...NGAL PROGRAMME
...t of Small-Scale Fisheries

BOBP/REP/14
(GCP/RAS/040/SWE)

Report of the First Phase of the "Aquaculture Demonstration for Small-Scale Fisheries Development Project," Phang Nga Province, Thailand

March 1979 - September 1981

SIDA SWEDISH INTERNATIONAL DEVELOPMENT AUTHORITY

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

BAY OF BENGAL PROGRAMME **BOBP/REP/14**

Development of Small-Scale Fisheries **GCP/ RAS/040/SWE**

Report of the First Phase of the "Aquaculture Demonstration for Small-Scale Fisheries Development Project" in Phang Nga Province, Thailand March 1979 — September 1981.

Executing Agency :

Food and Agriculture Organisation of the United Nations

Funding Agency :

Swedish International Development Authority

Development of Small-Scale Fisheries in the Bay of Bengal
Madras, India, March 1982

<<

PREFACE

This document is the report of the implementation of the project "Aquaculture Demonstration for Small-Scale Fisheries Development, Phang Nga, Thailand" during its first phase, March 1979 to September 1981.

A short account of the project's background, objectives, modus operandi and pre-operational activities is followed by a description and assessment of each component of the project — aquaculture demonstration, community development and the women component. It shows that cockle culture is the most successful aquaculture activity, while the commercial feasibility of finfish cage culture and oyster culture and the technical feasibility of mussel culture are yet to be established. The achievements of the community development component and the extensive training activities under each project component are also highlighted in the report.

The report is based on the work of Mr. Boon Boonruang, Senior Fishery Biologist (team leader of the project) under the supervision of Mr. Vanich Varikul, Director of the Brackishwater Fisheries Division of the Department of Fisheries, Thailand (Project Director) and the South China Sea Fisheries Development and Coordinating Programme.

On behalf of the Bay of Bengal Programme (BOBP), technical support for the execution of the project was provided to the Department of Fisheries, Thailand by the South China Sea Fisheries Development and Coordinating Programme (SCSP).

Consequent to a joint review of the project, carried out at the end of the first phase, in which representatives of the Thailand Department of Fisheries, BOBP and SCSP participated, agreement for the support of a second phase of the project was reached between the Department and BOBP.

The Bay of Bengal Programme for the Development of Small-Scale Fisheries seeks to develop and demonstrate appropriate technologies in several areas of small-scale fisheries-such as fishing craft, fishing gear, fish handling and utilisation, coastal aquaculture. Its goals are to improve the conditions of small-scale fishermen and the supply of fish from the small-scale sector in five countries that border the Bay of Bengal — Bangladesh, India, Malaysia, Sri Lanka and Thailand. The Programme is funded by the Swedish International Development Authority and executed by the Food and Agriculture Organisation of the United Nations.

<<

CONTENTS

Figures

Appendices

<<

1. INTRODUCTION

1 .1 Background

The rapid development of the commercial demersal trawl fisheries in Thailand since the early 1960's has resulted in a state of over-exploitation of the fishery resources as indicated by the continuing decline in the rate of catch-per-unit effort. In recent years, the new trend of the extension of fishery jurisdiction by the neighbouring states has also reduced drastically the access of Thai fishing botas to their traditional distant fishing grounds. These circumstances have posed considerable, and in many cases, serious hardships to coastal fisherfolk communities due to significant reductions in their average annual earnings. This problem is especially serious in the rural small-scale fishing sector in the more remote areas, where the villagers have been raditionally engaged in inshore fishing.

To alleviate this problem, the Government of Thailand and its Department of Fisheries decided to introduce coastal aquaculture as a viable alternative source of employment and/or supplementary source of income to the needy and especially socio-economically depressed communities. In collaboration with the FAO/SIDA Bay of Bengal Programmefor Development of Small-Scale Fisheries (BOBP-GCP/RAS/040/SWE) and the FAO/UNDP South China Sea Fisheries Development and Coordinating Programme (SCSP-RAS/74/013), the Department of Fisheries of the Government of Thailand identified an area for this type of development in the province of Phang Nga and formulated, as the first exercise of its kind, an action-oriented pilot project incorporating aquaculture demonstration together with a number of essential components of self-help community development activities.

The project area is located in the northern coast of Phang Nga Bay (Fig. I), along which are scattered 16 villages with an estimated total population of 8,566. The majority of the villagers are small-scale fishermen and the average annual earnings of the households are far below the national average. The area is essentially an extensive mangrove forest with many stream systems of various sizes flowing into the bay. Among other reasons, this area was chosen because of the depressed state of its socio-economic setting. In particular, the decreasing financial return from fishing, the inadequate and sub-standard supply of fresh water, and the increasing pressure of the need of socio-economic development, had been of great concern to the Government.

Six of these villages were selected as sites for the implementation of the project, namely Ban Ko Mai Pai, Ban Ko Khiam, Ban Ko Mak Noi, Ban Bang Patana, Ban Sam Chong and Ban Ko Pan Yi.

1.2 Objectives

The major objectives of the project were to provide a basis for improving the living standards of the village population, and to provide a model for expanded development effort in the rural fishing sector.

To achieve these, the following operational targets were identified:

(a) the establishment of appropriate aquafarming pen, cage, raft or pilot units in the project area complete with all necessary facilities to rear finfish fry or fingerlings and/or other suitable commercial organisms to marketable sizes;

(b) the practical demonstration of aquafarming techniques at the village level;

(c) the provision of assistance to strengthen and expand the activities of village cooperatives as a means to manage and operate the aquafarms, initiate collective marketing and provide other essential common services to the villages;

(d) the demonstration of improved village-level processing techniques;

(e) the training of villagers in the technology involved in all project components; and

(f) assistance in the acquisition of loans and/or grants to expand operations and provide basic facilities for improving local living standards.

<<

With external financial support provided by the Bay of Bengal Programme (BOBP) the project was executed by the Department of Fisheries, Thailand with technical support from the South China Sea Programme (SCSP).

The external financial support amounted to about US $ 180,000. The details are given in Appendix 1. The South China Sea Programme was directly responsible for the disbursement of project funds provided by the Bay of Bengal Programme. To facilitate local expenditure, the Project Manager of the FAO/UNDP Pole and Line Tuna Fishing Project (THA/77/008) in Phuket handled accounts on behalf of SCSP.

The Director of the Brackishwater Fisheries Division of the Department of Fisheries was designated as the Project Director with the Programme Leader of the SCSP as the Co-Director. A staff member of the Phuket Brackishwater Fisheries Station was appointed as the Team Leader in February 1979, of a team including biologists, technicians and administrative personnel assigned full-time to the project. Other full-time staff were also provided by the Government. In addition, the Fisheries Department provided the services of at least two professional aquaculture specialists, as required, on a short-term basis. Provision was also made for short-term services by international consultants.

As project activities involved the participation of other divisions in the Department of Fisheries, as well as other government agencies, liaison was provided through the Fishery Economics and Planning Sub-division of the Department of Fisheries. Other agencies expected to participate in certain project activities included the Phang Nga Provincial Government, the Department of Cooperative Promotion, the Fish Marketing Organisation and the Cold Storage Organisation.

The Team Leader collaborated closely with the provincial fisheries officer in Phang Nga, an outposted staff member of the Department of Fisheries whose main functions are to regulate and control fishery matters at the provincial level. The Brackishwater Fisheries Station in Phuket and that in Songhkla also provided direct assistance to the project in various technical matters and by the provision of seed stocks. A summary of these arrangements is presented in Fig. 2.

The project commenced in March 1979 and its first phase terminated in September 1980. A second phase of one year's duration has been agreed upon.

2. WORK PLAN

Appendix 2 summarises the main project activities in chronological order and also by the principal project components from February 1979 one month before the officiation of the project. It can be seen that while the focus of this work plan was primarily on the demonstration of a number of aquafarming systems, it also emphasized the training of selected fishermen groups with the object of enabling them to acquire the basic techniques and skills essential to their subsequent takeover of the introduced aquafarming facilities. Similarly, in the community development and women component activities, priority was also given to training programmes applicable to the village level, as well as to group activities, in an attempt to demonstrate the benefits of collective efforts in the planned development activities. An operation chart is given in Fig. 3.

3. PRE-OPERATIONAL ACTIVITIES

Considerable preparatory work was carried out before and immediately after the officiation of the project in March 1979. Pre-operational activities of note are described in the sub-sections that follow.

3.1 Preliminary site survey

3.1.1 Three preliminary site surveys were made by the professional staff of the Brackishwater Fisheries Division of the Department of Fisheries. The first survey of potential aquaculture demonstration sites in the project area was undertaken in November 1978 for the purpose of identifying suitable locations for aquaculture demonstration and at the same time the status of the fisheries in Phang Nga Bay was also studied. From this survey, Ban Ko Pan Yi was found to show potential for fishcage culture of seabass (fates calcarifer) and the estuarine grouper (Epinephelus tauvina), Ban Ko Mai Pai for the culture of the horse mussel (Modiolus senhausenii) and Ban Ko Khiam for the culture of the cockle (Anadara granosa).

In this survey investigatory efforts were concentrated on the species of these proposed commercial aquatic organisms and their relative abundance in the coastal environment, the ecological aspects at the estuaries of the mangrove streams, the nature of the substrate of the intertidal mud fiats, and the salinity values in the water column. The sites investigated were, by necessity, restricted to areas within close proximity of villages to enable convenient accessibility to the villagers.

3.1.2 The second site survey, in May 1979, was to investigate in detail the hydrographical setting in Phang Nga Bay, and to confirm the suitability of sites selected for the demonstration of finfish cage and mollusc culture. A total of 12 hydrographic parameters were measured at six stations, the substrate of the intertidal mud flats at 15 locations wasstudied, and plankton samples were analysed qualitatively and quantitatively at five locations. From this survey it was confirmed that the following sites and aquaculture activities were suitable:

(a) finfish cage culture: Ban Ko Pan Yi and Ban Ko Khiam;
(b) oyster culture: Ban Ko Mak Noi and Ban Ko Pan Yi;
(c) mussel culture: Ban Ko Mak Noi; and
(d) cockle culture: Ban Ko Mai Pai.

3.1.3 In April 1980, the third site survey was made to expand these aquaculture demonstration activities to another two sites:

(a) finfish cage culture and oyster culture at Ban Sam Chong ; and
(b) oyster culture at Ban Koh Kai.

3.2 Socio-economic survey

A survey of the socio-economic conditions of six coastal communities in the Phang Nga project area was undertaken in the period April-July 1979. The overall objective of this study was to provide an in-depth cross-section profile of the living standards and other closely associated socio-economic conditions of these poverty-stricken small-scale fishermen believed to have further been adversely affected by the depleting fishery resources. The base line data collected in the survey was intended to be used for the detailed planning and implementation of project activities and for eventual measuring of the impact of the project.

It was found that most of the sampled fishermen had a long history of experience with traditional small-scale fisheries. It was revealed that resulting from the declining trend of the accessible fishery resources, there had been a continuing increase in the importance of non-fishing engagements for the household members; the main occupation, however, was still fishing in terms of the relative levels of income and working time.

<<

Fish processing, particularly shrimp paste preparation, was the most important engagement, followed by trading and general labour in other sectors.

Despite the strong evidence of declining fishery resources, fishing continued to be the main occupation. The reported decline in catch rates coupled with the decreasing size composition of the species were also observed by the fishermen as evidence of the deteriorating status of fish stocks. Over 90% of the fishermen interviewed felt that measures should be taken to conserve the resources in their traditional fishing areas.

Considerable interest was expressed in the introduction of aquaculture, although the majority of the fishermen admitted their lack of experience in fish culture. Also over 75% expressed their willingness to become involved. These indicated that aquaculture practices could and should be introduced to the project area.

The survey also showed that the scarcity of fresh water was one of the major problems of the area, thus indicating the need to concentrate on providing this basic facility for improving local living standards.

The data provided by the socio-economic survey has proved to be of practical use so far mainly for the purpose of assessing the knowledge of the fisherfolk regarding the status of their fishery resources and consequently their interest in engaging in aquaculture, in identifying the relative importance of non-fishery occupations engaged in by membersof fisherfolk households and the basic facilities needed for improving living standards.

It is still too early to measure the impact of the project against the baseline data gathered in the survey. It will however be possible to do so already in relation to some aspects at least such as attitudes, living standards, and non-fishing occupations, by the end of the present phase of the Bay of Bengal Programme, i.e. mid 1983. A follow-up survey for this purpose should therefore be undertaken at that time.

3.3 Cage culture survey

As a follow-up of the site selection surveys (sub-section 3.1) an assessment of the suitability of the Ban Ko Pan Yi and Ban Ko Khiam sites was carried out in August 1979. This was undertaken by a cage culture specialist from Hong Kong.

Based on the overall environmental setting and hydrographical findings, a location at each of these two villages was recommended for the siting of floating net cages for the culture of the seabass (Lates calcarifer) and the estuarine grouper *(Epinephelus tauvina).* The former was more favoured in view of the ready availability of fry and fingerlings from the hatchery of the Songhkla Brackishwater Fisheries Station. The latter was also strongly recommended but subject to wild fry and fingerlings being available in time.

Attention was however, drawn to the potential adverse effects on the caged fish of the mining activities adjacent to the Ban Ko Khiam location. It was therefore cautioned that this potential pollution risk and its associated events should be kept closely in view.

For planning purposes, the consultant extrapolated a potential gross yield at harvest of approximately 10 kg/m^3, and allowing a total mortality of 12% for the estuarine grouper a stocking density of 13.5 numbers of fish per m^3. One feeding per day at a ratio of 6% of the total fish biomass was recommended, using fresh low-cost trash fishes. Other operational requirements were also suggested.

A sampling of pictures on the three components of the Phang Nga aquaculture demonstration project – aquafarming. community development and women's activities.

Fresh water scarcity is one of the problems in villages covered by the Phang Nga project. Picture shows fresh water for transport boats and for project villages being supplied at Ban Ko Khiam.

Mussel seed for culture is being brought to Ban Ko Mak Noi by boat.

<<

Mussel spat is being transported to Ban Ko Mak Noi for culture.

Oyster cultured in trays at Ban Ko Pan Yi. The trays are submerged at high tide, exposed during low tide.

The windmill and the water storage tank at Ban Ko Khiam. The windmill is used to drive water up from a well into the water storage tank.

<<

Under the women's component of the Phang Nga project several training courses were held on fish processing and handicrafts.

A shrimp paste training course in session.

Training course in fish products.

Training course in handicrafts.

<<

4. PROJECT IMPLEMENTATION

4.1 Aquaculture Demonstration

Since it was envisaged that the success of the project would very much depend upon the participation of villagers in the project area, seven fishermen and three school groups were formed in collaboration with the Provincial Fisheries Officer and also in close consultation with the village leaders at the early stages of the project (Appendix 3).

Each fisherman group comprised two to ten but mostly six members, one of whom was chosen by the members to take the role of a leader. The school groups were each headed by a school master. These group leaders assumed the responsibility of being the contacts of the project staff, and also served the project by managing their members in the conduct of the day-to-day work at the aquaculture demonstration sites. For the purpose of enabling these groups to acquire the basic essential skills, appropriate training was provided throughout the period. Details of this training are shown as items 1-3, 7-8, 12-1 3, 19-20 and 22 in Appendix 4. At the same time, the work of these groups was directly supervised by the project staff.

Subsequent to the take-over of cockle culture by the Provincial Government of Phang Nga another five similar action groups were formed in October 1980 with membership ranging from 15 to 31 fishermen per group (Appendix 3). These were deployed specifically to work on cockle culture.

4.1.1 Fishcage culture

On the basis of the site surveys, the demonstration of fishcage culture was located at Ban Ko Pan Yi and Ban Ko Khiam. At a later stage of the project (September 1980) Ban Sam Chong was also included. A total number of 26 cages each measuring 3 x 3 x 3 m^3 was constructed and rigged to four floating rafts towards the end of August 1979. The cost per raft of 6 cages together with anchors and anchoring ropes, was Baht 19,629 (US $982) or at Baht 3,271 per suspended cage.

(a) ***First culture trial at Ban Ko Pan Yi***

The first fishcage culture trial was initiated in November 1979 at Ban Ko Pan Yi using an initial stock of 712 seabass ***(L ates calcarifer)*** fry of 1-3 cm in length, and a small number of 40 fingerlings of the estuarine grouper ***(Epinephelus tauvina).*** The seabass stock was made up of 400 2-3 cm fry from an October 1979 shipment of 3,000 from the Phuket Brackishwater Fisheries Station, and a November 1979 shipment of 312 1.0-1 .5 cm fry from the Satul Brackishwater Fisheries Station. The 87% mortality of the October shipment was primarily due to disease infection in the hatchery followed by the adverse effects of handling and transport stresses. The estuarine grouper shipment was supplied by the Satul Brackishwater Fisheries Station together with the 312 seabass fry shipment.

An evaluation of this trial was made in September 1980, 11 months after the first stocking. The seabass stock attained a total biomass of 207 kg comprising 287 numbers of fish at a weight of 700-800 g per fish. This means the stock experienced a 60% mortality during the period of culture. As regards the estuarine grouper, 100% survival was achieved at the end of this period. The total weight of the 40 fish stood at 37 kg ranging from 900 to 1,000 g per fish. At an ex-farm value these were sold at Baht 35 (US $ 1.75 per kg).

(b) ***First culture trial at Ban Ko Khiam***

For Ban Ko Khiam, the first fishcage culture trial started somewhat later in April 1980 with a stock of 1,500 estuarine grouper fingerlings. At the time of evaluation (in March 1981) 11 months after the initial stocking, the total biomass at harvest stood at 188 kg comprising 450 fish

ranging from 400 to 500 g per fish. The 70% culture mortality, an abnormally high figure for this species, was mainly caused by poaching. It is therefore, not a true mortality figure.

(c) Seabass fry stocks for the second culture trial

In June 1980 a 10,000 seabass fry stock at a size of 1.0-1.5 cm length was relayed to Ban Ko Khiam from the Songhkla Brackishwater Fisheries Station for nursery purposes. At the same time part of this stock was also for use at the Ban Ko Pan Yi site for a 2-day training course on the nursery of the seabass. Again, transport mortality was high leaving 1,400 fry, or 14% of the shipment. Additional seabass fry shipments had therefore, to be introduced from the Phuket Brackishwater Fisheries Station in July 1980 to Ban Ko Pan Yi involving 2,000 numbers, and in September 1980 another stock totalling 3,600.

Later in October 1980, a further shipment of 6,000 seabass fry of the same size from the Songhkla Brackishwater Fisheries Station was also received for equal distribution to Ban Ko Pan Yi, Ban Ko Khiam and Ban Sam Chong.

(d) *Second culture trial at Ban Ko Pan Yi*

Based on the July 1980 shipment of 2,000 and the September consignment of 3,600 1.0-1.5 cm fry, the seabass stock evaluated in August 1981 showed a survival rate of 38% or a surviving stock of 770 fish ranging unevenly from 750 to 1,350 g each. As for the September stock of 3,600, it stood as at August 1981 at 1,106 numbers with a length ranging from 24-40 cm and weight 500-1000 g per fish.

(e) Second culture trial at Ban Ko Khiam

The September 1980 stock of 1,400 seabass fry suffered a mortality of 69% by May 1981 when an evaluation also showed that the stock attained extremely uneven growth. The weight per fish ranged from 200 to 400 g and the length from 20 to 40 cm. The stock was reduced to 94 fishes.

(f) *First culture trial at Ban Sam Chong*

The October 1980 stock of 2,000 seabass fry at the time of evaluation in May 1981 showed a survival rate of 35%. The 710 remaining seabass attained a total length ranging from 13 to 36 cm and a weight of 40 to 300 g. This stock will be harvested in October 1981.

4.1 .1 .1 Assessment

In terms of relative level of performance, the first culture trial at Ban Ko Pan Yi appears to be the more outstanding of the trials summarised above. The survival rate of the seabass of 40% beginning from a size of 2-3 cm and after 11 months of culture, is considered to be satisfactory. In this observation one has to take into consideration the level of capability of the participating villagers on the one hand, and the highly cannibalistic nature of the fish species on the other. Without separating the nursery and grow-out activities in the present instance, the latter constraint then becomes even more significant. An optimal attainment of 60% survival in the fishcage culture of this species should be used as a gauge. As regards growth, and despite the absence of growth measurement data which are not required of this project, certain extrapolation could be reliably made. Assuming the 2-3 cm fry required 3 to 4 months to attain 100 g from which the growth of this species begins to approach an optimal weight increment rate, this left 6 months for the stock to reach a mean weight of 750 g. Based on this assumption, and if the nursery aspect is separated from the actual grow-out of this species, a 4.4 g average daily weight increment is actually the true measurement of the performance of the villagers. Again, if a 6 g/day weight increment was used as a gauge for this species, the difference of 1.6 g is in fact perfectly acceptable. In this consideration, it must be noted that the supply of trash fish feed has been an intermittent affair. Under cage culture conditions, this species requires two daily feedings each at full satiation to acquire the 6 g/day optimum weight increment performance. In this trial at Ban Ko Pan Yi, such intensive feeding has not been possible. This therefore, could have affected the growth performance of the fish on the one hand, and presumably also the lower survival rate through cannibalistic behaviour on the other.

The 100% survival of the estuarine grouper though at low stocking density of 40 numbers per cage, is also considered to be highly satisfactory. Under the inconsistent feeding programme, the growth attainment of the fingerlings, said to be at a starting size of 15-30 g each, is extremely noteworthy. Again, using 100 g as the beginning size of optimum weight increment, the 40 fingerlings should require four months to reach that weight. This therefore leaves about 6 months for the grow-out of the 100 g fish. Using a mean weight of 22.5 g for the fingerlings and 950 g for the harvested fish, an extrapolated average daily weight increment from a 100 g size onwards is estimated at 5 g. This is somewhat higher than the average growth performance under cage culture conditions for the species. The low stocking density and presumably the supplementary feeds of live organisms entering the caged waters might explain this discrepancy in performance.

If these extrapolations were used to gauge the performance in the other trials, the adverse effects of a number of circumstances can easily be seen. These are:

(i) much smaller seabass fry of 1.0-1.5 cm were used, thus prolonging the period of nursery undertaken by obviously inexperienced villagers and therefore, increasing the mortality rate on the one hand, and incurring uneven growth in terms of both weight and total length on the other;

(ii) the high transport mortality incurred on nearly all occasions suggests disease infection of the fry inside the hatcheries, room for improvement in packaging techniques, and certainly the need for improvement of transport arrangement and handling skills (since for the seabass, the smaller the size the lower the transport mortality).

(iii) the nursery of the seabass is a highly skilled activity requiring not only extensive experience and the application of well-managed skills, but also intensive grading and great handling care-a development to be emphasised in further assistance input;

(iv) the irregular feeding and possibly prolonged periods of lack in feeds, could have been the triggering off mechanisms, of "man made" stresses imposed upon the fish ;

(v) thus, under adverse and abrupt environmental changes, the species under confinement conditions immediately felt the impact of such adverse effects; and

(vi) in this consideration, it should be borne in mind that both species are quite capable of withstanding stresses of these kinds if their original condition factor is normal.

Given the opportunity of the furtherance of this activity these are problems that could be solved by provision of intensive training and guidance. The annual gross yield obtained so far in the 26 fishcages is below commercial viability. An economic model for household seabass cage culture is set out in Appendix 5. The viability as can be seen is largely determined by the price of trash fish.

The initiative taken by some villagers during the latter part of the project period to utilise other fish species captured from the wild for fattening purposes (SCS-SWE/THA/80/WP/10) is an encouraging development. Another encouraging development is the construction of cages by the villagers in Ko Pan Yi on their own initiative and with their own resources.

4.1.2 Cockle culture

In June 1979, a cockle (Anadara granosa) culture demonstration plot of an area of 3,200 m^2 was contracted out for impoundment work at Baht 3,600 and was completed within 5 days. Within the same month, 1,500 kg of cockle seeds at a size of 1.0-2.0 cm were transplanted from Petchaburi Province, but the majority died during transport possibly as a result of prolonged exposure to the air. A second shipment was arranged in September of the same year from Trang Province at a weight of 1,000 kg and an average size of 3 cm. Harvest in March 1980 yielded a total weight of 3,100 kg average 16 g per shell or 62 pieces per kg. At an ex-farm price of Baht 4 per kg, the gross proceeds of sale was therefore Baht 12,400. This indicated at the time that the rate of growth of this cockle was fast, and that the Phang Nga Bay was economically feasible for the culture of cockle. Subsequent to this harvest, additional quantities were collected from outside the plot, in which area and its vicinities there had been no records of the presence of cockle. The Provincial Government of Phang Nga has since then taken over this activity for further promotion utilising its own resources. A donation of Baht 1,806,000 (US $ 90,000) was made to finance the subsequent development work of this activity.

<<

A seed stock of 120 tons was acquired in November 1980 at an average size of 1,200-1,500 pieces/kg. This stock was equally distributed to 5 demonstration plots of a size of 4 ha each at Ban Ko Pan Yi, Ban Ko Mai Pai, Ban Sam Chong, Ban Hin Rom and Ban Ao Ma Kham. The total number of villagers involved in this work was 98. As of June 1981, the stock attained an average weight of 80-100 shells/kg. Harvest is scheduled to commence mid October 1981.

4.1.2.1 Assessment

The culture of cockle in the project area as indicated by the performance at both the 3,200 m^2 and the subsequent five 4 ha plots, has clearly demonstrated the future potential of this form of mollusc production, and also the suitability of the natural setting. An economic model for cockle culture is set out in Appendix 6. It is clear that cockle culture with its high economic return will play an important role in the future development of the communities in the area.

Like other molluscs, the species should be capable of propagating itself in the wild. It is therefore, essential that research and development efforts should be coordinated in a creative attempt to provide solutions to this end. The training and professional services so far provided have already transferred adequate know-how for the present need of technical skills. It should however, be anticipated that if research and development results come forth, there may be a further need to develop the level of skills of the villagers. In particular, the preservation of brood stocks and the timing and location of harvesting should all conform with the basic stock management concept.

4.1.3 *Oyster culture*

In July and October 1980 stocks of a small oyster species *(Crassostrea vitrefecta)* which also occurs naturally in the Phang Nga area were transplanted from Chantaburi and Chonburi provinces for stocking the demonstration sites at Ban Ko Pan Yi and Ban Ko Mai Pai. The growth of this oyster was satisfactory, but in view of its natural abundance in Phang Nga area and its low market value, the fishermen groups requested that a larger species *(Crassostrea lugubris)* observed by them in other areas during one of the study tours, be utilised instead for culture. *Crassostrea lugubris,* which was also found to occur naturally in the Phang Nga was therefore selected to replace *Crassostrea vitrefecta.*

In November 1980 some 3,000 spats of 1 .0-1.5 cm shell length of this large species were transferred to Ban Ko Mak Noi for hang-drop culture in IO uncovered trays. These grew at a rapid rate and by June 1981 attained a shell size of 7-8 cm. Unfortunately most of this stock was lost on account of heavy monsoon weather. Another trial had therefore to be carried out with a replacement stock of 1,000 oyster placed in covered trays. To date over 20,000 spats of this species have been collected with a view to transferring them to Ran Ko Khiam for hang-drop culture, Ban Ko Mak Noi for bottom and tray culture and Ban Sam Chong for hang-drop culture.

4.1.3.1 Assessment

The rate of spat fall, the initial observations on growth of the species, ar d the interest shown by the villagers coupled with the low production cost-for oysters, as for other forms of mollusc culture-are all indications favouring the culture of this species of oyster.

As against the above, the following seem to show the need for a careful review of this activity before proceeding further:

- in comparison with smaller species of oyster, C. *lugubris* enjoys a higher market value at present due to the limited supplies available. The price (about Baht 5 per piece) however is not sufficiently high to bear the impact of increased supplies and there may be a risk of its plummetting to uneconomic levels in such cases.
- for ease of management it is necessary to site the culture facilities next or close to the dwellings of the villagers. This involves the certain risk of contamination of the oysters by the uptake of contaminants through the discharged wastes from the villages. This will in turn entail the need to adopt depuration methods by keeping the cultured oysters for some time in a separate cleansing station located away from dwellings before they are marketed, thus adding to the

cost of production. The alternative of marketing the oysters in cooked form may also raise production costs while affecting their price and marketability.

4.1.4 Mussel culture

The demonstration of the culture of the green mussel (Mytilus smaragdinus) was first initiated in July 1979 at Ban Ko Mak Noi using seed stock of 200 kg measuring 2.4-4.1 cm from Chumphon Province. Later in October 1979 an additional seed stock of 1,000 kg was transplanted from Chonburi Province to the site. After 70 days, the first stock had doubled in size and attained a shell size of 7-8 cm. These first plantings were intended to build up a brood stock of mussel in the project area.

To gather mussel spats, mangrove poles which are readily available at the site were used. These were staked in the same site where the breeding stock were planted, but it was found that no spats could be collected at the planting site. Lately however, sites were detected in portions of the Phang Nga Bay along the coast at Ban Bang Patana and Ban Ko Mai Pai some 8 km away. Stake collectors were installed at different spots along this vicinity. Spats of 20-30 per pole were observed and peaks of spat fall during the year were determined.

4.1.4.1 Assessment

The first and second plantings of young mussels at the project site showed that the area is suitable for rapid growth of mussels. This fast growth was encouraging and has generated keen interest from the villagers.

The spawning peaks were determined with the test spat collection and were found to fall in June-July and November-December during the year. This is valuable information to farmers to expose the collecting poles during these periods. However, this has to be further monitored to confirm the specific period.

The spat fall so far obtained from the collecting poles showed that the amount of spats even during the peak periods was still inadequate (20-30/pole). The number of spats per pole to be adequate should be at least 1,000. The specific spat collecting sites in the project area can serve as valuable information in the future operation of this aspect of the project but further investigations are needed to locate the best spat collection sites.

4.2 Community development

This project component emphasized the provision of fresh water supply and the basic facilities essential to the betterment of the ways of living of the villagers in the project area. The other facilities included improved new walkways and jetties. The implementation of these activities also stressed the need for self-help, and the collective approach to problem-solving. The design, costing and work supervision were assisted by specialised consultants from the Kasetsart University (Artachinda eta/., 1981). Under professional supervision most of the planned facilities were completed during the project period. The capital input was provided by the project and the Government of Thailand. In the case of the water reservoir at Ban Bang Patana the Provincial Government contributed 30%; in the case of the jetties at Ban Bang Patana and Ban Ko Khiam the villages provided the labour which considerably reduced the capital outlay. A summary of the facilities provided is given below:

Village	*facilities*
Ban Ko Khiam	— jetty — windmill driven water pump — shallow well — holding tank and piping system
Ban Bang Patana	— jetty — water supply from Ban Ko Khiam — water tank (500 m^3)

<<

Village	*Facilities*
Ban Ko Mai Pai	— repair of village walkway
	— water supply from Ban Ko Khiam
Ban Sam Chong	— design of jetty
The area	— multipurpose service boat operated by the project for transport of construction materials and fresh water
	— an experimental solar still for fresh water has been tested with good results and three units are just about to be introduced in different villages.

4.2.1. Assessment

The supply of fresh water is one of the major problems in the area. The villages in the mangrove area depend on rain water during the rainy season but have to transport water by boat during the dry season. The provision of water supply systems have therefore significantly improved the living conditions in the villages concerned. The villagers are extremely appreciative of their new situation; it does not only mean an easier life but also cash saving for some since they don't have to pay for the transport of water during the dry season.

Two types of water supply systems have been tried and both have been found to be satisfactory solutions. The windmill pump with a small holding tank can be used where shallow groundwater is available. In other areas, like Ban Bang Patana, a larger storage tank catching water by itself and from neighbouring house roofs during the rainy season is feasible. The solar stills not yet fully tested may become an alternative or a supplement to the other systems depending on the local conditions.

Water supplies can be improved at reasonable costs; the tank in Ban Bang Patana cost the equivalent of about US $ 15,450 and the windmill system in Ban Ko Khiam the equivalent of about US $ 12,400. They are of direct and immediate benefit to the communities and should be provided in other villages in an extension or expansion of this project and other schemes together with demonstration of economic fishing or fish farming activities.

The two jetties were completed only at the very end of the project period and no feedback on their usefulness or benefit has been obtained. However they will facilitate easier handling of both fishing and transport boats and therefore provide convenience to the villagers. The jetties also make the villages more accessible which may lead to an increased number of visitors including tourists and benefits of new or expanded economic activities.

4.3 Women component

This additional activity first incorporated in the project in July 1979 was officially implemented as from December 1979. Prior to its implementation, and based on the detailed work plan prepared in July 1979 (SCS-SWE/THA/80/WP/8) seven training courses were organised resulting in a total of 93 trained female villagers in handicraft and fish processing at the village level. This training was mainly concerned with handicraft and fish processing, including in particular, improvement of shrimp paste processing techniques practised in the project area at the time.

Further local and overseas training (Appendix 4) was arranged subsequent to the implementation of this activity. In the handicraft training course in December 1980, the Department of Industry Promotion of the Ministry of Industry (SCS-SWE/THA/80/WP/4), the Dept. of Fisheries (SCS-SWE/THA/80/WP/7) and the Phang Nga Provincial Development and Provincial Fisheries offices and a handicraft designer consultant (Sallador, 1980) also participated. Apart from handicraft and shrimp paste, the village women were also given training in the processing of fish sausage, shrimp biscuit (SCS-SWE/THA/80/WP/5-6), fish cake and fish sauce. Practical demonstration and training on aquaculture for the female villagers were also organised throughout the project period. More than 220 female villagers were trained since July 1979.

<<

The application of the training resulted in the production of a variety of handicraft items, mainly macrame, and the production of a shrimp paste of improved quality. Women groups also showed active participation and involvement in aquaculture activities.

4.3.1 Assessment

The expectations regarding production of handicrafts and shrimp paste as income generating possibilities have not been fulfilled.

The handicraft items produced by the women have remained virtually unsold. These items were produced with the intention of selling them to tourists who visit the area. The failure to sell them may be due to the fact that they are inferior in quality to those produced elsewhere in the country and abroad and/or to the fact that they are not the type of product found attractive by tourists visiting the area. In the circumstances, any effort at market promotion seems unlikely to yield any positive result and it seems advisable to switch to the production of items such as shell craft souvenirs which are already being marketed in the area.

In the case of shrimp paste also, difficulties have been experienced in selling it. The product has moved slowly but some sales have been effected. Shrimp paste is however an item that is widely consumed locally; further, the improvement effected has been the value added process of subjecting the paste to fermentation which greatly increases its shelf life. Since it is a superior product prospects seem to exist of improving sales by market promotion and sales organisation and the engagement of professional expertise for this purpose should be considered,

REFERENCES

SCS-SWE/THA/79/WP/1 Mok, T. K. Report on assessment of suitability of cage culture of marine fish in Phang Nga Bay, Thailand. Manila, South China Sea Fisheries Programme, 1979. 29p.

SCS-SWE/THA/80/WP/2 Sallador, C. Report on handicraft training course, Phang Nga, Thailand. Manila, South China Sea Fisheries Programme, 1980. 7p.

SCS-SWE/THA/80/WP/3 Adulavidhaya, K., S. Artachinda and S. Isvilananda. Socio-economic conditions of coastal fishermen in Phang Nga. Manila, South China Sea Fisheries Programme, 1980. 64p.

SCS-SWE/THA/80/WP/4 Ithipongs, S., N. Densiri and P. Shevaosot. Report on a handicraft study tour to the Philippines from 25 June to 9 July 1978. Manila, South China Sea Fisheries Programme, 1980. 4p.

SCS-SWE/THA/79/WP/5 Ithipongs, S. Report on a village level post-harvest fisheries technology training/demonstration course. Manila, South China Sea Fisheries Programme, 1980. 9p.

SCS-SWE/THA/80/WP/6 Pruthiarenum, R. Report on a training/workshop to improve quality of locally produced shrimp paste. Manila, South China Sea Fisheries Programme, 1980. 7p.

SCS-SWE/THA/80/WP/7 Pruthiarenum, R. and P. Kiatkungwalkrai. Report on three training workshops held to improve quality of locally produced shrimp paste. Manila, South China Sea Fisheries Programme, 1980. 4p.

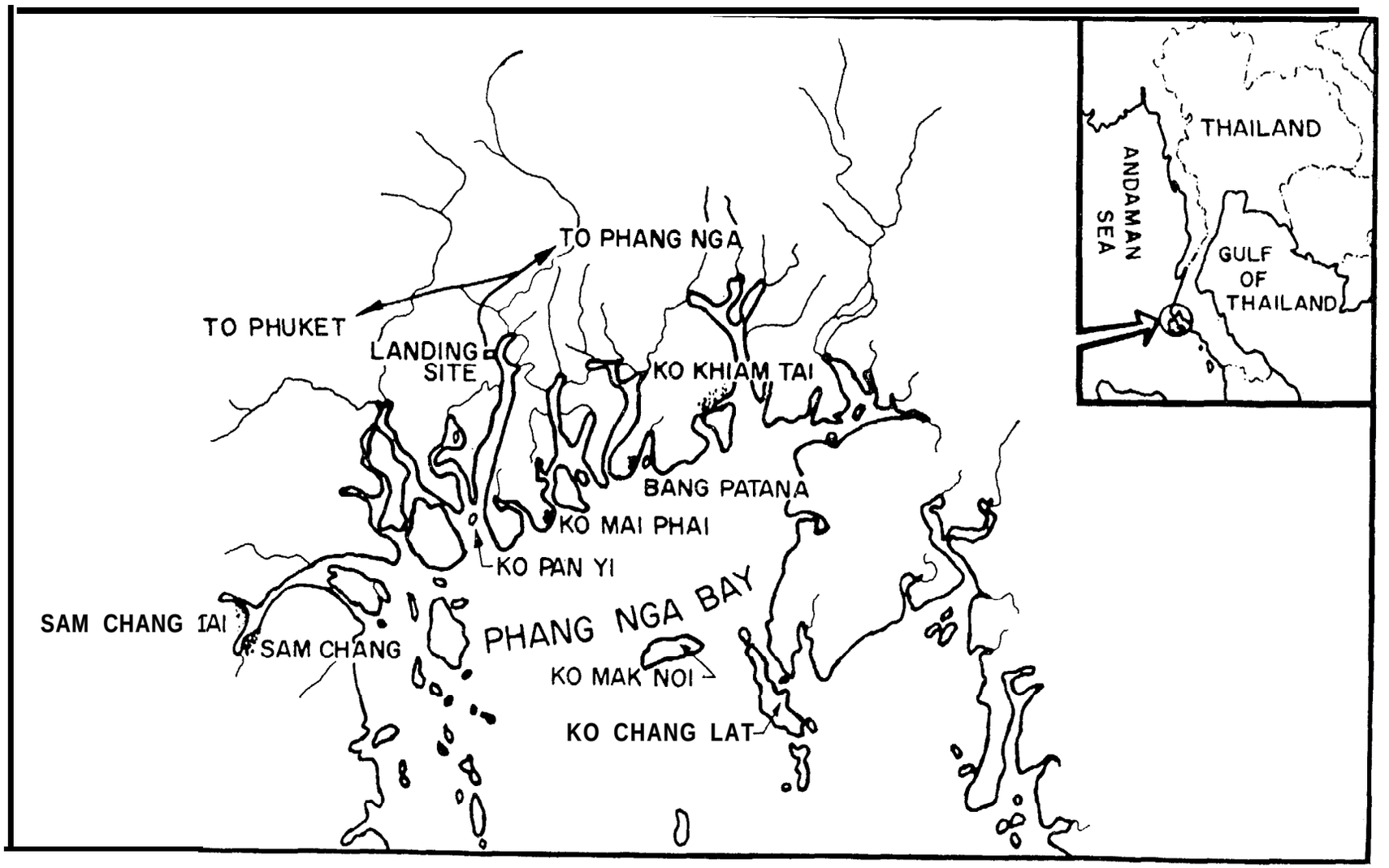
SCS-SWE/THA/80/WP/8 Progress reports covering the periods from March-November 1979 and November 1979-October 1980. Manila, South China Sea Fisheries Programme, 1980. 33p.

SCS-SWE/THA/81 /WP/9 Oswald, E. 0. Report of the regional study on the implementation and objectives of an operational small-scale fisheries development project. Manila, South China Sea Fisheries Programme, 1981. 16p.

SCS-SWE/THA/81 /WP/10 Progress report covering the period November 1980-June 1981. Manila, South China Sea Fisheries Programme, 1981. 4p.

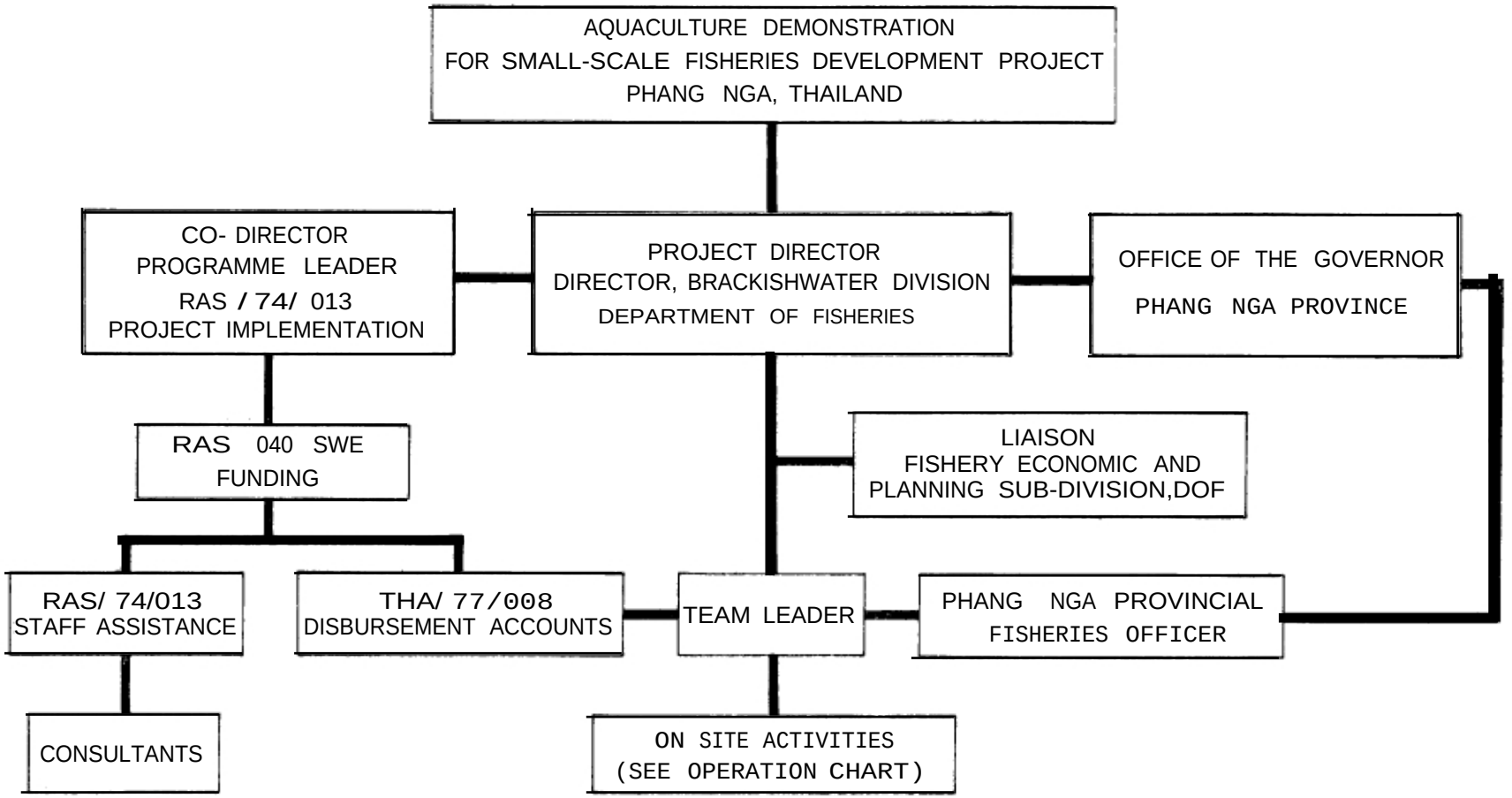
<<

FIGURE-I : PROJECT-SITE AT PHANG NGA BAY SHOWING THE VILLAGES CHOSEN FOR IMPLEMENTATION OF THE ACTIVITIES OF THE PROJECT



<<

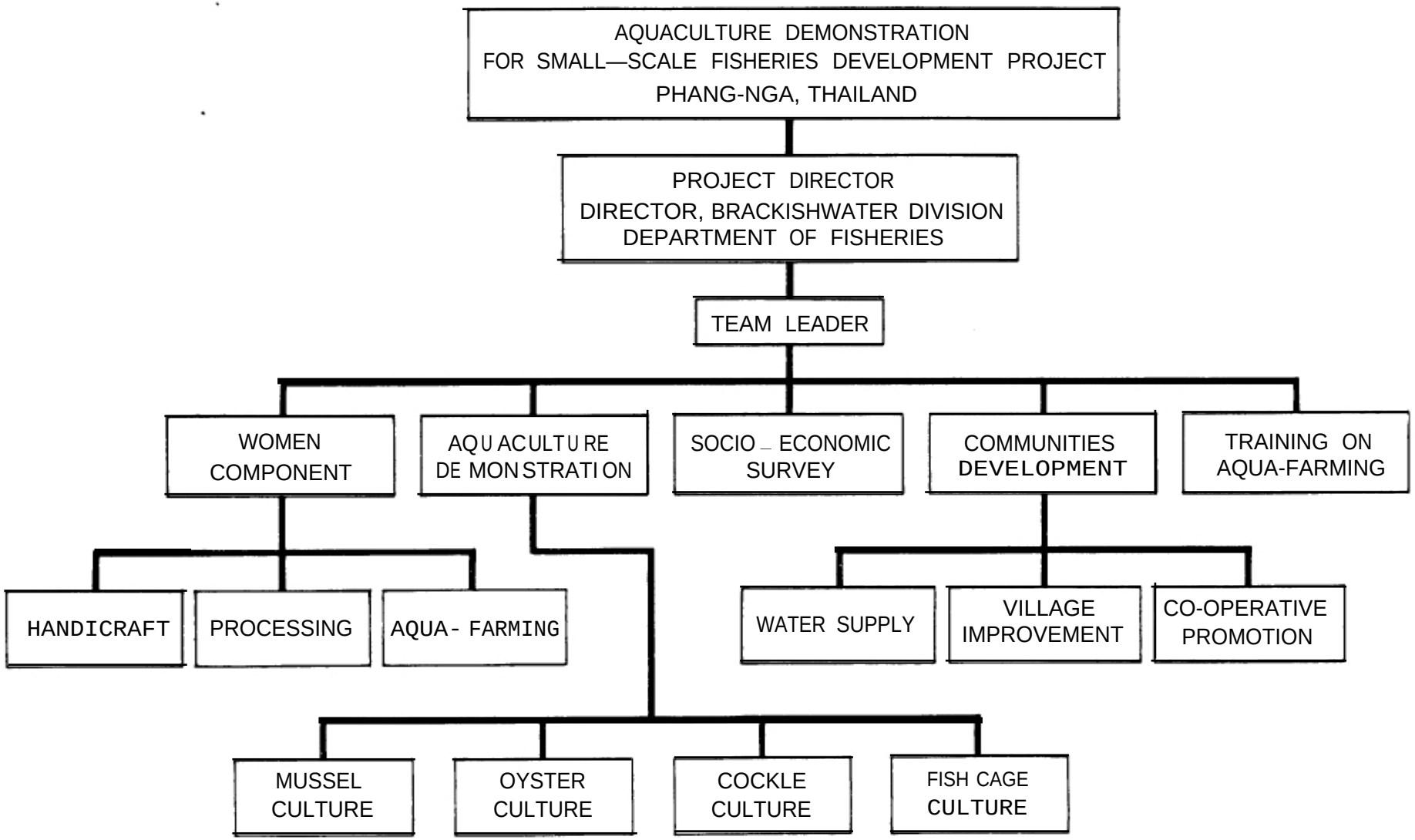
FIGURE-2 CHART FOR THE PHANG NGA PROJECT



ORGANIZATION OF ADMINISTRATIVE ARRANGEMENTS AND INTER- RELATIONSHIPS BETWEEN THE DEPARTMENT OF FISHERIES AND THE SOUTH CHINA SEA FISHERIES DEVELOPMENT AND CO-ORDINATING PROGRAMME (RAS 74 013),AND BETWEEN THE LATTER AND THE BAY OF BENGAL PROGRAMME FOR SMALL—SCALE FISHERIES DEVELOPMENT (RAS /040/SWE)

<<

FIGURE-3:PHANG NGA PROJECT:OPERATIONAL CHART



<<

Appendix 1

GCP/RAS/040/SWE (Bay of Bengal Programme)

EXTERNAL FINANCIAL SUPPORT TO THE PHANG NGA PROJECT($)

	Budget	Expenditure	Balance
10. Personnel Services	71,000	59,798	11,202
— Consultants	48,000	27,000	21,000
20. Duty Travel	9,000	12,391	(3,391)
40. General Operating Expenses	9,000	16,167	(7,167)
50. Supplies and Materials	29,000	29,062	(62)
60. Equipment	56,000	39,276	16,724
80. Training and Fellowships	18,000	20,545	(2.545)
Total	192,000	177,239	14,761

<<

Appendix 2

WORK PLAN

Activity	Time Frame		
	1979	1980	1981
Preparatory :			
— Appointment of Team Leader	February		
— Technical and administrative briefing of Team Leader	February		
— Recruitment of full-time project technicians and support personnel	March		
— Place orders for equipment and supplies to be imported	From March		
— Determine availability of local materials required for aquaculture demonstration	From March		
— Acquisition of office space and storage facilities in Phang Nga	March		
— With the assistance of professional officers of the Fisheries Department, carry out a survey of the project area to select the most appropriate sites for installing fishcages and for installing facilities for mariculture demonstration	April		
— Carry out a socio-economic survey of villages in project area in order to obtain baseline data upon which progress can be measured including amount and source of incomes, village structure, status of existing cooperative activities, existing marketing system (price structure, fluctuations, transport costs, role of middlemen, etc.), existing production, etc.; survey to be supervised by a consultant from Kasetsart University	June		
— Construction and installation of floating net cages for demonstration and initial stocking of fish seeds	April/May		
— Consideration of purchasing or constructing project boats in the local areas, including one service boat used as cooperative transport for supplying materials between the landing site and the villages; two workboats for fish farming, transporting service ; and one traditional fishing boat capable of operating in Phang Nga Bay	April/May		

<<

Activity	Time Frame		
	1979	1980	1981
— Selection and designation of local farmers to operate and manage fishcage culture units and to carry out basic training	April/May		
— Selection and designation of local farmer demonstrators for initial demonstration of mussel, oyster and cockle culture	May		
— Initial visit of aquaculture consultant	June		
— Regional training of selected project staff and fish farmers on fishcage/pen culture to Hong Kong, Singapore and Malaysia (1 month)	June/July		
— In consultation with the village leader in Ban Bang Patana (where there are no boats capable of operating in Phang Nga Bay), select fishermen to operate project fishing boat under a cooperative charter arrangement	From June		
— Based on the results of the socio-economic survey, prepare plan for strengthening and expanding village cooperative operations. This will include plans to implement a collective marketing and distribution system; determine the viability of establishing a cooperative store, and if feasible to assist in arranging the necessary capital, and in organising and operating such a venture; operate the service boat as a cooperative service to the villages; and identifying other appropriate services that could be provided through the cooperatives. This would require cooperation with the Cooperative Promotion Officer of the Cooperative Promotion Department and the Provincial Cooperative Officer in Phang Nga	From June		
— Study existing village fish processing methods and initiate improvements where appropriate in order to improve quality and to train villagers on better methods of processing mussels, making shrimp paste, etc.	From July and seasonally as appropriate		
— Study ways and means of improving the fresh water supply to the villages and if appropriate assist in the construction of simple water reservoirs and catchments	From July and as appropriate		
— Encourage and assist in self-help activities to improve conditions in the villages. Specific activities will be identified during the course of the project and where applicable assistance given in arranging :	From July		

Activity	Time Frame		
	1979	1980	1981
Aquaculture Demonstration:			
(a) Fishcage culture — construction of floating fishcages	April/Aug.		
— First trial on nursery of fish fry		June/July	
— First trial on growout of fish fingerlings		Aug./Dec.	
— Second trial on nursery of fish fry		Aug./Sept.	
— Cage construction for fattening juvenile fish		Sep./Oct.	
— Second trial on fish fingerling culture		From Oct.	To Feb.
— First trial on fattening of juvenile		From Oct.	To Feb.
— Second trial on fattening of juvenile			March/July
— Conclusion and evaluation			August
(b) Mussel culture			
— Place order for materials and supplies in spat collection		Jan./April	
— First trial on spat collection		May/August	
— Second trial on spat collection		Oct./Dec.	
(c) Oyster culture			
— Place order for materials and supplies for raising oyster spat		April/May	
— Demonstration on oyster culture		From May	
(d) Cockle culture			
— Harvest cockle in demonstration plot and sell the produce		March/April	
— Conclusion and evaluation		April/May	Oct./Nov.
— Organise group meeting of villagers from Ban Ko Mai Pai		May	
Community Development:			
— Repairvillage walkway at Ban Ko Mai Pai	July		
— Construction of concrete tank for holding fresh water at Ban Bang Patana	From Sept.		
— Acquisition of project service boat		March	
— Construction of windmill pump, fresh water well, holding tank and piping connections at Ban Ko Khiam		From Oct.	
— Construction of jetty			Aug./Sept.
— Construction of solar stills			From August
Women Component:			
-Training in handicraft	From Nov.		
— Training in fish processing		From April	
— Marketing trials of products		December	Jan./June
Training Programmes:			
— (See Appendix 3)	From Feb.		
Technical Surveys and Evaluation:			
— Study of the distribution and relative abundance of wild stocks of oyster, mussel, seabass and estuarine grouper		From May	
— Evaluation of fishcage, oyster and mussel culture		From June	
Terminal Assessment:			
— Submission of draft terminal report			August

<<

Appendix 3

FISHERMEN GROUPS FOR AQUACULTURE DEMONSTRATION

Village			
Ban Ko Pan Yi (project)	Group 1:	6 fishermen	Fishcage culture
	Group 2:	6 fishermen	Fishcage culture
	Group 3:	6 fishermen	Fishcage culture
	Group 4:	8 school masters	Fishcage culture
Ban Ko Khiam (project)	Group 5:	6 fishermen	Fishcage culture
Ban Sam Chong (project)	Group 6:	2 fishermen	Fishcage culture
Ban Ko Mai Pai (project)	Group 7:	10 fishermen	Cockle culture
Ban Ko Mak Noi (project)	Group 8:	1 school	Oyster culture
Ban Ko Pan Yi (project)	Group 9:	1 school	Oyster culture
Ban Ko Mak Noi (project)	Group 10:	6 fishermen	Mussel culture
Ban Ko Pan Yi (provincial government)	Group A :	15 fishermen	Cockle culture
Ban Ko Mai Pai (provincial government)	Group B:	15 fishermen	Cockle culture
Ban Sam Chong (provincial government)	Group C:	15 fishermen	Cockle culture
Ban Hin Ron (provincial government)	Group D:	22 fishermen	Cockle culture
Ban Ao Ma Kham (provincial government)	Group E:	31 fishermen	Cockle culture

<<

Appendix 4

STUDY TOURS/WORKSHOPS/TRAINING COURSES OF THE PROJECT

	Purpose	Place	No. of Persons	Period
1.	Attendance at SEAFDEC/IDRC International Workshop on Cage and Pen Culture; technical and administrative briefing	Philippines	(Team Leader)	11-28/2/79
2.	Fishcage culture	Phang Nga	10 fishermen	5-6/9/79
3.	General aquaculture, molluscs and finfishes	Phang Nga	40 fishermen	23-25/11/79
4.	Handicraft training	Bangkok	15 women	26/11-14/12/79
5.	Handicraft training	Phang Nga	28 women	17-28/12/79
6.	Handicraft training	Phang Nga	30 women	13-24/1/80
7.	Seabass nursery training	Phang Nga	34 fishermen	23-24/1/80
8.	Local aquaculture study tour	Thailand, 6 provinces	37 fishermen and provincial officers	
9.	Fish processing training	Phang Nga	20 women	21-23/4/80
10.	Fish processing training	Phang Nga	20 women	24-26/4/80
11.	Fish processing training	Phang Nga	25 fishermen	19-23/5/80
12.	Attendance at mariculturesymposium, and fishcage/oyster culture study tour	Japan	(Team Leader)	19-29/5/80
13.	Aquaculture study tour	Hong Kong/ Singapore/ Malaysia	2 project technicians	29/5-7/6/80
14.	Handicraft training	Ban Sam Chong	30women	13-22/4/81
15.	Fish processing training	Phang Nga	25women	17-19/6/80
16.	Handicraft study tour	Philippines	3 women	13-22/4/81
17.	Fish processing training	Phang Nga	25 women	7-9/7/80
18.	Fish processing training	Phang Nga	25 women	13-17/8/80
19.	Aquaculture study tour	Japan/Singapore/ Malaysia	2 biologists	17/8-5/9/80
20.	Local aquaculture study tour	6 Thailand provinces	54 fishermen	5-13/8/ 81
21.	Fish processing study tour	Japan	3 women	1-10/9/81
22.	Local aquaculture study tour	6 Thailand provinces	40 fishermen	5-15/9/81

<<

Appendix 5

MODEL FOR HOUSEHOLD SEABASS CAGE CULTURE

Assumption

1. The production unit will be one raft containing six (6) cages, each measuring 3 x3 x2.5 metres (total 135 m^3).
2. Construction will be with Styrofoam floatation devices supporting wooden pole walkways and nylon mesh cages. Cost of purchased materials for construction is assumed to be Baht. 20,000 and life of the raft is assumed to be 3 years.
3. The cages will be stocked with seabass fingerlings from local nursery, 6-8 cm size, 250 pieces per cage or a total of 1,500 per raft. Cost of fry is Baht. 5 each, total Baht. 7,500 per raft unit.
4. Feed consumption will be 8 kg per fish for a 1 kg grow-out size. The feed will be locally produced scrap fish with a value of Baht. 1-3 per kg.
   (a) 1500 fish x 8 kg x Baht. 1- Baht. 12,000
   (b) 1500 fish x 8 kg x Baht. 2- Baht. 24,000
   (c) 1500 fish x 8 kg x Baht. 3- Baht. 36,000
5. Mortality rate is assumed to be ten (10) per cent.
6. Grow-out time is assumed to be nine (9) months.
7. Farmgate value is estimated to be Baht. 45 per kilo.

Viability Test

Item			Amount (Baht)
1. Harvest 1500 fish less 10% mortality= 1350x1 x45			60,750
2. *Less*	cost of seed	Baht. 7,500	
	cost of raft maintenance	Baht. 7,000	
			14,500
			46,250
	cost of feed (a)	12,000	
	(b)	24,000	
	(c)	36,000	
3. Margin for household	(a)		34,250
	(b)		27,250
	(c)		10,250

<<

Appendix 6

MODEL FOR VILLAGE COOPERATION COCKLE CULTURE

Assumptions

1. **The unit size of a cockle culture area will be 4 hectares.**
2. **Seed stock of a size of about 1,350 pieces per kilo will be purchased at a cost of Baht. 15,000 per ton, all inclusive of transportation and handling.**
3. **Seeding will be at a density of 5 tons per hectare.**
4. **Mortality and loss factor is assumed to be 30 per cent.**
5. **About 30% of the crop will be reserved for broodstock.**
6. **Grow-out to a size of 65 pieces per kilo will take one year. Thus grow-out is calculated at 20 times the weight of surviving seed stocks.**
7. **Twenty (20) village people will share the work including watchman duties, planting and harvesting of each 4 hectares plot.**
8. **Farm gate value is assumed to be Baht. 5,000 per ton.**

Viability Test — *item*	*Amount* Baht.
1. Harvest: 20 tons seed less 30% mortality (i.e. 14 tons) x 20 = 280 tons grow-out product. Deduct 30% reserve for broodstock, i.e. 196 tons for market at Baht. 5,000	980,000
2, Less: Cost of seed, 20 tons at Baht. 15,000	*300,000*
3. Gross return	*680,000*
4. Less: Cost of area maintenance and miscellaneous expenses	10,000
5. Net Return	*670,000*
Net return for each of 20 participants	*33,500*

<<

Development of Small-Scale Fisheries (GCP/RAS/040/SWE)

Reports (BOBP/REP/ . . . .)

1. **Report of the First Meeting of the Advisory Committee. Colombo, Sri Lanka, 28-29 October 1976. (Published as Appendix 1 of IOFC/DEV/78/44.1, FAO, Rome, 1978)**
2. **Report of the Second Meeting of the Advisory Committee. Madras, India, 29-30 June 1977. (Published as Appendix 2 of IOFC/DEV/78/44.1, FAO, Rome, 1978)**
3. **Report of the Third Meeting of the Advisory Committee. Chittagong, Bangladesh, 1-10 November 1978. Colombo, Sri Lanka, 1978. (Reissued Madras, India, September 1980)**
4. **Role of Women in Small-Scale Fisheries of the Bay of Bengal. Madras, India, October 1980.**
5. **Report of the Workshop on Social Feasibility in Small-Scale Fisheries Development. Madras, India, 3-8 September 1979. Madras, India, April 1980.**
6. **Report of the Workshop on Extension Service Requirements in Small-Scale Fisheries. Colombo, Sri Lanka, 8-12 October 1979. Madras, India, June 1980.**
7. **Report of the Fourth Meeting of the Advisory Committee. Phuket, Thailand, 27-30 November 1979. Madras, India, February 1980.**
8. **Pre-feasibility Study of a Floating Fish Receiving and Distribution Unit for Dubla Char, Bangladesh. G. Eddie, M. T. Nathan. Madras, India, April 1980.**
9. **Report of the Training Course for Fish Marketing Personnel of Tamil Nadu. Madras, India, 3-14 December 1979. Madras, India, September 1980.**

10.1 **Report of the Consultation on Stock Assessment for Small-Scale Fisheries in the Bay of Bengal. Chittagong, Bangladesh, 16-21 June, 1980. Volume 1 : Proceedings. Madras, India, September 1980.**

10.2 **Report of the Consultation on Stock Assessment for Small-Scale Fisheries in the Bay of Bengal. Chittagong, Bangladesh, 16-21 June 1980. Volume 2: Papers. Madras, India, October 1980.**

11. **Report of the Fifth Meeting of the Advisory Committee. Penang, Malaysia, 4-7 November 1980. Madras, India, January 1981.**
12. **Report of the Training Course for Fish Marketing Personnel of Andhra Pradesh. Hyderabad, India, 11-26 November 1980. Madras, India, September 1981.**
13. **Report of the Sixth Meeting of the Advisory Committee. Colombo, Sri Lanka, 1-5 December 1981. Madras, India, February 1982.**
14. **Report of the First Phase of the "Aquaculture Demonstration for Small-Scale Fisheries Development Project" in Phang Nga Province, Thailand. Madras, India, March 1982.**

Working Papers (BOBP/WP/.. . .)

1. **Investment Reduction and Increase in Service Life of Kattumaram Logs. R. Balan. Madras, India,February 1980.**

<<

2. **Inventory of Kattumarams and their Fishing Gear in Andhra Pradesh and Tamil Nadu. T. R. Menon. Madras, India, October 1980.**

3. **Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Sri Lanka. G. Pajot. Madras, June 1980.**

4. **Inboard Motorisation of Small G.R.P. Boats in Sri Lanka. Madras, India, September 1980.**

5. **Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Bangladesh. G. Pajot. Madras, India, September 1980.**

6. **Fishing Trials with Bottom-Set Longlines in Sri Lanka. G. Pajot, K. T. Weerasooriya. Madras, India, September 1980.**

7. **Technical Trials of Beachcraft Prototypes in India. ϕ. Gulbrandsen, G. P. Gowing, R. Ravikumar. Madras, India, October 1980.**

8. **Current Knowledge of Fisheries Resources in the Shelf Area of the Bay of Bengal, B. T. Antony Raja. Madras, India, September 1980.**

9. **Boatbuilding Materials for Small-Scale Fisheries in India. Madras, India, October 1980.**

10. **Fishing Trials with High-Opening Bottom Trawls in Tamil Nadu, India. G. Pajot, John Crockett. Madras, India, October 1980.**

11. **The Possibilities for Technical Cooperation between Developing Countries (TCDC) in Fisheries. E. H. Nichols. Madras, India, August 1981.**

12. **Trials in Bangladesh of Large-Mesh Driftnets of Light Construction. G. Pajot, T. K. Das. Madras, India, October 1981.**

13. **Trials of Two-Boat Bottom Trawling in Bangladesh. G. Pajot, J. Crockett. Madras, India, October 1981.**

14. **Three Fishing Villages in Tamil Nadu. Edeltraud Drewes. Madras, India, February 1982.**

Miscellaneous Papers (BOBP/MIS/. . . .)

1. **Fishermen's Cooperatives in Kerala : A Critique. John Kurien. Madras, India, October** *1980.*

Newsletters:

1. ***Bay of Bengal*** **News. January 1981, May 1981, September 1981, December 1981, March 1982.**

Published by the Bay of Bengal Programme, FAO, 91, St. Mary's Road, Abhiramapuram, Madras 600 018, India. Printed at Amra Press, Madras 600 041.

<<