

Present Status of Fish Culture Development Project in the Black Sea under JICA Program

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Since April 1997, a collaborative project between Japan International Cooperation Agency (JICA) and Ministry of Agriculture and Rural Affairs, Central Fisheries Research Institute in Trabzon has been working for the sustainable seed production of Black Sea turbot, *Psetta maxima*. Through this project, 8,000 fish juveniles were produced in 1998, 27,000 in 2000 and 14,000 in 2001. The target production was 10,000 juveniles of 100 mm total length (TL). Production in 1999 was disappointing low due to the destruction of the water intake pipes resulting in water quality deterioration. Juvenile production increased with accumulation of more knowledge of its seed production.

From the yearly achievement of the project, it seems that a sustainable experimental seed production is viable. As year 2002 is the final year of the project, to attain its goal in developing fish culture in the coastal waters of the Black Sea, the following technical subjects should be worked out:

- 1) Establishment of spawning technique in hatchery-bred broodstock
- 2) Improvement of larval survival
- 3) Establishment of high quality artificial feed

Seasonal Distribution and Migration Pattern of the Turbot *Psetta maxima* in the Eastern Black Sea, Republic of Turkey

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To determine the seasonal distribution and migration pattern of the Black Sea turbot *Psetta maxima*, specimens were collected off Trabzon, Turkey, in the eastern Black Sea. A total of 422 specimens were caught by 364 otter trawl hauls in 95 cruises from 24 July 1997 to 19 February 1999. Average catch per unit effort was 1.2. The turbot were distributed between 5 m and 70 m depth where the bottom water temperatures varied from 26.4°C down to 8.0°C. They were found mainly at 10 m in July-October and at 5-60 m in November-March. However, the turbot were found in high densities at <20 m depth from April to June. Thus, it appears that the Black Sea turbot migrates from deeper water to shallow coastal waters during the spawning season, April to June. Off Trabzon, *Psetta maxima* spawns in coastal areas <20 m deep.

Age and Growth of Turbot *Psetta maxima* in the Black Sea, Turkey

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The age and growth of turbot *Psetta maxima* in the Black Sea were examined from specimens caught by both coastal fisheries in Trabzon and a trawl net survey of the Trabzon Fisheries Research Institute from December 1997 to July 1999. The number of otoliths available for examination was 641 pairs of otoliths. We counted the number of otolith opaque and hyaline zones and measured the otolith and ring radii. Monthly changes in the ratio of the number of opaque edges and marginal growth rate indicated that a single ring was formed once a year for both sexes. The relations of back-calculated standard length (cm) $L(t)$ to age t (years old) expressed using the Bertalanffy growth equation were represented as $L(t)=54.8\{1-e^{-0.481(t+0.011)}\}$ and $L(t)=45.0\{1-e^{-0.597(t+0.011)}\}$ for female and male, respectively. The estimate of growth coefficient did not differ from those of turbot in the Gulf of Lion and in a release-recapture experiment in the Black Sea, but were nearly twice as large as that in the Gulf of Pomerania.

Broodstock Rearing and Spawning of Black Sea Turbot, *Psetta maxima*

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Broodstock development and induction of spawning of Black Sea turbot, *Psetta maxima* has been conducted between 1998 and 2001 in the Central Fisheries Research Institute, Trabzon, Turkey. One of the environmental and feeding conditions evident in broodstock management is the optimum water temperature below 17°C which is the present culture condition at the Institute. Likewise, frozen whiting is considered to be a good broodstock diet from the viewpoint of nutritional and ecological aspects. Growth of hatchery-bred broodstock fed this diet is shown as the relationship of body weight to age (month) represented as an equation of: $y = 0.072x + 0.164$ ($R^2 = 0.998$).

Natural spawning was observed for 2-year-old hatchery-bred stock at water temperature of 14°C, however, no spawning was observed by the same broodstock at 3-years of age. On the other hand, induction of spawning for wild-caught broodstock were established through hormonal treatment.

A total of 78 artificial inseminations for 61 wild-caught females were carried out between 1998 and 2001 spawning season (April and May). An average yearly production of 1.96 million newly hatched larvae was recorded with an average fertilization rate of 39.5% and a mean hatching rate of 32.5%.

Rearing of Larvae and Juveniles of Black Sea Turbot, *Psetta maxima*, in Turkey

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Abstract

Rearing techniques for the larvae of the Black Sea turbot *Psetta maxima* have been developed at the Central Fisheries Research Institute (CFRI) in Trabzon since 1997. Research programs have been focused on finding out optimum rearing conditions regarding to larvae and juvenile rearing technology. Black Sea turbot were kept in indoor flow-through tanks and fed live food, rotifers and *Artemia*, for 45 days from hatching. The number of juveniles (100 mm TL) produced at CFRI increased from 8,000 in 1998 to 27,000 in 2000 but dropped to 14,000 in 2001. Production failed in 1999 because of trouble with the water intake system. For the future, CFRI aims to (i) establish spawning techniques for hatchery-bred broodstock, (ii) improve larval survival, and (iii) formulate a high-quality artificial feed. A number of private companies in Turkey intend to invest in commercial production of turbot by the techniques developed at CFRI.

Effects of Feeding Stimulants, and Diet pH on the Growth of Black Sea Turbot, *Psetta maxima*

Adnan Erteken, Goro Nezaki

Abstract

Feeding and growth studies were conducted to define the basal nutritional requirements of juvenile Black Sea turbot (formerly *Scophthalmus maeoticus* or *Psetta maeotica*). First, diets with different feeding stimulants were tested on *P. maxima*. Inosine, alanine, and glutamic acid were effective feeding stimulants. A combination of 0.9% L-glutamic acid and 0.1% inosine had the same effect as 0.27% inosine. Second, it was found that the nutritional value of diets was significantly affected by the pH of the diet; the optimum for turbot was pH 7.1-7.5.
