- Invited Paper -

STATUS AND PROSPECT OF JAPANESE MARINE FISH CULTURE

Hidemi KUMAI
Fisheries Laboratory of Kinki University, Japan

More than 25 marine species of fish, from Seriola species to hybrids, are now cultured in Japan. Annual aquaculture production of these marine fishes has maintained 250-270 thousand tons during the last decade. Among them, production of yellow tail totals 140-150 thousand tons and exceeds others, and the next most is red sea bream's of 80 thousand tons total. These two fishes have been leading the age of small-kind and large-quantity production, and given a favorite reception in Japan. There is no room for the increase in production for these two species now. On the contrary, little overproduction of these fishes has an influence on their market prices, and sometimes their prices are lower than the cost of production. From the market statistics, their market prices tend to decline heavily when the production exceeds 150 thousand tons for yellow tail and 80 thousand tons for red sea bream. Recently, the depression of Japanese economy suppresses people's purchasing power, and their market prices do not increase when the production of these fishes decreases. Still, the aquaculture production of yellow tail accounts for 70% of total production including fishery production.

Yellow tail seedlings used in aquaculture are still mostly wild-caught ones. For the purpose of its natural resource preservation, the Fisheries Agency of Japan decides the annual maximum catch of wild seedlings, and the association of aquaculturist, Japan Sea Water Fishery Cultivation Association, regulates seedling catch and culture quantity. For the preservation of natural resource and for the stable supply of seedlings, it is expected to produce artificially hatched seedlings.

Considerable quantity of Amberjack, Seriola dumerili, is also cultured in Japan. Catch of amberjack seedlings is very little in Japan, therefore, most of them, 20 million per year, are wild-caught in Vietnam, and cultured at Hainan Island for intervening culture. However, imported wild-caught amberjack seedlings are suspected to bring pathogenic organisms, such as IRID virus, to Japanese aquaculture. Recently, vaccination of wild-caught seedlings has been spreading, and on the other hand, its seedling production has become been attempted in Japan.

Aquaculture of red sea bream has spread in the western area of Japan from 1970's. It consistently has increased in quantity, and exceeded 80 thousand tons in 1997. The

aquaculture production of red sea bream, accounting for 63.0% in 1983, accounted for 84.5% in 2000, which was the highest among cultured marine fish. Those which enabled the development of red sea bream aquaculture are stable supply of artificial hatched seedlings sustained by the improvement of production technique, improvement of seedling quality, demand of high value and delicious fish, improvement of artificial diet quality, and hanging low of yellow tail aquaculture. However, market price of red sea bream decreased and reached the bottom in 1994 because of the overproduction and the depression of Japanese economy. In addition, iridoviral infection piled on this. Therefore, aquaculture of red sea bream is not tranquil.

A new technology in red sea bream is improvement of breed by way of selective breeding in which the growth is the index of improvement. Recently, because it is profitable for sales strategy and for prevention of disease, season of production and seedling size diversify, such as the late production in October and November or the early production in March and April. Improvement of maturation promoting technology enables such off-season production at all times of the year by the control of spawning. Another technology in red sea bream aquaculture is the improvement of body color by use of synthesized astaxanthin.

Salmon aquaculture began in Miyagi Prefecture in 1975. Eggs of salmon are imported from USA and are hatched. Resulting larvae are reared in land-based hatchery and thereafter transported to the open sea net cages. In 1991, its production reached the maximum of 25,730 tons, however thereafter production and number of producers decreased because increase of imported salmon quantity, big catch of wild salmon, and depression of economy made the market price to hover at low level.

A private aquaculturist firstly started the flounder, Paralichthys olivaceus, aquaculture in 1977, and it propagated mainly to the western area of Japan in 1980's. Its production, being 648 tons in 1983, increased to 6,039 tons in 1990 which exceeded the wild fish catch. Afterward it maintains 6000-7000 tons which approximately equals to the wild fish catch. It is profitable to flounder aquaculture that its aquaculture is possible at land-based facility which does not need the fishery right. Flounder shows sex differential growth and females grow to the size of 1.4-1.6 times larger and 1.7-2.1 times larger than males at one and two years old, respectively. For example, average female body weight is 1,550.8 g (2,750 g at the maximum) and that of male is 725 g (1,500 g at the maximum). Recently, feminization of males has been attempted commercially.

On the other hand, movement of multikind and small-quantity production begins for striped jack, tiger puffer, flounder, and groupers. In addition, aquaculture of hybrids of yellow tailkingfish, red sea breamcrimson sea bream, Japanese parrot fishspotted parrot fish are attempted. These fishes are very delicious and high value. However, because their cuisine and locality are restricted, their production is specialized in certain localities and products get name-brand.

On the other hand, industrialization of large sized tunas has recently succeeded in Japan. Among tunas, aquaculture experiment of highest value Pacific bluefin tuna started in 1969,

and its aquaculture has propagated in the western area of Japan, such as in Wakayama, Ehime, Nagasaki, Kagoshima, and Okinawa. At present, wild seedlings "Yokowa" caught by trolling are used in its aquaculture. However, regulation enforcement of wild fish catch is certain in near future for the preservation of its natural resources if the quantity of cultured fish keeps increasing. The Pacific bluefin tuna does not have sufficient natural resource and the opinion wanting the regulation of its catch has become dominant in the congress of CITES and among conservationists. Research on the seedling production of Pacific bluefin tuna started backed by such situation. In 1979, five-yr-old broodstock fish firstly spawned naturally in captivity. Fish produced in 1996 and 1997, aged 6 and seven-yr old (90 kg in average body weight and 165 cm in average total length), spawned 23 June 2002 and the closing of complete life cycle of Pacific bluefin tuna was attained. Produced juveniles were already transferred to the open sea net cage from land-based hatchery and more than 10 thousands of them still survive. Such technical progress will enable the tuna aquaculture without using wild-caught fish as the seedlings in the near future. In future aquaculture, it will be needed to artificially produce seedlings with good shape, color, disease tolerance, and environmental stress tolerance by improving the seedling production techniques.

In the area of fish nutrition, it will be needed to develop fish feed which enables sustainable aquaculture production by decreasing environmental pollution in aquaculture area, of course enabling good rearing results.