

Aquaculture in China— Freshwater pearl culture

JIALE LI AND YINGSEN LI¹

Pearls can be processed into various treasured adornments, decorations and works of art that have been cherished by people. Pearls are also important materials to make traditional Chinese medicine, which can be used to treat several diseases with good efficacy. In recent years, some high-class cosmetics and Chinese medicines for health care made of pearl powder are welcomed by consumers. Pearl is a product of aquaculture and also plays an important role for earning foreign currency in China from their export.

In 1963, freshwater mussels were used successfully to produce artificial pearls in Jiangsu province. Because the mussels came from natural waters, the limitation of natural mussel resources further hindered the development of freshwater pearl culture. In 1973, a breakthrough in technology of artificial propagation of mussels made large-scale pearl culture possible. Since then, the output of freshwater pearls has risen quickly (Zhang 2005).

China first exported freshwater pearls in 1972. In the mid-1970s, as the output of the product rose quickly, the amount of the pearls exported from China assumed the top position in the world. In 1979, the amount of pearls exported reached 11 t and earned US\$18 million dollars in foreign currency. Chinese freshwater pearl mussel culture has made much progress after 40 years of development. Statistics showed that pearl production reached 1,800 t in 2006 and of that, more than 98 percent was from freshwater pearls. Production from China accounted for 95 percent of world's total freshwater pearl production. No doubt, China has been the largest producer of pearls. Nevertheless, Chinese pearl production by value was only 10 per-

cent of the world's total. Price per kilo of Chinese freshwater pearls was only US\$113, while the price of Polynesia pearls was often more than US\$10,000, which was nearly 90 times greater.

In China, the main production areas of freshwater pearls are the Zhejiang and Jiangsu provinces, followed by Jiangxi, Hunan, Hubei and Anhui provinces. There are two primary commercial markets of freshwater pearls in China: the Shanxiahu pearl market in Zhuji city, Zhejiang province and the Weitang pearl market in Suzhou city, Jiangsu province. In 2006, the quantity sold reached 650 t, and total sales reached over US\$1.8 billion through the Shanxiahu pearl market, the largest freshwater pearl sales market. The amount of freshwater pearl sales in that market was about 65 percent of the that in the entire nation and 60 percent of that in the world (Chen *et al.* 2007). That market had been regarded as the biggest professional pearl sales and pearl ornaments market certificated by the national administration in China. The pearl price in that market can affect the price of the pearls in the world.

There are more than 100 species of freshwater mussels in China, but only 10 of them are suitable for pearl culture; for example, the triangle sail mussel (*Hyriopsis cumingii*), the crown mussel (*Cristaria plicata*) and the swan mussel (*Anodonta sp.*, Li 2007). In the 1960s and 1970s, the main cultured mussel was the crown mussel (*Cristaria plicata*), because it was easily cultured. The crown mussel grows fast and forms a large pearl, but the pearl of that mussel is not round or bright and its surface usually has more carvers. After many experiments, the pearls formed with the triangle sail mussels were found

to have better quality, including color, cleaning degree and shape than the crown mussels. The triangle sail mussel has been considered the best species in which to culture freshwater pearl, instead of the crown mussel since 1980s. The triangle sail mussel, a species specific to China, has been the main mussel for pearl culture. More than 70 percent of the freshwater pearls are produced by it.

In 1970s, the Biwa pearly mussel (*Hyriopsis schlegelii*), a species from Japan, was introduced, but was not cultured. In 1997, it was introduced to China again and cultured in some areas (Li *et al.* 2007). We collected stocks of the triangle sail mussel in five Chinese freshwater lakes: Poyanghu Lake, Dongtinghu Lake, Taihu Lake, Chaohu Lake and Hongzehu Lake. We evaluated these five stocks at Zhuji city, Zhejiang province and obtained Poyanghu stock with excellent growth and genetic character. Poyanghu stock is being selected to obtain a new strain. The Poyanghu stock of triangle sail was crossed with the Biwa pearly mussel to obtain a new variety with heterosis - "Kanglebang" in Chinese. The Kanglebang mussel has many advantages with fast growth, a thicker outer membrane and better pearls (Li *et al.* 2007). Now, Kanglebang is being cultured gradually in the areas of primary pearl production. So far, the triangle sail mussel is still the most important and widely used pearl mussel, followed by Kanglebang.

There are many types of freshwater pearl culture in China, including in ponds, lakes, reservoirs and rivers (Ge *et al.* 2002). The main type is pond culture with other aquatic animals, including silver carp (*Hypophthalmich-*

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tat used by young game and forage fish species. Concentrated predation by larger fish may positively or negatively affect future sport fish population balance in a pond or lake. Beneficial predation may occur when carnivorous fish are reduced over abundant forage. However, excessive predation of young game and forage fish could limit food availability to larger fish and delay their recruitment into the fishery. Predators, such as water snakes, fish eating birds and river otter may prey more readily on concentrated fish populations confined in shallow water.

Aquatic plants and filamentous algae may have more shallow water habitat, less than 1 m in depth, to ex-

tend their growth and increase density during low water levels. Increased vegetation growth in shallow water may interfere with fish feeding, seining and sport fishing activities. Ponds filled with aquatic plant and algae growth may increase the habitat in which small game and forage fish species hide and avoid predation by larger fish. Such conditions could contribute to an overabundance of small fish and cause a future imbalance in pond fish populations. Lake managers may struggle to control aquatic vegetation growth in shallow waters. Contact herbicides and algaecides should be used with care to prevent chemical toxicity to fish and to avoid oxygen depletions.

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thys molitrix), bighead carp (*Aristichthys nobilis*), mandarin fish (*Siniperca chuatsi*) or freshwater shrimp (*Macrobrachium nipponense*). The mussel mainly grazes on plankton for food; the more plankton in the water, the more rapid growth of the mussel and production of better freshwater pearls. So, pearl ponds need to be fertilized to increase plankton blooms. However, fertilization leads to eutrophication. Chinese freshwater pearl culture needs to improve pearl quality and reduce water pollution resulting from the manuring practiced in pearl culture. A bio-promoter containing calcium and other mineral elements is used to promote mussels to secrete nacre to gain good quality pearls.

Pearls are divided into nucleus pearls and non-nucleus pearls. Almost all of marine pearls are nucleus pearls. Freshwater pearls are mainly non-nucleus pearls, which account for more than 90 percent of all freshwater pearls. Non-nucleus pearls are formed by inserting cell slices manufactured by the out membrane of the mussel. Generally, it takes 3-5 years to produce a marketable pearl. The sizes of freshwater pearls are unequal and the small size pearls accounts for the greater part of production. This affects the total average price of the freshwater pearl. Actually, the high

quality freshwater pearls are equal to the saltwater pearl. In the last few years, as the output of freshwater pearls increased, the nucleus pearl has developed more quickly.

Nucleus pearls are formed by inserting the nucleus manufactured from the shell of the mussel or other stiff materials. It takes 1-2 years. Because the freshwater mussels are larger, the types of nucleus pearls are many, for example, button pearls, cross pearls, Buddha pearls and men pearls. The most important factor that limits freshwater nucleus pearls is high mortality of the mussel after inserting the nucleus into the mussel. To improve the quality of the mussel and change the method of insertion are two ways to solve this problem.

The primary color of freshwater pearls is white and those account for more than 60 percent of all output. Other colors include orange, red, green, black and purple. Pearl color relates to the host mussel, the cell slices inserted and the minerals in the water.

Many companies that manage freshwater pearl culture, process and trade in China. The main companies include Shanxiah Group, Ruanshi Company, Qidazhou Company, Shan-shui company and Suzhou United Pearl Company. Most of the pearls on the mainland were exported through Hong Kong 10 years ago. Now, more

Note

¹ State Extension Specialist for Aquaculture, Kentucky State University Aquaculture Program, Graves County Extension Office, 251 Housman Street, Mayfield, KY 42066; Tel: 270-247-2334; E mail: fwynne@email.uky.edu

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and more pearls are exported directly to other countries. Many Chinese pearl companies have their own pearl culture sources. They play an important role in the development of pearl culture by solving the problem of disease, the improvement of water quality and the extension of good strain of mussels.

Notes

¹Aqua-life Science and Technology College, Shanghai Fisheries University, Shanghai, 200090, P. R., China.

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