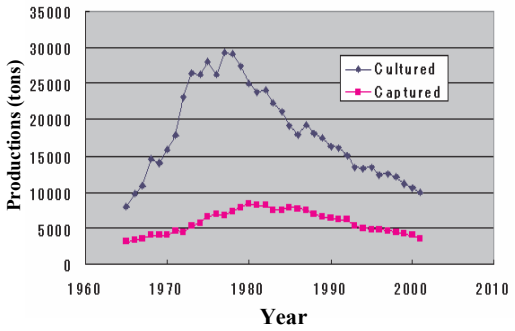

Fig. 1. Changes in the productions of carp in Japan. Data are from "Fisheries Agency, Fisheries Statistical Indices, 2001".

Subsequently, with the diversification of people's food preferences and product availability, total production decreased gradually in accordance with lower demand and depressed prices. Total annual production of cultured carp reached a low of 9,949 tons in 2001 (Figs. 1 and 2). However, because of deeply-rooted local needs and cultural preferences, carp remains the third largest target of freshwater aquaculture in Japan following eel and trout. Production based on capture fisheries has fluctuated similarly, reflecting the trend observed with aquaculture production, and was 3,558 tons in 2001. At present, 52% of total carp aquaculture production and 17% of the related seed production is dependent on the Lake Kasumigaura area, and these products are supplied throughout Japan (Fig. 2).

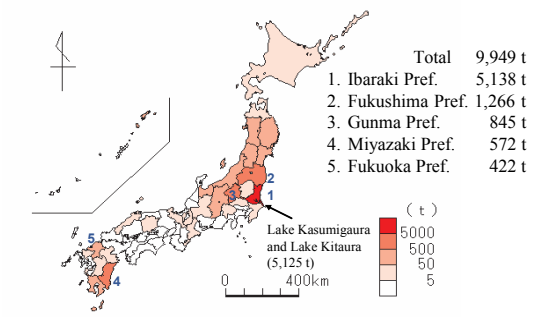

Fig. 2. Carp aquaculture production in 2001. Data are from "Ministry of Agriculture, Forestry and Fisheries, Annual Report of Statistics of Fisheries and Aquaculture Productions in 2001", 2003 (issued).

Forms of carp aquaculture

There are five major types of carp aquaculture system as follows.

(1) Paddy field (rice field) aquaculture

This is an extensive aquaculture system in which carp are cultured with rice in paddy fields. Recently, this form of aquaculture has declined, except in some cases or in restricted areas, as mentioned above.

(2) Irrigation reservoir aquaculture

In this system, carp are fed and cultured in irrigation reservoir ponds used for agriculture. One-year-old carp fry approximately 100g in body weight are transferred into the reservoir from fish seed culture ponds from April through May, and the fish are reared to market size of approximately 800g by harvest time in autumn. This aquaculture system is usually implemented by private companies or local aquaculture cooperatives mainly in Fukushima and Gunma Prefectures, which have produced as much as 1,266 and 576 tons in 2001, respectively. Feed conversion efficiency and survival rates are approximately 60% and 70%, respectively.

The total annual production from this

system exceeded 10,000 tons in the 1970's, but has lately declined to 2,221 tons in 2001.

(3) Still water pond aquaculture

This is an aquaculture system in which carp are fed in artificial culture still water ponds; 576 tons were produced mainly in Toyama Prefecture in 2001.

(4) High-density flow-through pond aquaculture

This is an intensive and high productive aquaculture system in which carp are fed and cultured in flow-through ponds under high density conditions using clean running river water. This form of aquaculture has been developed in areas where large quantities of clean river water can be easily utilized, such as Fukuoka, Gunma and Nagano Prefectures, and production was 372, 269 and 180 tons, respectively, in 2001. In the flow-through pond, 300 – 500 *l* / sec of running water is provided, maximum productivity is approximately 300 kg / m^2, and the quality of the carp meat is high. However, as the oxygen consumption of fish is also enhanced, the feed conversion rate is low as 40%, such that production costs are relatively high.

This aquaculture system has been deeply linked with the silk industry; this is because silk worm pupa can serve as an important component of low cost feeds. In Gunma and Nagano Prefectures, flow-through pond aquaculture has developed together with the silk industry, but more recently, production has decreased in association with the decline of silk production. As a result, the center of carp production has shifted to net-pen aquaculture in the Lake Kasumigaura area.

The total annual production of this aquaculture system was 1,188 tons in 2001.

(5) Intensive net-pen aquaculture

This aquaculture technology was developed by the Miyazaki Prefectural Fisheries Station in 1951 as an aquaculture system which can handle large-scale, intensive carp production at low costs. In the system, the feeding conversion efficiency and survival rates are approximately 70% and 90%, respectively. This form of aquaculture has been developed in large lakes such as Lake Suwa in Nagano Prefecture and Lake Kasumigaura in Ibaraki Prefecture since the 1960's, but the major production is concentrated in the Lake Kasumigaura area at present. Annual production in 2001 was 5,125 and 500 tons in Ibaraki and Miyazaki Prefectures, respectively.

Utilization of common carp

Carp is majorly utilized as a food fish, and is consumed in fresh, chopped, and processed forms. Carp is particularly popular as an ingredient in local special dishes or seasonal celebration dishes. Since efforts for stock enhancement must be conducted in inland fisheries as dictated by law, the demand for fish seeds is also quite high; local fisheries cooperatives have a responsibility to release seeds into lakes and rivers as well as to conduct aquaculture. Carp originating from seed release are targets of recreational fishing as well, and local fisheries cooperatives managing fishing sites can collect fishing fees from anglers. Additionally, there are private fishing ponds where recreational fishermen pay a fee to fish for carp. In addition, carp and koi are often released into park ponds, urban river areas, or sightseeing locations for purposes of landscape conservation and beautification. Carp can also be found in many private ponds.

Ornamental carp (koi) production

Nishikigoi (koi) have been bred as ornamental fish since the Edo Era in 18th century Japan. The difference between nishikigoi aquaculture and that of common carp is that the breeding strain is very important and the highest quality individuals are extremely expensive. Fish seeds produced in breeding and nursery ponds are reared in culture ponds, and strain selection is

conducted repeatedly in order to discriminate choice individuals. The selected fish are thereafter traded at local auction markets.

In this way, koi shows and contests are important activities in Japan, and the koi trade is conducted throughout the country. International trading is also being actively promoted, and these fish are well-known and admired in many foreign countries.

Nishikigoi farms are located in many areas of Japan; 48% of the farms are found in Niigata Prefecture, followed by Gifu (8%) and Hiroshima (6.5%) Prefectures (Figure 3). Since Niigata has been a rice agricultural area, paddy field aquaculture of nishikigoi has developed historically.

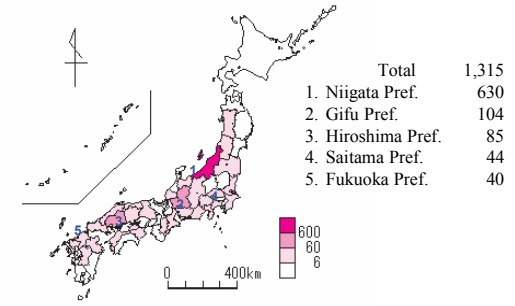

Fig. 3. Number of nishikigoi (koi) farms in Japan. Data are from "Ministry of Agriculture, Forestry and Fisheries, Statistics on Inland Water Fisheries. The 10th Fisheries Census in 1998, Vol. 7, 2000."

Conclusion

At present, a large portion of carp production, e.g., 52% of total aquaculture production and 17% of total seed production depends upon two particular areas, being Lake Kasumigaura and Lake Kitaura, and this is based on economic and social trends. Therefore, the transportation of carp is often conducted without being in the confines of a single water system. The production and circulation of nishikigoi is smaller in scope than that of common carp, but intra- and international trade and transportation of nishikigoi is being actively promoted. These trends are significantly correlated with the outbreak of KHV infection that is now occurring in Japan. The transportation and handling of carp should be conducted more prudently, observing the regulations of the World Organisation for Animal Health (OIE).

References

Axelrod H. R.., 1973: Koi of the world - Japanese colored carp. *T.F.H. Publications, Inc., Neptune City.*

Fisheries Agency, 2001: Fisheries Statistical Indices, 2001.

Ministry of Agriculture, Forestry and Fisheries, 2003: Annual Report of Statistics of Fisheries and Aquaculture Productions in 2001.

Ministry of Agriculture, Forestry and Fisheries, 2000: Statistics on Inland Fisheries. *The 10th Fisheries Census in 1998,* **Vol. 7,** 200.