

Inshore Fisheries Research Project
Country Assignment Report

THE NAMDRIK PEARL OYSTER PROJECT

South Pacific Commission
Noumea, New Caledonia

The Namdrik pearl oyster project

by

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SUMMARY AND RECOMMENDATIONS

1. INTRODUCTION

Three weeks were spent on the island of Namdrik in November 1990. During this period, the consultant was able to deploy a number of spat collectors, establish a sub-surface pilot pearl oyster culture farm, construct an underwater platform, and discuss with the people the outline of a pearl oyster management plan for the lagoon at Namdrik Atoll.

2. PEARL OYSTER ABUNDANCE

Pearl oysters were found in moderate numbers around and in close proximity to coral heads. Over 50 per cent of the lagoon is too deep to support wild oyster populations thereby, severely restricting settlement area for pearl oyster larvae.

2. MOTHER OF PEARL FISHERY

The diving of pearl oysters from the wild to support a fishery based on the sale of mother of pearl is not feasible.

3. SPAT COLLECTION PROGRAMME

Water exchange and geographical features appear to favour artificial spat collection. This area of development should be given priority. Over the next twelve months, a minimum of 1,000 spat collectors should be deployed on a monthly basis. Different types of collector materials should be used, and a careful monitoring programme set up to determine peak spawning periods.

4. POTENTIAL FOR PEARL CULTURE

There is potential for the development of a limited pearl culture industry. The long term viability of pearl farming will depend almost entirely on the ability to collect seed stock through the implementation of a successful spat collection programme.

5. PILOT PEARL FARM

The establishment of a pilot pearl farm is highly recommended. The acquisition of important information on a number of critical areas with respect to pearl farming can be achieved through the operations of a pilot pearl farm.

6. PEARL OYSTER MANAGEMENT PLAN

The present Namdrik Alele Local Government Pearl Culture Ordinance of 1985 should be strengthened to include a complete ban on the harvesting or taking of pearl oysters from the lagoon. A suitable area for the establishment of a permanent reserve should be identified and gazzetted. This area will act as the depositary for those oysters deemed unsuited for pearl culture.

7. TRAINING

It is proposed that the Marshall Islands Marine Resources Authority (MIMRA), identify and designate a staff member to be responsible for the development of pearl farming. This person should be given the opportunity to undergo practical training on a commercial pearl farm for a period of 2 to 3 weeks duration, preferably in the Cook Islands, where there would not be a language problem. This officer will be expected, on his return, to oversee all maintenance and developmental work on the pearl farm at Namdrik, and to conduct training programmes on pearl oyster culture and husbandry.

8 LONG TERM DEVELOPMENT

The future and the level of pearl farming on Namdrik will depend to a large degree on how successful the spat collection programme will be. Initially, pearl farming activities should only be carried out on a single farm under the management of the Namdrik Alele Local Government, with assistance from the National Government. This farm will have the dual purpose of providing the venue for training, and by its existence, will contribute to a stock enhancement programme. If, at some time in the future, pearl oyster spats can be collected in quantity, it may be feasible to either expand the operations of the communal farm, or to permit small co-operative type farming operations to begin.

The island of Ebon further to the south should be surveyed as soon as possible to determine pearl oyster populations. If results prove encouraging, a programme for the deployment of spat collectors should be implemented.

Other lagoons in the Marshall Islands may prove suitable sites for pearl farming. Provided seed stocks can be made readily available, the potential for expanding pearl farming operations to other locations in this archipelago may be viable.

ACKNOWLEDGEMENTS

This work was made possible by the support and assistance of a number of organisations and individuals. The United States Agency For International Development provided the funds to purchase most of the materials required for the project. The South Pacific Forum Fisheries Agency ordered and arranged payment of project materials. The South Pacific Commission through its Inshore Fisheries Research Project funded the consultant. The Marshall Islands Marine Resources Authority provided all of the necessary on-the-site backup support.

The consultant would like to thank the Senator and Vice Speaker Andrew Hisaiah for his guidance and support on Namdrik, Mr Steve Muller, Director of the Marshall Islands Marine Resources Authority, for the welcome advice and personal hospitality that was given freely, and to all the people of Namdrik, and in particular to William Gideon and his family who went out of their way to provide a home away from home.

Finally, special thanks must go to Ronald Alfred, counterpart to the consultant, for his untiring help and indispensable advice and guidance.

THE NAMDRIK ATOLL PEARL OYSTER PROJECT

1. INTRODUCTION

1.1 GENERAL: The island of Namdrik (Fig.1), lies 208 nautical miles SW of the capital Majuro. It is the second southern-most island within the Marshall Group. It has a land mass of 2.77 square kms, and a lagoon area of 8.42 square kms. The most recent population census (1986) lists the number of inhabitants at 814, and the number of dwellings at 96. The island itself is densely covered with vegetation. Coconuts, bananas, breadfruit and pandanus are grown in quantity, and with fish, make up the bulk of the inhabitants diet. Pigs and domestic fowls are raised by almost every household to supplement and add variety to the ubiquitous diet of fish. A local inter-island shipping service originating out of Marjuro, services the island once every 2 to 3 months. By this service, the inhabitants are able to export their copra and to import basic foodstuffs and other essential goods. Air Marshalls provides a weekly flight to Namdrik. The island, for all practical purposes, is governed by an Island Council. This consists of 15 elected members and a Mayor. In addition, the Senator and the 4 chiefs of the island are accorded automatic rights, with full voting powers, on the Council. The term of office for all elected members to the Council is for 2 years. The island has a subsistence economy with copra being the major income earner. Some local handicrafts, and salted and dried fish are sold to markets in Marjuro. Of the total population, only 16 are employed by Government.

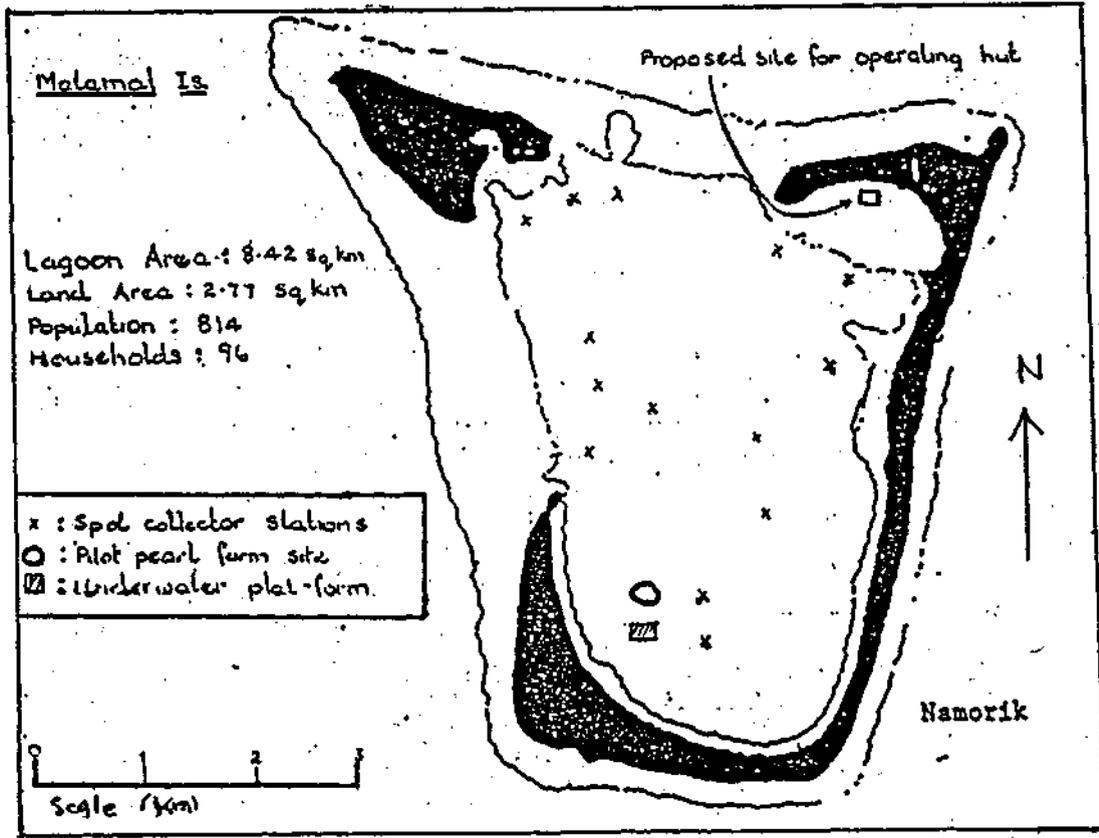


FIGURE 1: NAMDRIK ATOLL

1.2 HISTORY OF PEARL SHELL EXPLOITATION: There appears to be no documented evidence dealing with the exploitation of the black-lipped pearl oyster resource, Pinctada margaritifera, on Namdrik. Mention has been made of a Japanese button manufacturing company (Nakai Industries Ltd, Nara Prefecture), having purchased mother of pearl (MOP) from Namdrik at US\$0.30c per lb during the mid 1980's. However, this could not be substantiated through interviews held with several of the inhabitants.

It has been reported that in the early 1930's, a Japanese living on the island of Ebon would occasionally travel to Namdrik to collect live oysters. These oysters were shipped to Ebon for transplanting. (Jia Hisaiah, Namdrik resident, pers comm)

During the mid 1970's, between 10,000 and 15,000 oysters were harvested over a period of 2 weeks. Harvesting was terminated when it was established that the company that was to have bought the shells did not possess the necessary permits. The oysters that had been harvested were never sold and have since been discarded. (William Gideon, Community Judge, Namdrik Is. pers comm)

During 1987, a Korean businessman arrived on Namdrik and offered to purchase pearl shells at US\$1.25 per lb. With the assistance of a few local divers, approximately 1,000 pearl oysters were taken during 3 days of diving. The Island Council, unaware at first as to what was happening, quickly stepped in and halted the harvest. The pearl shells from this harvest were never sold, and the consultant was able to view the remains of this harvest. The shells from this harvest had been left in a pile on the beach and had been sun-bleached and no longer had any commercial value. However, it was possible to ascertain shell diameter and damage caused by borers and sponges. Most of the shells were examined randomly and it was found that these were mostly in the 5 to 6 inch range and of average quality.

1.3 THE CONSULTANCY; Developing the pearl oyster resource on Namdrik was first mooted when the Senator for Namdrik visited the Cook Islands in the latter part of the 1980's. In 1989, the South Pacific Commission was approached by the Marshall Islands Marine Resources Authority (MIMRA), with the view to identifying a consultant. This consultant was to undertake the preliminary task of constructing and deploying a number of spat collectors, and to establish the nucleus of a pilot pearl oyster culture farm on Namdrik. However, before the request for assistance to SPC, no survey of the abundance of the pearl oyster stock on Namdrik had been carried out. An officer from the MIMRA was therefore attached to the field survey team that undertook a pearl oyster abundance survey of Christmas Island in May 1989. On his return to the Marshall Islands, this officer then proceeded to the island of Namdrik where he undertook a pearl oyster abundance survey.

On the basis of this report, the consultant was then recruited in September 1990.

The consultant arrived in Marjuro on 1 November 1990. A record of meetings and people met in association with the work of the consultant is attached (Attachment 1).

1.4 TERMS OF REFERENCE:

The specific terms of reference were:

a) In consultation with the Marshall Islands Marine Resources Authority, other relevant authorities and the people of Namdrik Atoll prepare a resource management plan for the development, management and conservation of the pearl oyster resource on Namdrik. Such a framework should be sensitive to the role of central government in this development and should stress that the concerns of the people of Namdrik can best be accommodated through management principles which they have developed themselves.

b) Between 2,000 to 3,000 spat collectors should be assembled and deployed at suitable sites in the lagoon of Namdrik Atoll to collect the settlement of juvenile black lip pearl shell.

c) A pilot pearl oyster farm should be established at a suitable site in Namdrik Atoll, commencing with the collection of approximately 2,000 wild adult pearl oyster for sub surface culture on buoyed long lines and for subsequent local implantation.

d) A draft project development plan for the pilot pearl shell farm at Namdrik Atoll should be formulated in consultation with the relevant authorities and the Island Council of Namdrik including the terms of reference for a Project Manager. Attention should be paid to counterpart training by which there can be a transfer of the skills necessary to maintain the culture pearl shell stocks at Namdrik Atoll.

2. APPROACH:

2.1 GENERAL: On arrival in Marjuro, the consultant met with a number of people from central government. He discussed matters of procedure and gathered background information on the project. Some time was spent in purchasing essential farming materials that were available locally. An inventory was made of all project equipment ordered from overseas. It was unfortunate that no dive compressor was available to the project. This fact hindered or effectively curtailed some of the work that the consultant had intended carrying out on Namdrik. Several dive cylinders were filled with air in Marjuro and shipped to Namdrik in an effort to overcome the problem.

After some initial shipping delays, the consultant, and his counterpart from MIMRA departed Marjuro for Namdrik on 6 November by surface vessel.

On arrival in Namdrik, a meeting was held with the people of the island. The work that was to be undertaken was explained to the people at some length, and their cooperation sought. As the work progressed, whatever initial reluctance that had been expressed by some of the people soon disappeared. This was evidenced by the number of people who frequently turned up to assist with the work on a voluntary basis. (Attachment 2).

Throughout the time spent on Namdrik, the consultant conducted a series of workshops related to pearl oyster culture and husbandry. At the request of some of the divers attached to the project, a workshop was conducted on SCUBA, with particular emphasis on safety.

2.2 SPAT COLLECTORS: Spat collecting materials that had been ordered for the project and were on hand consisted of the following:

- 4,000 Polyethylene net sacks (collector bags) 40cm x 80cm;
- 100 Polyethylene net baskets, lantern type, 6mm mesh;
- 8 x 12mm x 220m coils superfilm rope;
- 2 x 6mm x 220m coils superfilm rope;
- 10 coils New Christmas tree mussel rope;
- 50 cartons Spatch Catch;
- 2 x 20mm x 250m coils polypropylene multiplat rope.

Some local purchases of ropes were required. These consisted of:

- 12 x 10mm x 250m coils Polypropylene rope
- 4 x 4mm x 250m coils Polypropylene rope

Three types of spat collecting materials were used. All Christmas tree ropes were cut in 1 meter lengths and 2 of these lengths were placed inside each spat collector bag. The same procedure was used for the spatch catch material. The multiplat rope were also cut up into 1 meter lengths but were unravelled to increase surface area. After placement of the spat collecting material inside the spat bag, the spat bag opening was then closed by pulling on the draw-string provided. Each spat bag was then attached at 1 meter intervals by this draw-string to a main line consisting of 10mm x 250m polypropylene rope. Approximately 250 spat collectors were strung on each main-line. (When attaching the spat bag to the main line, it is important to use a knot that can be easily untied. The spat bags can then be removed underwater with ease for inspection). Spat bags can be cleaned and reused.

A total of 3,500 spat collectors were made up using all the materials available.

Before the deployment of the spat collectors, a quick survey was made of the lagoon to mark out those areas best suited for anchoring the collectors. With the assistance of a portable depth sounder, it soon became apparent that much of the lagoon floor was at a depth greater than 45 meters. In most instances where soundings were taken, the depth increased very rapidly as one moved away from coral heads. Some areas recorded depths greater than 75 meters, this being the limit of the sounder.

Experience in other pearl oyster production areas have shown that the black lip pearl oyster rarely inhabits areas that are at a depth greater than 38 meters. Exploratory deep dives were made by the consultant and his counterpart to see if this would be the case for Namdrik. Except for a single oyster that was found at a depth of 41 meters, no other animals were observed growing beyond their recognised depth range. Most of the oysters observed were found in depths ranging from 2 to 18 meters, and tended to be associated with the larger coral outcroppings.

Because of the rapidly increasing depth as one moved away from these coral heads, spat collecting deployment sites had to be close to these shallower areas of the lagoon. However, an attempt was made to set the collectors in what appeared to be the most suitable areas, given the constraints of lagoon depth.

Each mainline with an average of 250 collectors was anchored in depths ranging from 10 to 30 meters (Fig 2). Collectors were positioned in the water column at an average depth of between 4-6 metres, using plastic floats. Each mainline carried all three types of collector materials. This was done so an assessment could be made as to which of the collector materials proved to be the most effective for spat settlement.

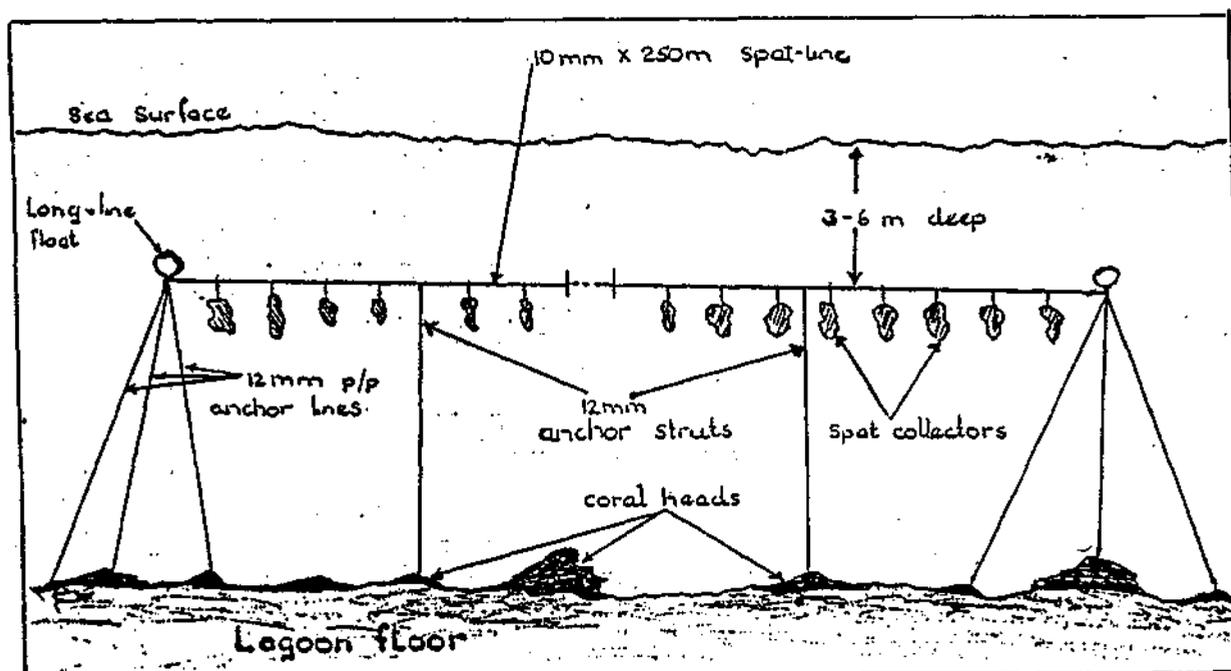


FIGURE 2: SPAT COLLECTOR LINE CONFIGURATION

Collectors will sink to the bottom of the lagoon floor with the passage of time, as a range of marine organisms begin attaching themselves to the collectors. It is important to maintain the collectors inside the 4-6 meter depth range. This can be accomplished by adding more floats to the mainline at the required intervals.

Collectors require periodic inspection and maintenance. Excessive algal growth may occur on the surface of the collector bags thus preventing pearl oyster spats from settling. Excessive growth needs to be removed either underwater or by detaching the collector bags from the mainline and cleaning out of the water. When collector bags are removed from the water, care must be taken not to allow these to be out of the water for extended periods of time as spats that may have already settled could be stressed and may later die.

2.3 PILOT PEARL OYSTER FARM: A total of 980 pearl oysters between 7 to 15cm in diameter were drilled and hung on sub surface buoyed long lines (Fig 3). Oysters were collected by free diving and transported to shore where they were graded according to size and age. Those that appeared to be aged or stunted were returned to a designated area within the lagoon and placed on solid substrate for breeding purposes. Each oyster selected for sub-surface culture was thoroughly cleaned and a hole drilled at the base of the shell. (Care must be exercised when carrying out this operation so the point of entry of the drill bit does not touch any living tissue). A short length of monofilament fishing line(40-50kg test) was then threaded through this hole and a firm knot made. This process was repeated for all selected oysters.

Branch lines from which to hang oysters were made from 4mm polypropylene ropes cut into 3 meter lengths. Knots were made at 25 centimeter intervals. These knots were used as attachment points for the drilled oysters. Oysters were hung in pairs from each knot by inserting the free end of the monofilament line through the center of the knot and then tying firmly. A total of 20 oysters, hung in pairs, were attached to each of these branch lines.

The sub-surface long lines from which the branch lines hang from consisted of 16mm polypropylene rope. These were firmly anchored to coral heads (Fig 3), and buoyed to a depth of 3-4 meters. Each branch line consisting of 10 pairs of oysters were spaced at 2 meter intervals along the long line. Long lines were spaced at 5 meters apart.

2.4 UNDERWATER PLATFORM

In addition to the construction of sub-surface long lines, an underwater platform was constructed. This was for an alternative method of pearl oyster culture, and to provide a medium for pearl oyster spat grow-out. Materials used for the construction of the platform were made up of PVC pipes and local timber (Fig 4). Construction and site selection were done in such a manner that

any future extension to the platform can be accomplished with little difficulty. If, and when oysters are nucleated, underwater platforms offer ideal structures for post-operational recovery of oysters. This is because of their close proximity to the lagoon floor.

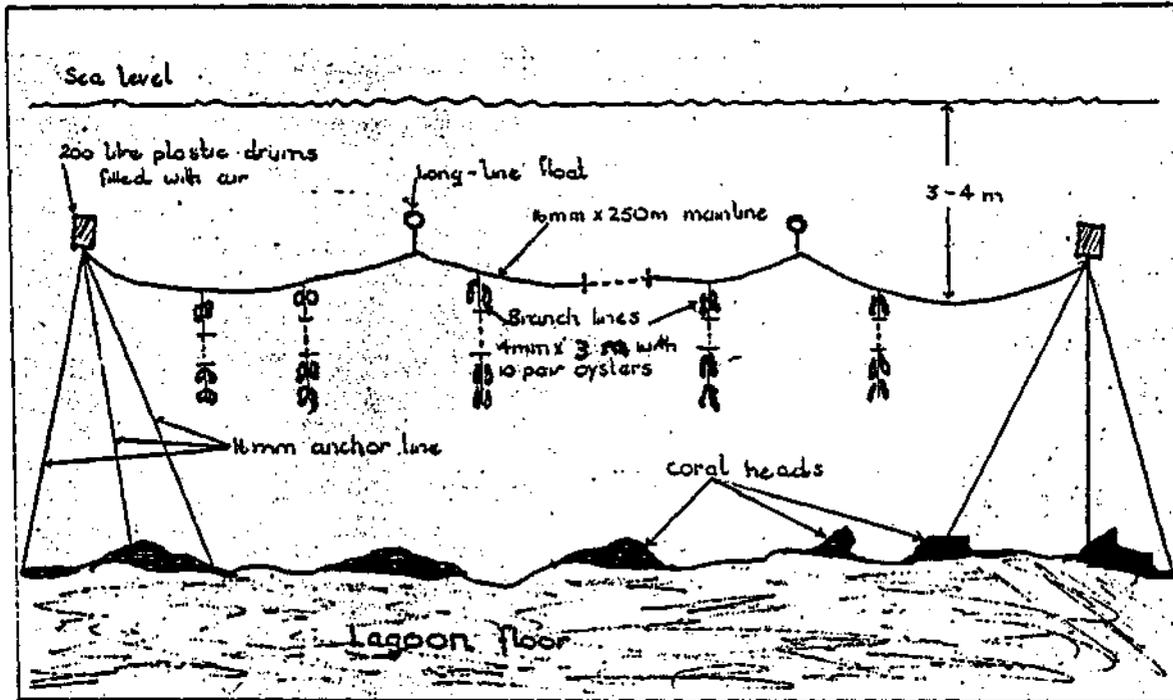


FIGURE 3: SUB-SURFACE PEARL OYSTER CULTURE

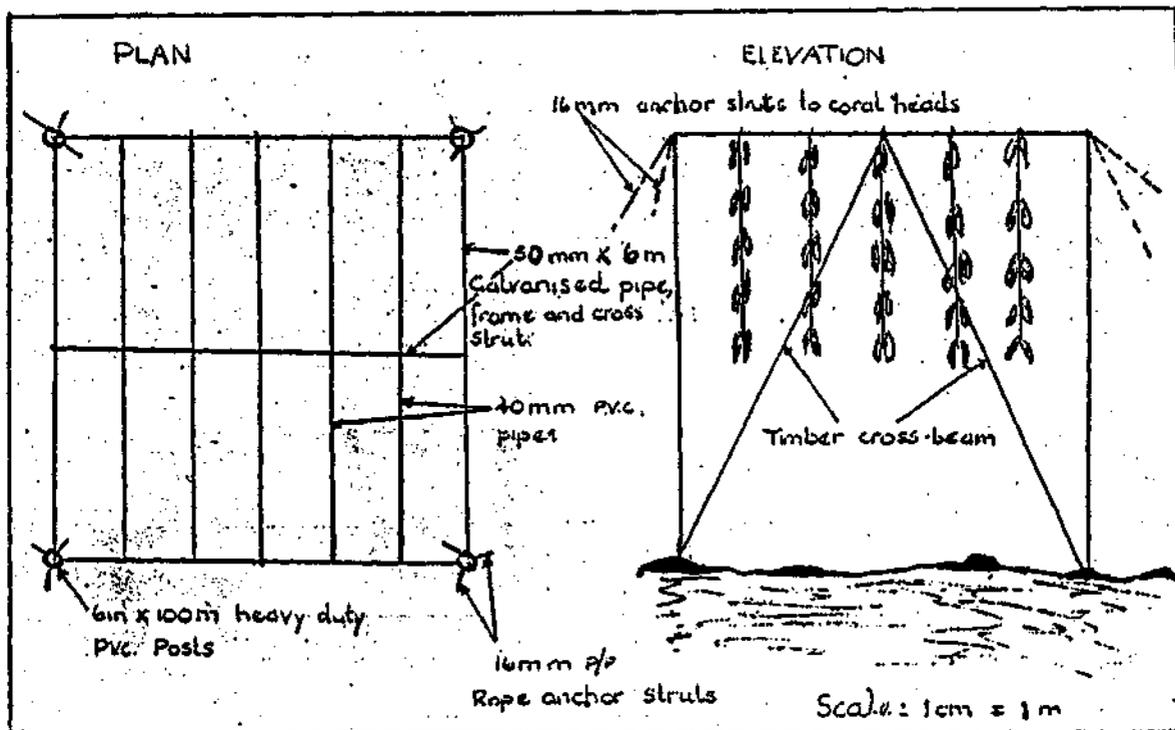


FIGURE 4: UNDERWATER PLATFORM

3. DRAFT PROJECT DEVELOPMENT PLAN FOR A PEARL OYSTER FARM AT NAMDRIK ATOLL.

3.1 INTRODUCTION: In 1984, a survey of some of the lagoons of the Marshall Islands for pearl oyster abundance was conducted. Except for the island of Namdrik, little or no black lip pearl oysters were encountered. A subsequent survey of Namdrik lagoon was made by MIMRA in 1989 which gave encouraging numbers. However, little mention was made of the fact that much of the lagoon proper at Namdrik Atoll is very deep and therefore out of the naturally occurring range for the species. It is estimated that over a half of the lagoon area is too deep to support wild populations of the black lip oyster through natural settlement.

The barrier reef that surround the atoll has no openings. However, water exchange that occur over the reef and into the lagoon during high tide is quite significant. The lagoon is relatively enclosed, and because of this, it can be expected that larval loss over the reef through excessive water exchange will be insignificant. It would then appear that the physical characteristics of Namdrik Atoll are suitable for spat collection.

The success of pearl farming depends heavily on reliable seed oyster supply. In areas where natural stocks are abundant (e.g. French Polynesia and Cook Islands), there has been a tendency to harvest these to supply pearl farms with seed stock. This practice has led, in some instances, to over-harvesting, resulting in poor spatfall and dangerously low levels of standing stocks.

It is generally agreed that pearl oyster spats harvested from collectors exhibit better nucleus retention capability than those collected from the wild. Young oysters acclimatise more readily to a farm situation and the nucleation process. This is perhaps because over time they exhibit less stress when they are subjected to man handling during the normal course of their existence on the farms.

Current stocks of pearl oysters on Namdrik Atoll are probably not large enough to support a pearl farm of up to 20,000 nucleated oysters per annum, through the supply of seed stock from the wild. A farm of this magnitude will carry, by the third year of its nucleation programme, close to 100,000 oysters. It is therefore important, if pearl farming is to be considered, that a comprehensive and well executed programme of spat collection be implemented as soon as possible.

3.2 SPAT COLLECTION PROGRAMME: The success of any spat collection programme will depend, to a large degree, on knowing when peak spawning periods take place. Placing collectors in the lagoon just before mass spawning will increase the chances of collecting spats of the right type, and in fairly large numbers.

A total of 3,500 spat collectors using three types of materials are now in the lagoon. Without prior knowledge of seasonality about oyster spawnings in Namdrik, it is imperative that good records are kept of whatever spatfall occurs, the location, and the type of material that is most effective in the collection of spats.

There are a number of different types of collector materials that are used for spat collection. Dependant on the availability of funds, trials should be carried out using a variety of collector materials. This would assist in determining which of these are the most effective for spat settlement. An attempt should also be made to experiment with setting collectors constructed out of the young branches of the plant Pemphis acidula, a shrub that is quite common along the foreshore area of Matamat island.

A target of up to 1,000 spat collectors using various collector materials should be deployed at suitable locations on a monthly basis over a period of twelve months. This programme should be given priority and the results should provide valuable information on peak spawning periods and when best to deploy collectors.

All collectors should be set in the water column between 3-6 meters below the surface. This allows for less movement and therefore less wear on the collectors themselves. Collectors on the surface, apart from being navigational hazards, are prone to collecting excessive and undesirable growth.

Collectors should be inspected at least once every month, to determine spat fall and to allow for maintenance. Collectors that accumulate growth will begin to lose buoyancy, and if not buoyed, will sink to the lagoon floor and their spat collecting capabilities reduced considerably. Heavy mortalities of pearl oyster spats have been known to occur when collectors have sunk to the bottom of the lagoon floor and where silt has built up over the collectors.

Spats found on the collectors should be allowed to grow up to 7 or 8cm before being removed, drilled and hung on branch lines. In the case where many spats have settled on a single collector, there will be a tendency for the oysters to bunch together. Those oysters in the middle may receive little nutrient. In such cases, spats will need to be removed at an early stage and placed in lantern baskets (20 spats per basket). These lantern baskets which act as nurseries for the young oysters can either be suspended from the sub-surface long lines or from underwater platforms. Once these spats have reached sizes of about 8cm, they can be removed from the lantern baskets, drilled and hung on branch lines ready for attaching to the sub-surface long lines.

There were little signs of any significant numbers in the populations of the normal predators associated with pearl oysters, such as octopii, rays and molluscivorous fishes. It is quite possible that the need to place collector materials inside spat bags for the protection of the newly settled spats may not be necessary. If this is the case, there will be considerable economic savings towards the implementation of a spat collection programme.

3.3 DEVELOPMENT OF A PEARL FARM: Work towards this end has commenced with the setting up of the pilot pearl farm of almost 1,000 pearl oysters collected from the wild. These are now hanging from sub-surface long lines.

Collection of oysters from the wild should continue over the next twelve months. Care must be exercised in that only healthy oysters are taken for the farm. It is inevitable that there will be oysters taken from the wild that will not be suitable for culturing. These oysters should be returned to a designated reserve as soon as it is determined that they are unsuited for farming. Causing unnecessary mortality among wild oyster populations must be avoided at all costs.

Ten thousand oysters between 7-15cm in diameter would provide the nucleus of a pearl farm. This should be achievable over a period of twelve months through the collection of oysters from the wild. Oysters should be kept out of the water for the minimum time possible when drilling and cleaning operations are being carried out. Oysters that have been hung on branch lines should be attached to the sub-surface long lines as soon as possible. Branch lines should carry a standardised number of oysters, and it is recommended that this number be set at twenty. Excessive numbers of oysters per branch line will prove awkward during routine oyster cleaning operations. Oysters should be cleaned of all foreign growth by chipping these off with the use a blunt knife, or similar instrument. This operation is usually carried out once every 2-3 months, depending on the severity of growth.

3.4 OYSTER SEEDING

Pearl oysters are normally seeded when they are three years old or about 12cm in diameter. During the pearl seeding operation, a spherical nucleus or round bead between 3 to 12 mm in diameter is implanted into the pearl sac or gonad of the recipient oyster. A piece of the mantle or nacre secreting tissue of a sacrificed oyster is also implanted. The details of this operation are known to many. However, Japanese pearl seeding technicians perform the majority of these operations, having consistently achieved excellent nucleus retention rates.

Japanese pearl seeding technicians currently work out of Australia, French Polynesia, Cook Islands, Indonesia, and the Philippines. They can be hired to seed oysters either through making a cash payment (normally \$4.00/oyster), or through an arrangement where an agreed percentage of the pearl harvest will

go to the technician. The latter arrangement is perhaps more attractive to the pearl farmer whose oysters are to be seeded.

He does not have to tie up his capital for up to 24 months at a time. In addition, this type of arrangement insures that the technician will do his best work as his remuneration will be dependent on his success rate. However, not all technicians will agree to an arrangement such as this. This is particularly true if they have no prior knowledge or yardstick by which to measure their prospective client's capability and reliability in terms of carrying out good post operative pearl oyster husbandry.

Depending on a number of factors, pearls can be removed from the oysters as early as 18 months from the time of nucleation. Pearls can be removed without killing the oysters. Suitable oysters can be reseeded, usually with larger nuclei. Second seedings usually produce larger and better quality pearls.

It is quite possible that a seeding operation can be mounted by mid 1992. The number of oysters to be seeded will depend on how many oysters have been collected from the wild and placed on the sub surface long lines. If, as recommended above, 10,000 oysters can be collected from the wild over the coming 12 months, it may be possible to nucleate up to 5,000 oysters sometime during the latter half of next year. It will become clearer at the end of the current year whether a nucleation programme can take place in 1992.

A pearl operating hut will need to be built. This would best be over a protected area of the lagoon and where oysters that have been prepared for nucleation can be lifted straight out of the sea and on to the operators work bench. This will reduce considerably the amount of time that the oyster will have to spend out of the water.

No suitable location for the establishment of a pearl operators hut could be found close to the main village. However, a suitable site was identified at the NE end of the main island (See Fig 1) . This location is well protected from the normal trade winds and depths of up to 15 meters close to the foreshore allows for underwater platforms to be constructed. These platforms can be built close to the operating hut where they can serve the dual purpose of conditioning the oysters before nucleation, and to provide ideal post operative sites for oysters recuperating from their operations.

There are several methods employed for the conditioning oysters before the nucleation process, and this varies among technicians. However, it is generally agreed that oysters must be in a sufficiently weakened state so the likelihood of it ejecting the implanted nucleus is reduced.

After the implantation of the nuclei, the oysters are handled carefully and are normally hung from underwater platforms or are placed in specially constructed plastic cages with up to 12 pockets or individual compartments. A single oyster is placed

inside each compartment and the cage is suspended from an underwater platform or sub surface long line. These oysters remain undisturbed during their post operative phase for up to 4 months. It is common practice to attach a fine mesh nylon bag around an operated oyster to catch an expelled nucleus. This practice serves two purpose. It provides the farmer with an accurate count of those oysters that have rejected their nucleus, and thus his expected harvest. It also provides the means by which to recover rejected nuclei, which are becoming very expensive.

The incubation period before the pearls are removed from their host oysters vary from 18 to 24 months. During the period that the oysters spend hanging from sub surface long lines, they must be cleaned at regular intervals to provide optimum growing conditions and to reduce mortality. Fouling by algae and other organisms such as parasitic sponges and polychaetes are common and such growth should be removed.

Because of the limited standing stock of pearl oysters on Namdrik, care must always be taken not to kill any oysters when pearls are being harvested. Those oysters not suitable for round pearl implantation should not be used for the production of blister, half round or mabe pearls. Instead, oysters that are not suitable for round pearl production should be placed in a reserve to act as brood stock.

4. PROJECT MANAGER

4.1 DRAFT TERMS OF REFERENCE

The project manager will be responsible for the following:

1. Maintain the current generation of spat collectors. This will include constant underwater inspection to see that all collectors are maintained in the water column between 3 to 6 meters below the surface. Fouling organisms growing on the spat bags will need to be removed.

2. Removal of spats from the collectors. These should be in the size range of 5 to 8cm. The larger shells can be drilled and hung directly on to the sub-surface long lines. Smaller spats are to be placed in lantern baskets (no more than 20 spats per basket) where they are allowed to grow up to 8cm before being drilled. Lantern baskets can either be hung from the sub-surface long line or from the underwater platform. Fouling will occur on the baskets and therefore constant care must be taken to remove these fouling organisms. Young oysters that are placed in lantern baskets will tend to congregate, with those in the center of these aggregations receiving little nutrient, resulting in poor growth, or even death. Oysters in baskets must be kept apart and prevented from forming these aggregations.

3. Maintain accurate records of spats harvested. This information must include the station from where the spats were taken, the date of harvest, the number of spats harvested, the type of collector material from which the spats were harvested and the average size of the spats collected.
4. Continue with placing more collectors at different locations within the lagoon. It is recommended that up to 1,000 collectors should be deployed each month for a period of 12 months. Different collector materials should be experimented with. The young branches of the shrub Pemphis acidula that are found growing in abundance on the island of Matamat should also be used as collector material.
5. Upgrade and maintain the underwater platform. If there is a need to extend the surface area of the platform, then this should be carried out as a matter of priority.
6. Maintain and clean all oysters that have been drilled and hung from the sub-surface long lines or underwater platforms. Oysters should be cleaned of all fouling organisms on a regular basis. Strings of oysters should be detached from the sub-surface long lines or underwater platforms and taken ashore for cleaning. All waste materials that have been removed from the oysters during the cleaning process should be disposed off on land and should not be put back in the lagoon. Strings should be checked for abrasions and replaced if necessary. As soon as the oysters are cleaned, they should be put back in the water without delay.
7. Check for abrasions on all mooring lines, particularly after inclement weather, and replace these if necessary.
8. Maintain all diving equipment and pearl farming gear. An inventory of all project equipment should be maintained and kept current.
9. Responsible for planning all dives using SCUBA or hookah. Must practise and implement safe diving among farm workers.
10. Record oyster mortalities on the pilot farm. All dead oysters are to be removed from the farm, the shells cleaned and stored under shade.
11. Continue with the collection of oysters from the wild to use as seed stock for the pilot pearl farm. A target of 10,000 oysters to be collected over the next 12 months should be set.
12. In collaboration with the Island Council, identify a suitable area within the lagoon that is to be used as a reserve. This can also be where oysters that are not suitable for farming purposes are deposited.

4.2 QUALIFICATIONS

The project manager should have the following qualifications:

1. A mature person between 30 to 45 years of age, physically fit, and should have completed secondary school.
2. Should be a certified SCUBA diver with some years of practical diving experience using either SCUBA or hookah gear.
3. Some previous experience in pearl oyster culture and husbandry desirable but not essential (on the job training can be given).
4. The ability to live on a small atoll community with only the basic ammenities available is essential.

5. PEARL OYSTER RESOURCE MANAGEMENT PLAN

5.1 BACKGROUND

For some time now, there has been the awareness within the Namdrik Alele Local Government that its pearl oyster resource, if exploited carefully, could yield much needed revenue for the island. In 1985, the Council enacted the Namdrik Alele Local Government Pearl Culture Ordinance. The Ordinance basically prohibits the harvesting and marketing of pearl oysters by anyone without the prior approval of the Council. The Ordinance also provides for monetary fines and imprisonment. This legislation has worked well except for the isolated incident that occurred in 1987 which is mentioned earlier.

There is a move within Central Government to give more autonomy to the local Councils to manage their own affairs. This augers well for the Namdrik Council in that they will be able to draw up the appropriate legislation for the development and management of their pearl oyster resource.

5.2 DRAFT MANAGEMENT PLAN

The main objectives of the management plan should take into consideration the following:

1. that any development of the pearl oyster resource should not detract from the traditional island ownership of that resource;
2. development should be structured in such a manner that it takes into account the traditional socio-cultural values of the people of Namdrik; and,
3. that any development should have the blessing of Central Government and that close liasion should be maintained between the Council and Government at all levels of development.

It was made abundantly clear to the consultant by the people of Namdrik that they preferred a communal pearl farm to any other type of farming arrangements. A communal farm, from a management perspective, provides certain advantages. Management issues are less likely to be contested vigorously as private pearl farmers will not exist. However, irrespective of the manner in which farming will be undertaken, there are some basic management issues relating to the pearl oyster resource on Namdrik, that will need to be addressed in a management plan.

Other issues that should be addressed in the management plan are:

1. setting a realistic quota of oysters for the communal farm;
2. conserving pearl oyster stocks to insure that there will always be sufficient brood stocks;
3. establish recognised pearl oyster husbandry techniques for the operation of the communal pearl farm;
4. strengthen the existing Namdrik Alele Local Government Pearl Oyster Ordinance by providing for the complete ban on the taking of pearl oysters other than for the purpose of establishing sufficient seed stock for the communal farm;
5. the prohibition of the transfer of pearl oysters from locations outside of Namdrik; and,
6. the establishing of a permanent pearl oyster reserve or sanctuary.

It may be possible at some future date when pearl oyster stocks have increased considerably, and when spats can be collected in quantity, to consider other forms of farming which could include family operated or cooperative farms. If this happens, then there will be the requirement for a more sophisticated pearl oyster management regime. Pertinent issues such as lagoon management, farming permits, farm quotas, spat collecting permits, seeding technicians, reporting and compliance procedures, and marketing will all have to be considered.

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Sims, N.A. (1988) Pearls and Pearl Oysters. Cook Islands Fisheries Resource Profile No 2.

Sims, N.A. (1990) Discussing and drafting a Pearl Oyster Management Plan in the Cook islands. A report to U.S.A.I.D. and the Cook islands Government.

ATTACHMENT 1

LIST OF PERSONS MET BY THE CONSULTANT

1. Hon Andrew Hisaiah, Senator from the Island of Namdrik and Vice Speaker to the House of Parliament.
2. Mr Steve Muller, Director, Marshall Islands Marine Resources Authority.
3. Mr Donald Capelle, Secretary, Ministry of Resources and Development.
4. Mr Ronald Alfred, Fisheries Extension Officer, Marshall Islands Marine Resources Authority.
5. Mr Jewon D. Lemari, Chief Planner, Office of Planning and Statistics.
6. Dr. H. M. Gunasekera, Senior Economic Policy Advisor, Office of Planning and Statistics.
7. Chief Kabua Kabua, Paramount Chief of Namdrik Island.

ATTACHMENT 2LIST OF PEOPLE ON NAMDRIK WHO WORKED WITH THE PROJECT

- | | |
|---------------------|---------------------|
| 1. William Gideon | 41. Ajlok Beaja |
| 2. Jokko Meilon | 42. Helmi Latior |
| 3. Wamos Jia | 43. Teta Kanono |
| 4. Jokane Milne | 44. Liton Beaja |
| 5. Rieo Colin | 45. Biraj Hisaiah |
| 6. Smith Lautej | 46. Zepty Lautej |
| 7. Benjiman Samson | 47. Bilimon Latior |
| 8. Ronald Ledor | 48. Phillip Jeik |
| 9. Ronald Jakop | 49. Phillip Jaiklo |
| 10. Lane Lolin | 50. Betwel Samuel |
| 11. Etawe Peter | 51. Walso Clament |
| 12. Bairoro Kanono | 52. Meek Kare |
| 13. Thomas Jokko | 53. Baijok Kare |
| 14. Paul Latior | 54. Clarence Luther |
| 15. Bemon Lolin | 55. Ajmon Albious |
| 16. Aibad Clament | 56. Kenneth Latior |
| 17. Eknan Ralpho | 57. Alter Saimon |
| 18. Jia Hisaiah | 58. Hency Aron |
| 19. Amos Samuel | 59. Johnson Aron |
| 20. Kobok Latior | 60. Fredles Kare |
| 21. Helly Yotma | 61. Harry Peter |
| 22. Painlly Jirokle | 62. Lang Jiu |
| 23. Hemy Lemon | 63. Jien Jokon |
| 24. Timmy Titus | 64. Harris Clament |
| 25. Hemos Kiotak | 65. Selton Clament |
| 26. Latior Samson | 66. Mojina Latior |
| 27. Carles Kare | 67. Runny Latior |
| 28. Carlson Ralpho | 68. Nathan Latior |
| 29. Franbey Lajer | 69. Samuel Phillip |
| 30. Tom Juna | 70. Thomas Bokba |
| 31. Belton Latior | 71. Monie Anjo |
| 32. Hemy Lolin | 72. Tiem Clament |
| 33. Jiti Samuel | 73. Hebel Luther |
| 34. Noah Luther | 74. Batlok Samuel |
| 35. Robinson Harris | 75. Mosie Kanono |
| 36. Aikuij Gideon | 76. Maro Aron |
| 37. Morton Jikit | 77. Hemos Jien |
| 38. Hemos Jetton | 78. Bondrik Aron |
| 39. Jorelik Peter | 79. Henson Harris |
| 40. Eban Edwin | 80. Sampo Clament |

ATTACHMENT 3RECOMMENDED LIST OF MATERIALS AND EQUIPMENT FOR
THE NAMDRIK PEARL FARMING PROJECT.

1. Capital Equipment	Approx Costs (US Currency)
1 x only 20' Yamaha fibreglass runabout	3,000
1 X only Hookah capable of putting two divers to a depth of 25 meters	3,500
1 x portable dive compressor	5,000
4 x complete sets of SCUBA gear	3,000
1 x only 25 HP outboard motor	1,500
	16,000
2. Spat Collection Materials	
10 bales(5,000) Polyethylene net sacks or collector bags	1,800
500 Polyethylene lantern baskets(6mm mesh)	700
20 x 250m x 12mm coils Polypropylene rope	2,000
20 x 250m x 10mm coils " "	1,500
20 coils Xmas Tree Rope	2,500
20 cartons Spatch Catch	700
100 x long-line plastic fishing floats with minimum of 15 kg buoyancy	1,800
10 rolls x 2m x 30m x 50 per cent black shade cloth	1,750
10 rolls x 5m x 30m black polyethylene sheet	800
	13,550
3. Culture Materials	
10 coils x 250m x 16mm Polypropylene rope for sub-surface long-lines	1,500
20 coils x 250m x 3mm Polypropylene rope (branch lines) to hang oysters from	400
2 coils x 1,000m x 50kg monofilament line	80
1,000 long-line plastic fishing floats	18,000
	19,980
4. Miscellaneous Equipment	
1 x only Power drill	100
10 packets 1/16" drill bits	100
1 x only portable generator	600
	800
GRAND TOTAL	<u>50,330</u>