

Glittery, lustrous and colorful, pearls have been called the queen of the jewels throughout the ages. The occurrence of natural pearls in wild freshwater mussels is very rare.

The technology of freshwater pearl culture was developed in China some 2,000 years ago. However, commercial freshwater pearl culture, dates back only to the late 1960s and early 1970s. Gradual changes in technology and, most importantly, in the type of mussel used, resulted in the production of greater quantities of larger and more lustrous round, near-round, and baroque cultured pearls with a variety of colors.

Today there is a great demand for cultured freshwater pearls and China produces 95% of freshwater pearls sold in the world market. Studies on the increment of pearl quality, treatment of pearl mussel disease and the techniques for conducting nuclei and special pearl operations began in the Freshwater Fisheries Research Center (FFRC) in 1990. The successful demonstration of this technology led to the initiation of commercial farmed pearl culture in China. Over the past decade FFRC has also trained hundreds of people in freshwater pearl culture from 50-60 countries in the Asia-Pacific, African, Latin American and East European regions. In particular, FFRC specialists have successfully transferred the technology for pearl culture to Bangladesh with encouraging results – the first tiny pearls were developing after only two months of program operation.

Freshwater pearl culture and production in China

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Freshwater mussels for pearl culture

Several species of freshwater mussel can produce pearls in China. Triangle sail mussel *Hyriopsis cumingii* and wrinkle comb mussel *Cristaria plicata* are widely used for pearl production. However, the triangle sail mussel (Fig. 1) is the best for producing high quality pearls.



Fig. 1. Triangle sail mussel *Hyriopsis cumingii*

Triangle sail mussel is widely distributed in the lakes and their tributaries in Hebei, Shandong, Anhui, Jiangsu, Zhejiang, Jiangxi, Hubei, and Hunan provinces. They are most abundant in Dongting Lake, Poyang Lake, Taihu Lake, Hongze Lake, Shaobo Lake, and Gaobao Lake.

This species occurs in the large or medium lakes or in perennial rivers. Typically it occurs in flowing waters with slightly firm sand-mud or mud bottom. It also can live in areas that have slow currents.

Mussels feed by filtering natural food from the water. Juveniles filter the single celled algae such as diatoms, gold alga (Chrysophyceae), green alga (Chlorophyceae) and *Euglena* sp. Adult mussels filter some colonial types of algae, organic matter and tiny zooplankton along with single cell algae. Therefore, effective management of natural food sources in the water body is very important in the cultivation of this species.

Dissolved oxygen (DO), pH and other parameters are also very important to the mussel. For triangle sail mussel, the proper pH range is from 7-8, and the DO level should be greater than 3 mg/l.

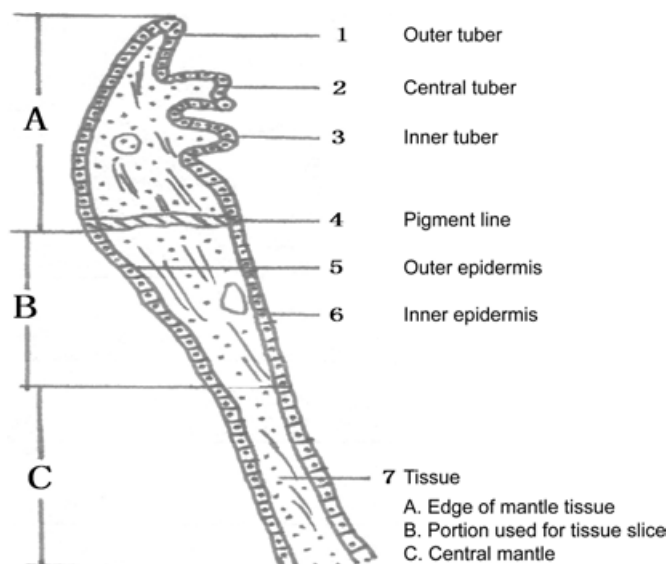


Fig. 2. Transverse section of the mantle tissue

Pearl production

Pearl production includes operation of pearl mussels and culture management.

Season for operating on pearl mussels

The best season for operating depends on the water temperature. When the water temperature is between 15-25°C, mussels have an active metabolism with high survival rate of mantle cells, recover rapidly from the operation wound, and quickly form the pearl sac and secrete nacre. These are important factors in producing good quality pearls. In China, March to May and September to October are the proper times of year for operating on the mussels.

Method for operating on the mantle tissue

The operation has two steps: making a slice of mantle tissue, and transplanting the slice. The two steps should be performed at the same time. The mantle tissue slice should be made from the edge of the mantle tissue near the pallial line. The nacre secretion capacity of this part of the mantle is the strongest (Fig. 2).



Fig. 3a - The tearing method of making tissue slices.

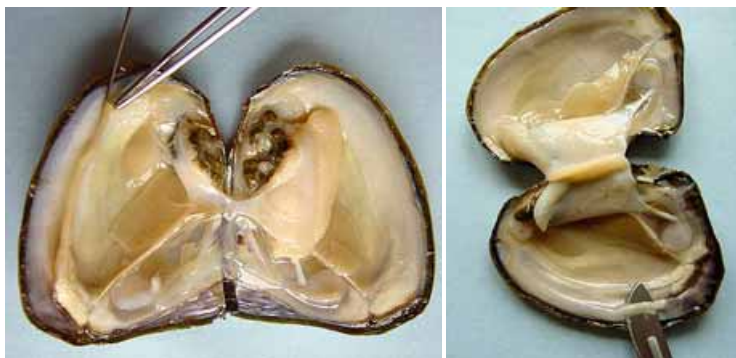


Fig. 3b. (left) and 3c. (right) the splitting and peeling methods

There are several ways to prepare the mantle tissue - by tearing (Fig. 3a), splitting (Fig. 3b), and peeling (Fig. 3c), in which the mantle tissue is separated into two parts from a cut mussel and the epidermis prepared for making a tissue slice.

The next step is to cut the epidermis of the mantle tissue strip into square slices 3 mm x 3 mm in size (Fig. 4).

The mantle tissue slice is then transplanted into the mantle tissue of a living mussel between the outer edge of the mantle and posterior part of the central mantle. The number of transplanted mantle slices used depends on the size of mussel operated on. About 25-30 slices can be transplanted into a mussel of 10 cm in length with 12-15 slices in each side (Fig. 5).

Producing nuclei pearls

Pieces of shell make the best nuclei material. They can be manufactured in different shapes (Fig. 6) to produce different shaped nuclei pearls. The nuclei, along with a piece of mantle tissue slice, are inserted into a mussel's body or mantle. The mantle tissue slice will undergo cell division and multiplication to form a pearl sac surrounding the nuclei. The pearl sac then secretes nacre over the nuclei creating a nuclei pearl (Fig. 7).

Producing image (shaped) pearls

Image pearls get their shape from that of the sculpted nuclei used to create them. The sculpted nuclei become covered by the nacre forming highly attractive pieces (Fig. 8). The original sculpture can be made from wax, shell, plastic, steel or other materials with a distinct convex surface design. These sculpted nuclei are inserted into the cavity between shell and mantle of the operated mussel, producing an image (shaped) pearl.



Fig. 8. The image pearl with a sculpture of Mandarin duck.



Fig. 4. Mantle tissue slices. (top - mantle tissue strip; and bottom - mantle tissue slices).



Fig. 5a (above). Mantle tissue transplantation.



Fig. 5b (above) shows finishing the operation.



Fig. 6. Shaped shell nuclei.



Fig. 7. Shaped nuclei shells.

Care and culture of operated mussels

Operated mussels can be held in net bags, net cages and net folders. The bags, cages or folders are hung from plastic ropes. Foam, glass balls, bamboo sections and plastic bottles are used as floats to support the containers. The plastic ropes are tied with the stakes made from wood or bamboo.

Operated mussels should be reared in the water bodies (ponds, rivers, reservoirs, lakes) free from pollution and disease. Pearls will be produced within several years of culture.

Careful management is very important during this period as it affects the quality and quantity of pearls produced, particularly in terms of water quality and management of natural food production through fertilization or manuring.