

Pearl culture in Hainan, China

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Attending a World Aquaculture Society conference provides an opportunity to gain an insight into much of the host countries' aquaculture activities; however, in China the sheer size of the industry seems only to be matched by the diversity of species cultured. Here, two days is insufficient to see all that is cultured in a single province, but if it's all the time you have, and you also have an interest in pearl culture, Hainan is worth the visit.

Hainan is a large island (34,000 km²) in the South China Sea off the southern Chinese coast. Most of the 7.1 million people live in the two largest cities, Haikou, the capital, and Sanya, a resort town on the southern coast. The island is tropical and particularly popular with Chinese tourists who visit the area to enjoy the mild winters. Temperatures average a little over 25°C and rarely drop below 18°C. Aquaculture is the island's most important industry, which until recently was dominated by fish culture. Now, thanks to the introduction of white shrimp, *Litopenaeus vannamei*, shrimp culture leads production. Regardless, Hainan is home to a wide variety of cultured species and has populations of *Pinctada martensii*, *Pinctada maxima*, *Pinctada margaritifera* and *Pteria penguin* at its disposal.

Pearl oyster culture in China occurs in the southern provinces of Guangxi, Guangdong and Hainan, although production from Hainan is comparatively very small. As in the other provinces, pearl culture has focused largely on *Pinctada martensii* and, to a much lesser extent, *P. maxima*. Both species are readily available from fisherman and have been produced in hatcheries run by staff of the Fisheries Department, Hainan University (FDHU).

While *P. martensii* can be spawned throughout the year, hatchery production generally occurs from February to May and from September to December. The techniques used are simple, reliable and inexpensive. Broodstock are gathered from the wild and from farms and can be spawned using temperature induction techniques or, in the case of *P. martensii*, simply sacrificed

and the gametes collected. Larvae are cultured in tile-lined concrete tanks and fed algae (*Dicrateria zhanjiangensis*, *Chaetoceros muelleri* and *Tetraselmis (Platymonas) subcordiformis*). Bakers yeast, *Saccaromyces cerevisiae*, is also used as a feed supplement during early larval culture. The larvae remain in the same tank until settlement and water is exchanged daily using a mesh covered siphon hose.

After approximately 24 days, larvae develop to pediveliger stage and settlement collectors are introduced to the larval culture tank. Each collector comprises ten 20 cm x 20 cm sheets of thin plastic suspended one above the other at intervals of approximately 10 cm. When spat have reached an average size of about 1–2 mm they are gently removed from the plates and the walls of the tank using a sponge. The spat are then grown in the field in fine mesh bags until they reach 5–8 mm when they are transferred to cages.

P. martensii are held on the farm for a period of 15 months until they reach 70 mm. The oysters are then commonly seeded with two nuclei of between 4.5 and 7.5 mm diameter. Following operation, the oysters are returned to the farm for a further 11 months before they are sacrificed and the pearls are collected. Survival rates from spat to 70 mm and from seeding to harvest were reported to be approximately 35 per cent and 60 per cent, respectively.

The experimental farm maintained by Hainan University can be found in Linshui Bay and is constructed of concrete pylons that are driven into the seabed. Timber poles are placed between the pylons to produce a lattice from which mesh cages holding the oysters are suspended. A hut has been constructed above the farm to house students and workers, and to permit operations and maintain security.

When initially set up in 1978, the farm at Linshui Bay produced pearls from both *P. martensii* and *P. maxima* although in the interim, attempts to produce *P. maxima* were halted and have only recently

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been revived by Professor Wang. The current farm site is small, approximately 1 mu (15 mu = 1 ha) in an area of particularly intense fishing and aquaculture activity. Nearby farms include seaweed culture, fish farms and spiny lobster growout. These additional activities were blamed for the demise of nearby edible oyster farming and were thought to be affecting the viability of pearl farming. Thus, moves were underway to select alternative, more remote sites for pearl culture.

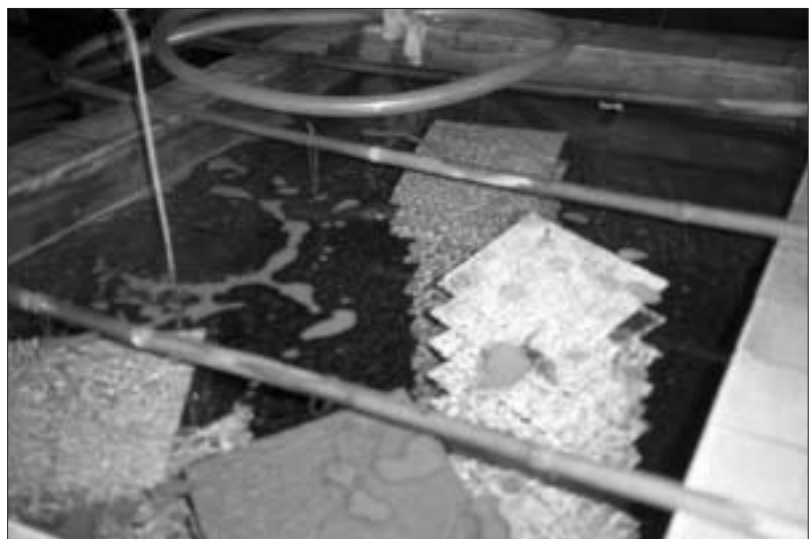
Nearby, in Sanya City, Professor Wang is establishing a Pearl Oyster Research Institute, which boasts a hatchery facility to produce both *P. martensii* and *P. maxima* spat, and a farm site for the cultivation of *P. maxima*. The institute will permit furthering development of techniques for the production of polyploid *P. martensii*. In addition, Professor Wang, in conjunction with Dr Fang Xuan Jun of the Hainan Institute of Tropical Agricultural Resources, is also investigating two other approaches to improve pearl quality.

Stemming from earlier work in Guangxi Province, a coated nucleus has been developed that reportedly increases post operative survival and reduces rejection rates. The coating is said to contain both an antibiotic and a constituent that accelerates the proliferation of epithelial cells from donor mantle tissue. Equipment has been purchased to begin small-scale treatment of nuclei to permit further evaluations. When treated, the nuclei are a lemon-yellow; however the colour is said to dissipate rapidly after implantation. The treated nuclei are expected to have a shelf life of at least 12 months when stored correctly.

Slow growth rates and the high prevalence of mudworm (*Polydora ciliata*) infestation have hampered *P. martensii* farming in Hainan. Fortunately, the succession of agriculture to aquaculture, in terms of economic importance in Hainan, has Dr Fang turning some of his attention from crop genetics to pearl oysters. Using oyster stocks gathered from Sanya (Hainan), Beihai (Guangxi) and



Algal culture room at the Pearl Oyster Research Institute, Sanya.



*Plastic collectors used to settle *P. martensii* and *P. maxima* spat.*

Daya Bay (Guangdong), each strain and its hybrids are being assessed for parameters of importance in pearl culture (growth, survival and nacre colour). First- and second-generation oysters have been produced and have shown significant variation in growth and survival. Using random amplified polymorphic DNA (RAPD) techniques, Dr Fang is attempting to find markers for these characteristics

to accelerate selection. Innovative techniques are also being assessed whereby digital images of the nacre layers are used to quantify colour characteristics so that further selection on this basis might take place.



Hainan University pearl farm at Linshui Bay, Hainan, with a small fish farm in the foreground.



Pearl Oyster Research Institute hatchery at Sanya, Hainan.



Pinctada martensii shells showing blistering caused by Polydora infestation.