

5. Thai government counterpart contribution to the project

Description of government counterpart contribution	Total contribution in baht (x 1000)			
	1987-1988	1988-1989	1989-1990	1990-1991*
1. Salary	3,163	4,126	5,232	5,621
2. Temporary wage	762	762	1,321	1,750
3. Travel material and supply	4,432	3,784	4,000	7,148
4. Public utility	1,075	1,891	1,900	1,900
5. Equipment	171	626	1,263	915
6. Land	3,613	2,670	1,415	4,020
Total	13,216	13,859	15,131	21,354

* This included budget for 3 shortterm government projects; namely Sea Farming Project, Village Fisheries Project and Minimized Shrimp Production Cost Project.

6. Future work plan

It is expected that after the termination of the project, Thai counterparts will continue the work in the laboratory and field service smoothly, and also carry out the transfer of advanced technology to farmers in order to maximize production and profit and minimize risk and cost.

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Annex I

The objective of NICA

Short term objective

1. To develop larval rearing and grow-out culture technology for red snapper, John's snapper, grouper and shrimp.
2. To produce shrimp broodstock in captivity.
3. To develop intensive shrimp culture technology.
4. To develop effective therapeutic treatment and anti-serum for parasites, bacteria and viruses.
5. To manage and maintain optimal water and soil quality for fish and shrimp culture in Songkhla and near by Provinces.
6. To find alternative species for aquaculture.
7. To transfer the developed technology to the farmer.
8. To provide disease diagnosis and water quality analysis services to the parties concerned.

Long term objective

1. To increase shrimp and fish production.
2. To minimize cost and maximize profit in aquaculture.
3. To maintain good water quality for aquaculture.
4. To supply new technology and culture species.

In order to fulfill objectives, the following research projects were conducted.

1988

1. Experiment on the culture of jumbo tiger prawn, *Penaeus monodon* Fabricius to the broodstock in cement ponds.
2. Experiment on the artificial fertilization and insemination of *Penaeus monodon* Fabricius cultured with various fresh foods.
3. Experimental rearing of zoea stage to post larva₂ stage of *Penaeus monodon* with various diets.
4. Study on the genetic variation of *Penaeus merguensis* (de Man) from different locations in Thailand.
5. Studies on the breeding and larval rearing of grouper, *Epinephelus malabaricus* (Bloch and Schneider).
6. Experimental rearing of red snapper, *Lutjanus argentimaculatus* (Forsk.) at different stocking densities.
7. Effects of salinity on survival rate and growth of 8 to 30 day old red snapper, (*Lutjanus argentimaculatus* Forskal)
8. Comparative study on the biomass production of *Artemia* spp. from China and Thailand in semiflow-through system.
9. Requirement of Vitamin B₆ for seabass, *Lates calcarifer*.
10. Study on the digestibility of some feed ingredients in diets for juvenile seabass. (*Lates calcarifer*).
11. Study on the suitable level of nutrient in marine yeast culture.
12. Influence of food (*Tetraselmis* sp.) density, on population growth of rotifer, *Brachionus plicatilis*.
13. Effect of malachite green on haematological changes in seabass (*Lates calcarifer*).
14. Effect of formalin on bacterial infection in seabass, *Lates calcarifer*.
15. Study on Vibriosis anti-serum in seabass.

16. Cultivation of *Gracilaria sp* by fertilization.
17. Study on intensive shrimp culture.
18. Morphological development of red snapper, *Lutjanus argentimaculatus* (Forsk.)
19. Distribution and abundance of fish larvae in Nakornsri thammarat Bay.
20. Survey on distribution and some ecological conditions of canine catfish, *Plotosus canius* (Hamilton) nursery ground at Klong Natab Estuary, Songkhla Province.
21. Distribution of aquatic animals and some ecological conditions at Klong Natab estuary, Songkhla Province.
22. Bottom sediment conditions of aquaculture ground in outer part of Songkhla Lake.
23. Environments of pen for *Macrobrachium rosenbergii* culture in Songkhla Lake.
24. Survey on the species composition and distribution of sea catfish (Ariidae) in Songkhla Lake.
25. Study on the effect of Songkhla Deep Sea Port on the water salinity and dispersion of suspended solids in Songkhla Outer Lake.
26. Study on physico-chemical properties of water in Nakornsri thammarat Bay.
27. Primary production of Nakornsri thammarat Bay.
28. Distribution and abundance of phytoplankton in Nakornsri thammarat Bay.

1989

1. Study on mating rate and suitable period to induce ovarian maturation of tiger shrimp (*Penaeus monodon* Fab.).
2. Experiment on artificial fertilization and insemination of tiger shrimp, *Penaeus monodon* Fabricious.

3. Study on reproductive biology of seabass (*Lates calcarifer* Bloch).
4. Rearing techniques of grouper larvae (*Epinephelus malabaricus*).
5. Preliminary study on breeding of John's snapper (*Lutianus johnii*).
6. Experiment on propagation of mullet (*Mugil dussumeri*).
7. Study on reproductive biology of red snapper (*Lutianus argentimaculatus*).
8. Study on *Penaeus merguensis* (de Man) cultured in earthen ponds.
9. Study on the method of producing young thallus of *Polycavernosa fisheri* in the laboratory.
10. Experiment on optimum stocking density for tiger shrimp, (*Penaeus monodon*) culture in net cages.
11. Rearing techniques of red snapper larvae (*Lutianus argentimaculatus*).
12. Preliminary study on broodstock selection of tiger shrimp, *P. monodon* cultured in nylon net cage.
13. Preliminary study on broodstock selection of banana shrimp *P. merguensis* cultured in nylon net cage.
14. Soil quality in intensive tiger shrimp (*Penaeus monodon*) culture ponds.
15. Water quality dynamic in intensive tiger shrimps, *Penaeus monodon* culture ponds.
16. The role of phytoplankton in intensive shrimp culture pond.
17. Survey on the suitable area for aquaculture in the outer part of Songkhla Lake.
18. Study on some biological aspects of seabass *Lates calcarifer* (Bloch) in Songkhla Lake. -tagging experiment.
19. Study on the phytoplankton in Songkhla Lake.
20. Study on the water qualities from the tiger shrimp hatcheries.
21. Estimated pollution loaded from intensive shrimp pond culture of *Penaeus monodon*.
22. Study on the environment of tiger shrimp culture in net cage in outer part of Songkhla Lake.

23. Study on the effect of some therapeutic treatment to protozoan disease of tiger shrimp *Penaeus monodon*.
24. Study on the cause of mortality of grouper (*Epinephelus malabaricus*) juvenile during nursing period.
25. Preliminary study on the unknown aetiological disease (swim bladder syndrome) in grouper, *Epinephelus malabaricus*.
26. Requirement of Vitamin B₆ for grouper, *Epinephelus malabaricus*.
27. Optimal dietary protein energy ratio of juvenile grouper *Epinephelus malabaricus*.
28. Technics of rotifer production using bread yeast for larval rearing.
29. Protozoa treatment by using hypochlorite in *Chlorella* culture.
30. Effect of some factors on the growth of *Chlorella* sp. in laboratory.
31. Effect of some factors on growth of *Skeletonema* sp. in laboratory.
32. Study on qualities of Thai fish meal and it's effect on feeding, and growth of tiger shrimp, *Penaeus monodon*.
33. Effect of vitamins on growth, survival and feed efficiency of tiger shrimp, *Penaeus monodon*.

1990

1. Experiment on nursing of wild grouper fry (*Epinephelus* sp.) in different water management.
2. Study on some rearing techniques of grouper larvae (*Epinephelus malabaricus*).
3. Effect of temperature on the growth, and survival of wild grouper fry. (*Epinephelus* sp.).
4. Effects of temperature on the growth and survival in seabass larvae, (*Lates calcarifer* Bloch).
5. Effects of salinity and LHRH-A treatment on the off-seasonal spawning of seabass (*Lates calcarifer*).

6. Effect of chloesterol and lecithin on ovaries maturation of tiger prawn, *Penaeus monodon*.
7. Activity of gonad inhibiting hormone from eyestalk of *Penaeus monodon*
8. Activity of sperm in the fertilization of banana prawn (*Penaeus merguensis*).
9. Experiment on rearing of mullet from juveniles to spawner in net cages.
10. Experiment on culture of *Gracilaria sp.* by various methods.
11. Study on broodstock preparation of tiger prawn, *Penaeus monodon* cultured in the earthen pond.
12. Experiment of *Skeletonema sp.* culture with three formulas of medium.
13. Effect of cod liver oil enrichment in brine shrimp nauplii for feeding grouper (*Epinephelus malabaricus*) larvae.
14. Effect of dietary vitamin levels on the growth, survival and feed efficiency of tiger shrimp, (*Penaeus monodon*).
15. Rearing of *Artemia* with milk powder, rice bran and rice powder.
16. Microsporidiosis of tiger shrimp *Penaeus monodon* (Fabricious.)
17. Study on the etiology of the infectious disease (swim bladder syndrome) in grouper, *Epinephelus malabaricus*.
18. Relationship of water quality and bacterial density on the disease occurrence of *Penaeus monodon*, *Lates calcarifer* and *Epinephelus malabaricus* seeds.
19. Study on tiger shrimp (*Penaeus monodon*) diseases from private hatcheries in Songkhla Province and surrounding area.
20. Study on dissolved oxygen dynamics in shrimp ponds.
21. Toxic nitrogen compound dynamics in shrimp ponds controlled by three commercial chemical reagents.
22. Abundance and distribution of some fish species in Songkhla Lake.
23. Effect of tiger prawn pond culture on water quality of Songkhla Lake.

24. Species composition and size distribution of marine shrimp in Songkhla Lake.

25. Study on seed production and stock culture of *Gracilaria*.

1991

1. Water quality monitoring of effluent water from shrimp farming of Songkhla Province and some part of Nakornsri thammarat
2. The environmental investigation at coastal area emphasized on intensive shrimp farm in Nakornsri thammarat and Songkhla Province.
3. Water quality monitoring along the coastal area of intensive shrimp farming in Songkhla and Nakornsri thammarat
4. Requirements of *Penaeus monodon* for vitamin AD₃, C and inositol.
5. Study on the best feeding management in *Penaeus monodon* culture.
6. *Epinephelus malabaricus* optimal dietary protein energy ratio of Juvenile grouper *Epinephelus malabaricus*
7. Requirement of Vitamin B₆ for Grouper, *Epinephelus malabaricus*
8. Effect of some factors on growth of *Tetraselmis* sp.
9. Rearing of *Molna* sp with *Chlorella* sp and decomposed rice bran
10. Study on size distribution and abundance of Malabar grouper *Epinephelus malabaricus* in Songkhla lake
11. Socio-economic survey of intensive shrimp farming around Songkhla Lake.
12. Species composition and abundance of fish and shrimp from coastal trawl along the coast of Songkhla Province in 1991
13. Study on abundance of fisheries resources along the coast of Songkhla Province
14. Study on the biology of aquatic resources in Songkhla Lake and adjacent coastal area.
15. Identification of bacteria isolated from *Penaeus monodon* larvae and rearing sea water
16. A study to test efficacy of feed additives in preventing *Agmasoma penaei* Microsporidian infections in *Penaeus monodon*.

17. Study on black gill disease in tiger shrimp (*Penaeus monodon*), ponds of Songkhla province
18. Study on breeding and rearing two species of grouper (*Epinephelus salmonoides* and *Epinephelus malabaricus*)
19. Study on reproductive biology of Red snapper (*Lutianus argentimaculatus*)
20. Activity of gonad inhibiting hormone from eyestalk of *Penaeus monodon*
21. Effect of injection steroids on gonad development of *Penaeus monodon*
22. Effect of salinity on culturing of *Penaeus monodon* in concrete pond
23. Study on broodstock preparation of tiger prawn *Penaeus monodon* cultured in the earthen pond
24. Experiment on nursing of *Penaeus monodon*, Fab. postlarval stage at different stocking densities.
25. Effect of crustaceans thoracic ganglion extracted on ovarian maturation in *Penaeus monodon*
26. Artificial breeding technique in *Penaeus monodon*
27. Intensive culture of tiger shrimp (*Penaeus monodon* Fab.) in cement ponds.
28. Intensive culture of banana shrimp (*Penaeus merguensis* Fab.) in cement ponds.

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