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**PROPOSAL FOR JOINT SPC/SPRADP REGIONAL RESEARCH PROJECT
ON REEF RESOURCE ENHANCEMENT AND CULTURE**

(Paper presented jointly by SPC Secretariat and FAO South Pacific Regional
Aquaculture Development Project)

INTRODUCTION

1. Coral reef resources are important for subsistence and artisanal fisheries in the Pacific Islands region. The recently held SPC Workshop on Pacific Inshore Fishery Resources (Anon, 1988) drew attention to the fact that, with increasing urbanisation and the development of cash economies, many inshore resources appear to have been over-exploited in many localities. This is partly because of the ease of fishing and collecting organisms which may be both conspicuous and sluggish, and partly because of their generally slow growth and maturation rates, despite high fecundities. Widespread poaching has also contributed to declines and local extinctions of certain resources, particularly giant clams.

2. As a result of the increasing incidence of local reef resource depletion, Pacific Island countries are becoming increasingly involved in attempts to bolster natural populations by 'ranching', or releasing artificially propagated juveniles into the natural environment. So far, the focus of such trials has been on giant clams (*Tridacna* species), for which hatchery techniques are now reasonably well developed, thanks to a combination of past work by the Micronesian Mariculture Demonstration Centre (MMDC), James Cook University of North Queensland (JCU), the International Centre for Living Aquatic Resource Management (ICLARM) and the University of PNG (UPNG). Countries of the region now undertaking projects that involve the on-growing of juvenile giant clams include American Samoa, Cook Islands, Fiji, Federated States of Micronesia, Guam, Marshall Islands, Northern Mariana Islands, Palau, Papua New Guinea, Solomon Islands and Western Samoa. Tuvalu is presently awaiting shipment of giant clam juveniles.

3. Additionally, examples of the introduction or re-introduction of reef organisms, either to create new resources outside the natural distribution range of the organism in question, or to re-establish populations that have become locally extinct, are common. Again, these mainly concern a small group of organisms, including trochus (*Trochus niloticus*), green snail (*Turbo marmoratus*) and the giant clams referred to in para 2. These species have been the subject of introductions or re-introductions throughout the region, some of the more recent examples having been carried out with the encouragement or assistance of the MMDC, and the FAO/UNDP Regional Fishery Support Programme.

4. Despite the growth in this type of resource enhancement, little work has been done to study the extent to which existing fisheries may benefit from juvenile release programmes, or to identify other resources that may be amenable to similar enhancement techniques. Nevertheless, in some cases, inshore fisheries may be better managed by the enhancement of wild stocks which have been depleted by over-exploitation, or because of recruitment limitations caused by unfavourable settlement conditions, current patterns, etc. Enhancement may be achieved by reseeding programmes using hatchery produced juveniles ('ranching'), by providing suitable grow-out habitats for the juveniles to survive at higher rates that occur in nature, or by a combination of both.

5. Additionally, numerous attempts to initiate commercial aquaculture have been unsuccessful in the tropical islands, with rare cases of success. Uwate and Kunatuba (1983) reviewed this and cautioned future development in this area, indicating many constraints and disadvantages in the Pacific Islands context. They suggested a more detailed investigation of the means by which aquaculture success may be improved rather than simply abandoning any further attempts based on the poor record in the past, as they believed that commercial aquaculture might present a means of achieving economic stability and growth for the Pacific Islands.

6. Specific areas that warrant further investigation are the identification of locally available organisms suitable for aquaculture, and the establishment of extensive aquaculture methods, such as ranching, that may lead to the gradual development of more intensive culture systems. The development of culture systems that can be organised within the traditional systems of resource management and control that exist in many Pacific Island locations may ultimately pave the way to greater success in commercial or semi-commercial aquaculture activities in the region.

Specific areas requiring research attention

7. In order to assess the feasibility of the three main types of resource enhancement already mentioned (enhancement of stocks which are limited by recruitment or other natural factors; enhancement of stocks which have been reduced by over-exploitation; and new introductions of locally extinct species), and the suitability of reef organisms for more intensive forms of aquaculture, basic information on the resource and its relationships with the environment are required. In particular, account needs to be taken of the three most important problem areas in any aquaculture venture: the acquisition of broodstock, whether from the wild or by artificial propagation; the protection of juveniles from predation and other forms of natural mortality at times when they are at the highest risk; and the optimisation of harvesting, including prevention of poaching. At the present time, sedentary organisms at low trophic levels (photosynthesisers, detritivores, algivores, omnivores) appear to offer greater production potential and ease of management than mobile animals at higher levels in the food chain.

8. A great deal of basic information relevant to these considerations is completely lacking, and can only be obtained by a programme of applied research. Areas of investigation that would be relevant to a wide range of resources include:

- identification of species amenable to juvenile culture, and development of optimum culture and/or juvenile habitat protection systems.
- information on changes in natural mortality and susceptibility to predation as juveniles grow, and on changes in food preference and conversion rate, which would allow determination of suitable release sizes.
- identification of suitable settlement areas for juveniles, and the factors which make these areas attractive.
- studies on local oceanographic factors influencing juvenile dispersal.
- socio-economic and feasibility studies.

Project Proposal

9. The joint SPC/SPRADP project being proposed would have as its objectives to study the feasibility of reef and lagoon ranching as a means of maintaining, managing and enhancing inshore fishery resources.

10. The project would be conducted in 2 phases, over an approximately 3 year period.

Phase 1: Preparatory phase to be initiated and conducted by a technical working group consisting of selected representatives of Pacific Island countries and regional organisations, and technical advisers.

- collection of resource information, and information on reef ranching from areas where it is being practised.
- identification of relevant on-going research activities in the region.
- study of potential reef-ranching opportunities, and their technical and socio-economic feasibility, in Pacific Island countries.
- presentation of study findings and workshop on reef ranching.
- project evaluation and phase 2 planning.

Phase 2: Field trials and pilot projects in cooperation with member governments, and experimental work on selected species in cooperation with regional institutions.

- seed production and growout
- growth and mortality studies in captivity and in nature
- juvenile habitat protection and control of predators
- other areas as identified in phase 1
- pre-release site selection and evaluation
- juvenile release and stocking experiments
- post-release population and environmental monitoring
- development and management of juvenile mass production systems
- studies on social, cultural and economic aspects of resource enhancement
- project evaluation and recommendations on future activities

11. Cooperation with regional governments and institutions will be emphasised at all stages of the project. A major focus of phase 1 would be the identification of ranching opportunities in Pacific Island countries. It is expected that a number of in-country projects will be developed in cooperation with national fisheries or marine resource departments during phase 2, and where appropriate these may continue as national activities following the projects conclusion. As a basis for discussion, Table 1 shows a list of selected resource areas for investigation and those countries that may be expected to have an interest in them. The listing is draft and is based on past correspondence, discussions, and documentation of national work programmes and priorities.

12. In addition, the cooperation of a range of institutions, including those listed in table 2, will be sought. The cooperation of institutions from other parts of the western tropical Pacific, and from Pacific rim countries, in particular Australia, Japan, New Zealand and the USA, will also be sought.

Summary

13. This project is seen as a means of both collecting important management information on inshore marine resources, and of investigating new aquaculture avenues that may avoid the repetition of many of the costly failures of the past. It is envisaged that the SPC IFRP would be mainly responsible for project activities that include elements of field survey, collection of data on exploitation levels, site evaluation and monitoring, and related areas. SPRADP would in the main be responsible for laboratory culture experiments, juvenile production, biological studies, and other elements related to culture techniques. The cooperation of regional governments and institutions would be sought throughout the project and with all its aspects.

14. This meeting is invited to discuss the outline proposal and, if necessary, recommend that the SPC, in cooperation with SPRADP and other organisations, proceed with the development of the project and seek funding for its implementation.

References

- Anon (1988). Workshop on Pacific Inshore Fishery Resources (1988 : Noumea) Report. South Pacific Commission, Noumea, New Caledonia.
- Uwate, K.R. and P. Kunatuba (1983): Aquaculture development : the Pacific Way? SPC Fifteenth Regional Technical Meeting on Fisheries, BP.2, 7pp. South Pacific Commission, Noumea, New Caledonia.

Table 1: Relevance of resource investigations to Pacific Island countries

Resource	Countries with possible interest
Green snail	FSM, Solomon Islands, PNG, Vanuatu
Beche-de-mer	Fiji, Solomon Islands, PNG
Trochus	Vanuatu, Fiji, Cook Islands, Solomon Islands, Northern Mariana Islands, New Caledonia, Palau, Tokelau
Black-lip pearl shell	French Polynesia, Fiji, FSM, Palau, Cook Islands, Kiribati
Coconut crab	Vanuatu, Niue, Solomon Islands, PNG,
Sponge	FSM, Marshall Islands, Tuvalu, Kiribati, Cook Islands
Mangrove crab	Palau, FSM, Fiji, American Samoa
Cockle	Tonga, Palau, Kiribati
Green Mussel	Western Samoa, PNG, Solomon Islands, FSM, New Caledonia, French Polynesia

Table 2: Institutions (other than Fisheries or Marine Resources Departments) involved in Pacific Island aquaculture research and development

Country	Institution
FSM	Pohnpei State Shellfish Hatchery Kosrae National Shellfish Hatchery (proposed)
Fiji	Makogai Shellfish Marine Laboratory Institute of Marine Resources, USP (IMR)
French Polynesia	Institut français de recherche scientifique pour le développement en coopération (ORSTOM) Institute français de recherche pour l'exploitation de la mer (IFREMER)
Guam	University of Guam (UOG) Guam Aquaculture Development and Training Centre (GADTC)
Hawaii	University of Hawaii (UOH) State Fisheries Research Centre Oceanic Institute
Kiribati	National Milkfish Farm Atoll Research and Development Unit, USP (ARDU)
Marshall Islands	Milli Hatchery
New Caledonia	Institut français de recherche scientifique pour le développement en coopération (ORSTOM) Institute français de recherche pour l'exploitation de la mer (IFREMER)
Palau	Micronesian Mariculture Demonstration Centre (MMDC)
PNG	University of PNG (UPNG)
Solomon Islands	ICLARM Coastal Aquaculture Centre
Tonga	Fisheries Division Aquaculture Centre
Vanuatu	National Trochus Hatchery
Western Samoa	National Giant Clam Hatchery