Marshall Islands farming expansion: New hatchery, new atolls, new techniques

by Neil A. Sims and Dale J. Sarver [1]

Hatchery Production

Efforts to expand pearl farming in the Marshall Islands received a significant boost over August–September 1997, with the first on-island hatchery production of local spat. Over 600 000 settled spat were produced from a single run in the temporary hatchery set up in Majuro. These spat have shown good early growth and survival during grow-out on the farm and in the land-based nursery system.

To meet the need for expansion to commercial scale of the Black Pearls of Micronesia (BPOM) farm in Majuro, hatchery operations needed to shift from the remote hatchery system in Kona, Hawaii, to an on-site set-up in Majuro. A temporary hatchery was therefore set up in a rented house next to the existing land-based nursery facility in Woja, Majuro.

A single batch of larvae was reared through to settlement over August and September. Most of the spat were held in an on-land nursery, and then moved out to the BPOM farm site during September and October. The remainder were held under different experimental regimes in the land-based nursery, and then moved out to the farm in late November.

Three separate batches of spat from this run were reared from single-female x single-male crosses. The same male was used for all three such crosses, providing three batches of full-siblings, each half-siblings with the others. The resultant spat are being raised separately on the farm, to provide experimental material for BPI's genetic improvement projects.

Farm Expansion

Refinements in handling of early spat both on the farm and in the nursery have resulted in improved survival and growth of these animals. The land-based nursery usually results in better survival, but the animals grow more slowly than those held on the farm. Plans for a larger-capacity nursery system are being implemented in stages, to provide increased algal production, higher flow-through rates and greater nursery holding-tank capacity. A large-scale permanent hatchery facility will also be built in the coming year.

This large increase in farm stock has also required a similar increase in manpower, to ensure that the spat are well tended. Growth in the fine-mesh bags on the longlines, as in the land-based nursery, is limited by the ratio of spat biomass to available water exchange. Overcrowding of spat (when survival is higher than expected) or fouling of the fine mesh bags (even at very low levels), can limit growth. Spat are stocked lightly, but there is still a clear pattern of stunting in bags where survival rates are high. As the spat grow, they must be repeatedly thinned, and moved into coarser-mesh bags. The timing of transfers to the next stages are crucial, particularly early in the grow-out.

Expansion of pearl farming in Majuro lagoon and to other atolls in the Marshall Islands is about to get underway. Grow-out trials at several sites throughout Majuro lagoon have yielded pleasing results. Most sites matched the growth and survival rates from the BPOM farm site at Didit Islet.

BPI has recently been awarded a three-year grant, through the US Department of Agriculture's Fund for Rural America (FRA), to expand their activites at the BPOM farm, and to set up satellite farm sites on two of the outer atolls. This FRA grant will allow these expansion sites to rear spat through the full grow-out cycle to seedable size, and to permit a first preliminary harvest, after pearls have been incubated for 12 months, to give some early indication of the quality of the resulting product.

The project involves a range of collaborating institutions, including Island Councils, Marshall Islands Marine Resources Authority (MIMRA), the College of the Marshall Islands' Land Grant Extension Program, the University of Hawaii Sea Grant's Pacific Aquaculture Development Program, University of Hawaii's Marine Option Program, and Hawaii Institute of Marine Biology. The emphasis for the FRA project is on training and extension; research and development efforts continue at the BPOM farm site and elsewhere through other projects and grant programmes.

Further Research

The new technique for grow-out of spat to juvenile size in individual mesh 'sausages' continues to be refined. This method has effectively eliminated the *Cymatium* snail predation problems experienced early on. Problems with fish attacking the 'sausages' have been minimised through use of protective plastic beads, and a central line of 4–6 mm

[1] Black Pearls, Inc. (BPI), Hawaii, and Black Pearls of Micronesia, Inc. (BPOM), Majuro

polypropylene, which prevents fish from breaking the sausages off the headline. Although the 'sausages' are labour intensive to set up, they overcome the necessity of repeatedly cutting clumps of spat apart to prevent stunting. The BPOM farm has completely eliminated the use of lantern baskets, with spat going straight from the spat bag to the 'sausage' and then to the net panel. Trials are currently examining the most cost-effective number of spat in each 'sausage' pouch, and the optimum cleaning regime for these 'sausages', and for net panels with older oysters.

Experimental work on the BPOM farm is also looking at deep-water culture, as a means of reducing the amount of fouling on early-nursery animals. Trials have shown growth rates to be comparable between larger animals held on longlines below 25 m depth, and tended only every six months or more, compared with animals held on the usual sub-surface longline arrays, and cleaned at least every two months. There is far less fouling on the deep-cultured animals, and the type of fouling organisms is noticeably different. Deep culture could therefore reduce the demand for manpower on the farm both in adult grow-out and through all stages of the nursery.

It appears that the high degree of mixing in the well-flushed Marshall Island lagoons ensures that the deep-cultured animals are still supplied with sufficient food and water exchange. In earlier work, Sims (1990) had shown that animals cultured in deep water in Manihiki lagoon showed slower DVM (dorso-ventral measurement) growth, but comparable increases in shell thickness to shallow-water cultured animals, suggesting some food or other limitation in the more stagnant deep water. Recent hydrodynamic and water-quality studies (see Miles Anderson's article in this issue) have confirmed this depletion in the entrapped deep water of this highly enclosed lagoon.

Black Pearls Inc. is also collaborating with a Maryland naval engineering company, Band, Lavis, and Associates, on a US Department of Defence research grant (through the Center of Excellence for Research in Ocean Sciences, or CEROS), investigating the use of non-toxic antifouling coatings of nets and lines. Candidate coatings have been identified, and over the next year these will be applied to various materials, and tested on different pearl farms and at other aquaculture and naval sites.

Under another CEROS grant, BPI is pursuing some early encouraging results in the use of probiotic bacteria to improve growth and survival of pearl oyster larvae and spat, and of other aquaculture species in the hatchery and nursery using both surface seawater, and the nutrient-rich deep sea water available at Kona's Natural Energy Laboratory site.

The ecological sustainability of pearl farming in Manihiki lagoon, Northern Cook Islands

by Miles Anderson [1]

Introduction

Culture of the black-lipped pearl oyster, *Pinctada margaritifera*, in the Northern Group of the Cook Islands began in the mid 1980s. The Ministry of Marine Resources (MMR), with the assistance of international aid donors, has sponsored a series of projects and activities encouraging the reasonable further development and expansion of the Cook Islands' black pearl industry. An integral part of this effort recognises the sustainable use of natural resources as the key to long-term success of the industry.

In 1995 the Asian Development Bank, in concert with the MMR, awarded a technical assistance contract to RDA International Inc. to establish a Lagoon Ecology Monitoring and Management Project (LEMMP) in Manihiki, an atoll in the Northern Cook Islands. The project mobilised in March 1995 under the direction of Dan Cheney with the construction of an environmental research and training centre, the Manihiki Environmental Laboratory (MEL). Technical assistance was provided by Project Manager, Miles Anderson.

[1] Analytical Laboratories of Hawaii Inc. and RDA International