

Cultivation and Propagation of Mullet (*Mugil so-iuy*) in China

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Mullet (*Mugil so-iuy*), also called eye mullet (*Liza haematocheila*), is found in the western part of North Pacific and is produced in the far eastern waters of the Soviet Union and the coastal waters of Korea, Japan and China. The highest yield in China (where it is an important fish) is obtained from the Bohai Sea and Huanghai Sea.

Mullet farming has been practiced in China for more than four centuries. Most mullet culture areas are found along the coast and estuaries of northern China. The methods mainly used are extensive culture in brackish water and polyculture with freshwater cyprinids or marine shrimp. Brackishwater culture is called "harbor culture" in northern China. It is a traditional method which depends on the number of desired seedlings introduced into ponds and the water quality management technique.

Cultivation Process

Maintenance routines for farm and fishing gear are usually done before the end of April each year.

Guiding the fry into the pond. This is usually done from early June to early July. Since at an early stage fry have poor swimming capability, they are introduced into the pond with incoming water. At the late stage, when fry are larger, they are introduced into the pond while it is being drained slowly.

Harvesting. Harvesting usually begins in early October, mainly using gill nets, bag nets, filtering grids, trap nets and shrimp cages.

Overwintering. The shelter ditch is usually deeper for overwinter of mullet fingerlings. The fingerlings can also be moved into freshwater ponds for the same purpose.

Production. Generally the yield is 150-750 kg/ha. The products are mainly *Mugil so-iuy*, *Clupanodon punctatus*, *Lateolabrax japonicus*, *Acanthogobius hasta*, *Penaeus orientalis* and *Palaemon carinicauda*.

Disease and predators. Because of the low stocking density in extensive culture, cases of disease are not frequent. But occasionally some problems may occur, for instance, high mortality by algal blooms (*Prymnesium parvum*) and in the overwinter period, infection by fish louse due to the deteriorating water quality.

Artificial Propagation of Mullet

Male mullet mature sexually at the age of 1-2 years and females at age 2-3. Sex ratio changes with age. There are more males among younger fish and less among older fish (2-6 years old); male to female ratio changes from 6.4:1 to 0.14:1.

The spawning season differs with the latitude: in Nanhai Sea, it is in autumn; in Huanghai Sea and Bohai Sea, it is at the end of spring and the beginning of summer (April-June). Spawning occurs in estuary waters usually at dawn and often peaks with spring tide. Mature eggs are all released in one spawning. Spawning temperature ranges from 14 to 20°C, with 15-16°C as the most suitable. Individual fecundity is about 0.3-3 million.

Mullet larvae were first cultivated successfully in the laboratory in the late 1950s. Artificial propagation was successfully completed in the late 1960s. In the 1970s, China began to produce mullet fry and artificially propagate mullet cultured in freshwater. Mass production of artificial mullet fry has recently begun in the provinces of Hebei, Liaoning, Shandong and Jiangsu and in the city of Tianjin in north China. Current annual production is about 5 million fry.

Source and Selection of Mature Fish

Adult fish from the wild or ponds must be kept for a period of time in saltwater to accelerate the development of the ovaries.

Generally, mature fish should be selected at the age of 3-4 years, about 1-2 kg. The mature male mullet will release milt when its belly is gently pressed while the mature female mullet can be selected by checking its eggs. In induced spawning of female mullet the optimum diameter of oocytes is greater than 700 μm and the minimum should be 600 μm . Healthy eggs are highly elastic and are apricot yellow in color. The oil globule can be seen in full mature eggs.

Hormones and Dosages

Studies and practices have shown that mullet hypophysis, carp hypophysis,

HCG and LHRH-A can all induce mullet to spawn. The effective dosages per kg body weight are:

* Pituitary homogenate (number)	
<i>Mugil so-iuy</i> PH	17-30
<i>Carassius auratus</i> PH	4-11
<i>Cyprinus carpio</i> PH	14
* HCG (iu)	3,500-10,000
* LHRH-A (μg)	125-300

These hormones can be mixed. The injection site can be the dorsal muscle or body cavity. A full dose of either one or two injections is effective in induced spawning. For two injections, the time interval is generally 24 hours; the dose of the first is usually less than the second.

Ideal water temperature is 15-16°C. Temperature higher than 24°C will cause ovary atresia. Ovulation takes place in one to three days.

Fertilization and Incubation

Good results can be achieved through either the "dry" or "wet" method of fertilization. Fertilized eggs will sink if water salinity is 10 ppt and float if 12-13 ppt. Salinity of more than 7 ppt is recommended for incubating fertilized eggs. Seawater, if available, is ideal. Dissolved oxygen must be not below 3 mg/l; pH should be kept at 7.5-8.5.

Larval Rearing

Factory nursery. Fry are cultivated in concrete tanks indoor and fed with fertilized eggs and trochophore larvae of oyster and mussel, rotifers and nauplii of brine shrimp. This method can yield 5,000-10,000 (2 cm-long) fry/m³.

Farm nursery. In this traditional Chinese method for culturing carp, it is important to first clean the pond by killing harmful organisms in it and then fertilize it with pig or cow manure at 750 kg/ha. Fry can be stocked into the pond when enough zooplankton (mostly copepods and rotifers) have grown for feeding. Larvae may be fed first with soybean milk as supplement then with paste made from soybean or peanut cake, when they can already swim in shoals. At late nursery stage they can be given artificial diet. In 30-40 days they will grow into stocking size; 1.5-3.0 million fry/ha can be produced. ●