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Akoya pearl oyster culture in Australia

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Pearl culture, the largest aquaculture industry in Australia, is worth an estimated AUD 300 million (U.S. $197 million) annually. It is currently based on production from the silverlip pearl oyster (*Pinctada maxima)*.

The culture of silver-lip pearl oysters began in earnest in Australia in the 1960s. Adult shells were collected from the wild and transported to pearl farms, where they were seeded to produce cultured pearls. However, overfishing and diseases almost crippled the industry in the 1980s.

Through improved management and the development of hatchery propagation techniques for larvae and spat (juvenile oysters), the pearl industry has once again begun to flourish. Today, Australia is world renowned for its lustrous South Sea pearls produced from *P. maxima* in northwestern Australia. There is also interest in pearl production from two additional species: the Akoya pearl oyster (*P. fucata)* and black-lip pearl oyster (*P. margaritifera)*, which are both abundant in Australian waters.

Akoya pearl oysters

P. fucata have received increasing attention in Australia in the last few years following the decline of Akoya pearl production in Japan due to disease and pollution. For example, in 1996, the Akoya pearl oyster industry accounted for 66 percent of the total world pearl production, whereas in 2000, Akoya pearls only occupied 21 percent of the market. Consequently, the opportunity exists for other countries to meet any shortfalls in supply.

Akoya pearl oysters are currently cultured at research and/or commercial scales in Australia, the Caribbean, China, India and Japan. Research in Australia has included determining the feasibility of hatchery and early nursery culture of Akoya pearl oysters in tropical (Queensland) and subtropical (New South Wales) waters.

Queensland research

Research to date in Queensland has been carried out at James Cook University's Orpheus Island Research Station. The techniques employed for *P. fucata* culture were adapted from those developed in this laboratory for *P. margaritifera*.

P. fucata broodstock are removed from the longline, scrubbed, and washed with 1-µ filtered seawater. Adult oysters are "cold conditioned" by placing them in a water bath at 220 degrees-C overnight. They are then placed in warm (30 degrees-C) water the following day, which induces spawning. Results have been promising, with *P. fucata* larvae competent to settle on day 20 with a mean (± S.E.) anterior-posterior measurement (APM) of 199 (± 5.4) µ.

Larvae are transferred into settlement tanks, where they remain until day 43. During hatchery production, larvae and spat are fed a microalgae diet consisting of *Isochrysis galbana, Pavlova salina*, and *Chaetoceros muelleri* at increasing densities of 1,000 cells per millileter on day 1 to 45,000 cells per milliliter on day 43.

On day 43, when the spat are transferred to the ocean, they have a mean dorso-ventral shell height (DVH) of 2.35 ± 0.9 mm. They are placed into 55- x 30- x 10-centimeter plastic mesh trays and positioned on a longline, where they remain until grading at 3.5 months of age. Graded oysters have a mean (± S.E.) DVH of 14.2 ± 1.3 mm with a range of 8.8 to 27.3 mm. Once graded, juvenile oysters are placed into pearl nets, where they reach a mean DVH of 44.09 ± 2.6 mm at 10 months of age.

A minimum dorso-ventral shell height of 50 mm is required for Akoya pearl production, indicating that hatchery-produced oysters could be seeded for pearl production at 12 to 14 months of age or less than a year after transfer from the hatchery. Oysters in Queensland have shown considerable growth, with shells capable of reaching 100 mm (in excess of 100 grams) in just over two years.

New South Wales

Left: Surface longline for *P. fucata* culture. Right: *P. fucata* cultured in Queensland, Australia.

In New South Wales, experimental production of *P. fucata* is now in its fifth year. In more than 20 larval production runs, larval growth has varied significantly in both the time taken to reach pediveliger stage and the mean size of larvae at that stage.

Most commonly, larvae with a mean APM of 201 µ are placed in settlement tanks by day 20. Following metamorphosis, the spat are removed from the hatchery when they have grown to a minimum DVH of 1.5 mm – generally by day 50. Spat are thenplaced in 1-mm mesh bags and deployed on subsurface longlines. Subsequent growth is highly seasonal. Larval production is scheduled for late winter, and spat are deployed in spring.

In Port Stephens, which is in central New South Wales, spat deployed at this time are expected to grow at a rate of approximately 1 milliliters per week, although mean growth rates as high as 1.6 mm week have been recorded. At 10 mm, juveniles are placed in 6-mm mesh pearl cages. With 12 months further culture, oysters routinely reach a DVH of 50 to 55 mm and can be seeded.

Conclusion

In addition to filling a niche market with the small pearls that *P. fucata* typically produce, there are a number of other reasons to establish a *P. fucata* industry in Australia. *P. fucata* can be seeded at a small size – 50 mm, compared to 100 mm for *P. margaritifera* and 120 mm for *P. maxima* – which can be achieved in 12 to 18 months. Therefore, pearls grown from hatchery-produced *P. fucata* can be harvested in three years or less. Additionally, the shape of *P. fucata* allows two and sometimes three nuclei to be implanted in one oyster.

The results of projects in Queensland and New South Wales are encouraging and have provided a basis for the development of an Akoya pearl oyster industry in Australia. However, further work is required through optimizing pearl production as well as improving stocks through genetic selection and ploidy manipulation, which will help maintain Australia's position as a leading pearl-producing nation.

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