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PROGRESS REPORT ON THE GREEN MUSSEL CULTURE PROJECT IN
WESTERN SAMOA, APRIL 1983

by

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Introduction

Investigation of the possibility of culturing the Philippine green mussel, *Perna viridis*, in Western Samoa was initiated by the Chief Fisheries Officer in October 1981. This species was seen as a potential cash crop, rich in protein and suitable for cultivation at village level. Funds were donated by the Canadian International Development Agency and the United Nations Development Project in early 1982 to enable a pilot culture project, which involved the growing on of imported mussel spat, to be carried out. The first importation in mid-June, 1982, consisted of about 40,000 spat, which were placed in sites close to Apia to enable growth rates and environmental conditions to be carefully monitored by Fisheries Department staff. A second phase in February, 1983, saw the importation of about 70,000 spat, which were placed in more remote areas on Savai'i and Upolu islands, as shown in Figure 1, to enable evaluation of their performance under conditions more closely akin to those anticipated in village culture projects.

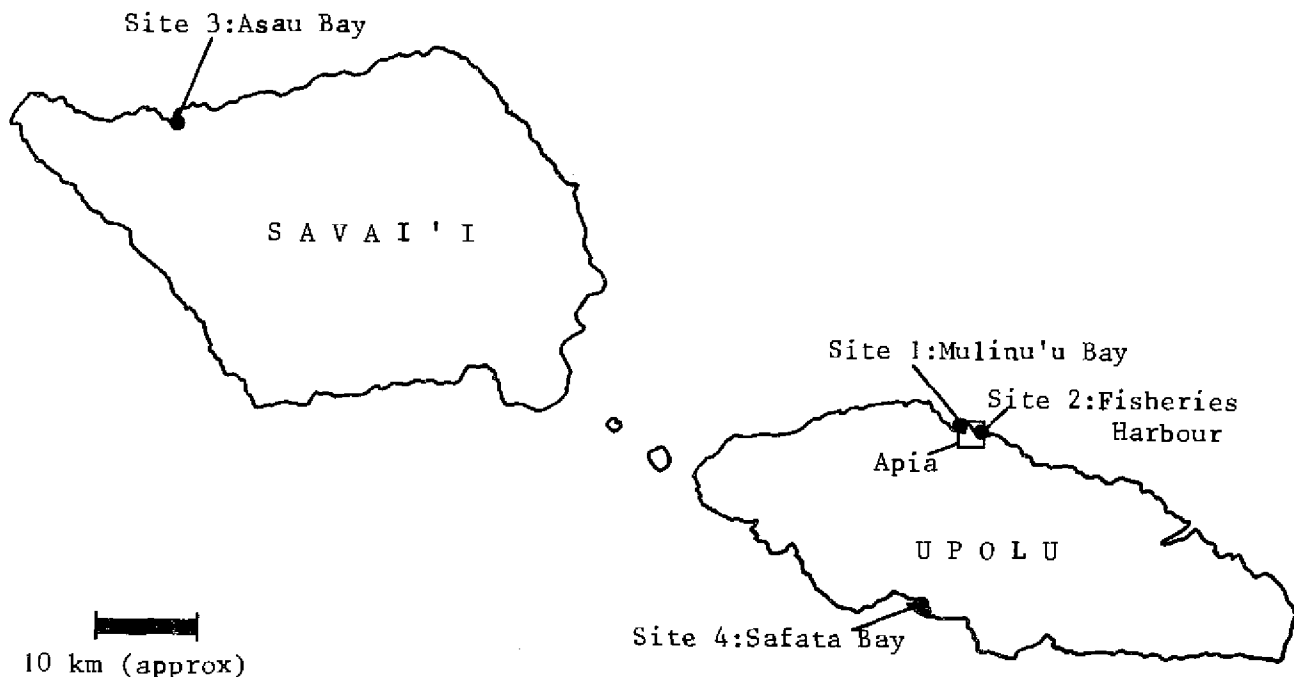


Figure 1: Pilot mussel culture sites in Western Samoa

Phase 1

The 40,000 spat delivered in mid-June 1982 had an average shell length of 9 mm, and were bound onto short lengths of 1.5 cm diameter polypropylene rope by wrapping them around the rope with strips of old knotless 5 mm square-mesh netting. This holds the spat in close contact with the rope until they attach themselves firmly by their own byssus threads. Once attachment has begun to occur, restriction of the growth of the mussels can be avoided by carefully slitting the netting, which is ultimately completely removed or deteriorates.

After binding on the spat, the ropes were each attached by one end to the underside of anchored bamboo rafts, of about 4m x 5m, and suspended vertically. The density of the spat along the rope sections was about 250-275 mussels per metre.

Site 1 : Mulinu'u. Approximately 10,000 spat were attached to one raft, on 18 rope sections each of about 2m in length. The site is a dredged area of about 300 sq.m and a maximum water depth of about 2.25m, set in a shallow bay about 5 times larger, and supporting some local bivalves. Salinity varied from 36 to 38 ppt (parts per thousand), temperature from 27.6° to 29.6°C, and pH from 7.5 to 8.1, during the four months that data was kept.

The mussels on this raft suffered severe mortality in the first month, and by mid-July a mere 170 mussels were left (less than 2%). This was attributed largely to poor handling and binding techniques - dead mussels were found in clumps under heavily and tightly wound netting, and some netting had been cut away before the spat were properly attached to the ropes, allowing the mussels to be swept away. It was clear that there had been human intervention, as some ropes were found stripped of mussels and there was some, but very little, evidence of natural predation. The raft was eventually cut from its anchor and blown ashore in November, 1982 after which it was dismantled and removed. At that time, the average length of the mussels had reached 2.0 cm (range 1.2 - 3.3cm) with only 72 mussels remaining.

Site 2 : Fisheries Harbour. About 30,000 spat were attached on 3m rope sections to two rafts in the same way as at Site 1. The area, located close to the centre of Apia, is open to the influence of oceanic waters through the large passage of Apia harbour, although the rafts themselves are protected by a newly constructed breakwater. The water of the harbour is relatively clear, a Secchi disc still being visible at the bottom, which is 4-5 m deep. Salinity was generally around 36 ppt and temperature varied from 27.2° to 30.6°C, with lower temperatures being experienced in July-August and higher ones in October-April.

Again, there was an initial mortality problem, with overall survival of only 30% after the first month. Heavy sponge and algal settlements occurred on the ropes in the months that followed, possibly hindering food acquisition by the mussels. Growth has been slow, with an average length of 3.3cm (range, 1.9 - 4.7cm) being attained after 10 months, although an increase in growth rate over the warmer months was noted (see fig.2). Meat content is low, and there is no sign of gonadal development. Some human interference also occurred, and only 400-500 mussels remain there now.

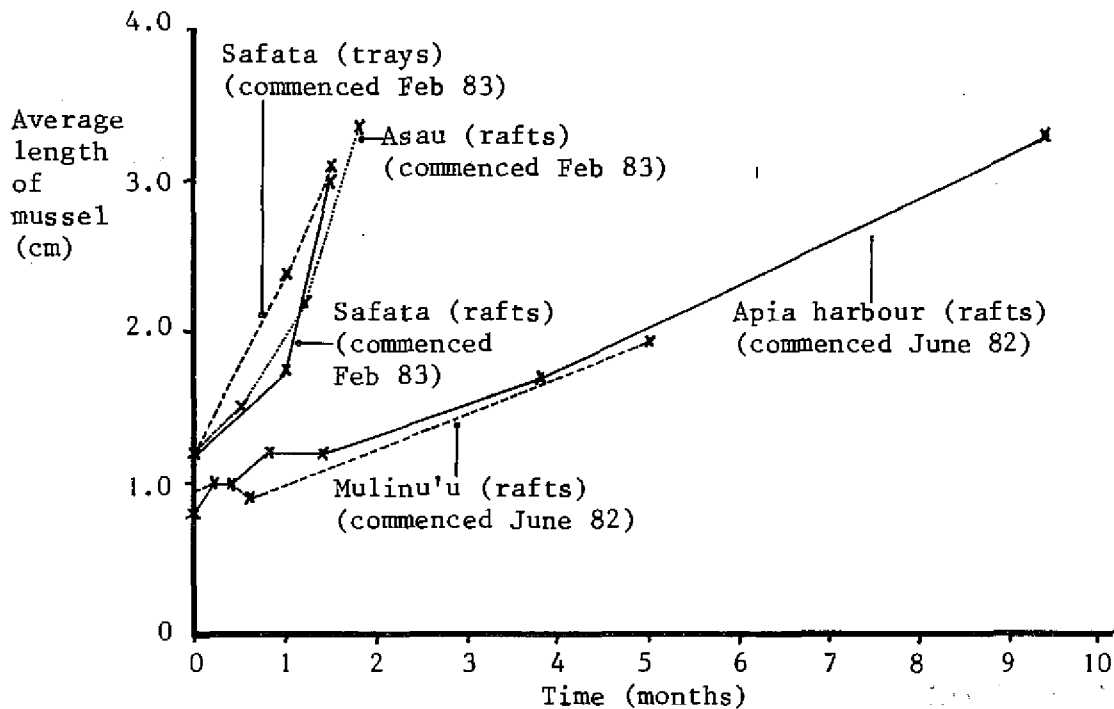


Figure 2: Average mussel growth rates for the two spat importations of June 1982 and February 1983

Phase 2

The second importation of approximately 70,000 spats, 93 days old from settlement and with an average shell length of 12mm, arrived in February, 1983. These were attached to rafts as before, with careful attention directed to spacing the spats more evenly on the ropes, avoiding large clumps of more than 40 in one spot, and binding them more gently with only one layer of netting. Another method of attachment in trays was also attempted at the Safata site.

Site 3 : Asau Bay. Rock oysters and barnacles abound on the rocks around the edges of this large bay, which has an area of 100 hectares estimated as suitable for mariculture (AQUACOP survey, July, 1978). A total of about 30,000 spats were attached to two rafts on growing ropes 3m long hanging below them.

The water is a rich green colour and Secchi disc visibility does not exceed three metres at one of the raft sites. This information combined with the growth rates of the mussels and of other bivalves in the area, suggest a rich supply of plankton. The water is about 10m deep below one raft and 5m below the other. Surface salinity is 30 ppt at the first site, 24 ppt at the second, and temperature in the bay varies from 28.0° to 31.5° C. Temperature drops suddenly 1-2 C and salinity rises to 36 ppt at a depth of 3m. Surface pH readings vary from 7.5 to 8.0. All these parameters will be monitored for evidence of seasonal change.

Mussel growth has been rapid, and their average length is now 3.6 cm, with a range of 2.4 - 4.9 cm. This represents an average growth of 2.4 cm in 1.5 months or 1.6 cm/month. Attachment was rapid and strong, and mortality was estimated at less than 10% (thought to occur mainly in areas of rope which were too crowded with mussels despite attempts to attach them carefully). Barnacles have settled on some mussel shells, but do not appear to be causing any damage. Gonadal development has begun, though mussels are not yet ready to spawn. Bright white and bright orange meat clearly distinguishes between male and female mussels, whereas no such distinction is possible with the Apia mussels, and meat quality and quantity are high.

Site 4 : Safata Bay. This bay is actually a well protected tidal pond lying between the shore and a peninsula parallel to the shoreline, and supports a wide variety of bivalve and crustacean life. Two rafts were placed in deeper areas of the bay (2.25m) with growing ropes 2m long. The salinity at the rafts was recorded as 28 ppt at low tide and 34 ppt at high tide, temperature from 30-31°C, and pH about 8.0. A total of 30,000 spats were attached to these rafts. An estimated 10% of the spats were lost as they apparently did not travel well (they floated when they were put in the water), and about 50% were found dead on one raft when the netting was slit too soon after binding. An additional 10% loss was incurred at this same raft presumably because of weak attachment, being knocked off by floating objects, and by people using the raft as a diving board. The other raft also suffered about a 40% loss due to tight binding. Growth rate of these mussels has been 1.2 cm/month for the past 1.5 months (average length 3.0 cm; range 2.3 - 4.0 cm).

Additionally, about 10,000 spat were placed in 3cm x 1m x 1.5m wooden-framed trays with small-mesh screening on the bottom, set in an area about 1m deep. Several 1m lengths of 16mm reinforcing rod, to which it was anticipated that the mussels would attach themselves, were introduced to the trays. Once attachment is complete the reinforcing rods can be removed and easily transported or hung horizontally for further growing on, a method based on trials in Tahiti.

Predatory crabs and siltation were an initial problem and necessitated separation of the trays (two on one rack and one on another) which also had to be closed in with 2.5 cm wire mesh. The mussels have been left to grow, most now attached to the reinforcing bar, but some to the wooden frame, and a few to the small-mesh screening. These latter will soon be removed as they are causing the accumulation of silt and algae.

Growth of these mussels has been about 1.3 cm/month, with an average length of 3.2cm and a range of 2.2 - 4.2cm. About 20% of the spats on the top tray floated away before attaching due to the current, and about another 40% mortality occurred on the bottom tray, mostly due to predation by the crab Scylla serrata. Puffer fish have also been seen attacking mussels on both the rafts and the trays.

Conclusions And Future Outlook: The growth which has occurred at the Asau and Safata sites clearly show that the culture of green mussels from spat to marketable size is possible in Western Samoa. As shown below, growth rates at these sites exceed those experienced in many other countries which market green mussels, although it must be kept in mind that these rates occurred during part of the warmer season, and may decline somewhat during the cooler part of the year.

Comparative Growth Rates Of Perna Viridis

WESTERN SAMOA	Asau	1.6cm/month
	Safata	1.2cm/month(rafts) 1.3cm/month(trays)
TONGA		0.5cm/month
TAHITI		0.8cm/month
PHILIPPINES		1.0cm/month(marketed after 4 - 6 months)
INDIA		1.2cm/month(marketed after 5 - 6 months)
INDONESIA		0.8cm/month
SINGAPORE		1.0cm/month(marketed after 6 months).

Data from Fisheries Division Annual Report, Tonga, 1982, and Davy and Graham, 1982.

We conclude that the spat placed in the Apia sites were not handled well, but more importantly that site selection was not optimal with respect to the nutritional requirements of the mussels. The question still remains as to whether the Asau or Safata mussels will spawn. Current plans call for continued data collection on the gonadal development of the mussels and preparation of settling ropes and plankton sampling when spawning seems likely to occur. Future plans will include expansion of these sites and investigation of other suitable areas for mussel culture.

REFERENCES

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