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TERMINAL REPORT

SMALL SCALE FISHERIES DEVELOPMENT PROJECT
CAGE CULTURE AND SEED PRODUCTION SUB-PROJECT
IN JAMBI AND SOUTH SUMATERA
AUGUST 20, 1984 – SEPTEMBER 30, 1986

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FISH BREEDING ADVISOR
NATIONAL INLAND FISHERIES INSTITUTE,
DEPARTMENT OF FISHERIES
BANGKOK, THAILAND

THE DIRECTORATE GENERAL OF FISHERIES, INDONESIA,
IN COLLABORATION WITH
THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
IN THE CAGE CULTURE AND SEED PRODUCTION SUB-PROJECT
OF THE SMALL SCALE FISHERIES DEVELOPMENT PROJECT
JAKARTA, SEPTEMBER 1986

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I. INTRODUCTION.

Indonesia's fishery resources provide important source of animal protein to the nation and the only affordable source to the majority of the population. In 1979, fish provided nearly 60% of total animal protein intake. Given the relatively high cost of meat, eggs, and milk products, fish is likely to continue to be the most important source of animal protein in Indonesia in the foreseable future.

The fishery sector also provides employment to over three million fishermen and fish farmers (about 5% of the labor force) either on a full-time or past-time basis. However, because the fishery sector is comprised of fishermen and fish farmers who generally earn very low incomes and because fish provides an important food source for the low income population, the fishery sector is an excellent target for development.

To maintain and increase fishery recources production, in Indonesia. USAID/GOI had collaborated and established "Small Scale Fisheries Development Project" to apply research effort undertaken to seek answers and develop usable solutions to the problems of fishery production and product losses due to spoilage.

The broad sectoral goal of this project was to increase annual percapita fish consumption to 30 kg while improving the quality and variety of good fish available to Indonesia. One of the necessary conditions to achieving this goal was an increase in total fish availability while simultaneously attempting to decrease the losses caused by spoilage. This project as originally envisaged had six sub-projects which sought to develop new or existing technology for:

1. Extension production methodology in brackiswater pond culture;
2. Floating fish cage culture;
3. Rice-cum-fish culture and the Ambarita Hatchery;
4. Freshwater shrimp culture;
5. Artisanal marine fisheries, and
6. Introduce flake ice to artisanal fishermen.

II. PROJECT DESCRIPTION.

A. Background.

Two of development priorities of Goverment of Indonesia (GOI), are an increase in edible fish food production, and an increase in rural poor disposable incomes. During Repelita I, Indonesia's first five-year plan, precedence in fisheries sector was given to a rapid build-up of commerical fisheries, which contributed to foreign exchange earnings. During Repelita II, the highest priority was placed on assistance to the small scale fish producers. Despite the change of GOI emphasis, a number of donor countries and international agencies have continued to fund commercially oriented fisheries projects. Of a number of donor-financed projects only three directly affect the small scale fishery sector and four others only impact on that sector to a limited degree.

"Small Scale Fisheries Producers" of Indonesia is a generic term describing artisanal fishermen and smallholder fish farmers. Usually they are classified with the rural poor, although a small number of both artisanal fishermen and fish farmers reside on outskirts of poor urban areas. The population, production, and annual incomes of this target group are noted below, with available 1961 statistics used as a comparison:

	1961	1976
1) Small Scale Fisheries producers		2,222,623
Small Scale marine fishermen		964,169
Inland fishermen		482,562
Small Fish Farmers		745,892
Small fishing boats	197,640	245,725
Fish farm hectarage	291,844	259,440
Annual marine catch (M/tons)	525,198	1,081,589
Annual Inland catch (M/tons)	297,988	246,711
Annual fish farm production(M/tons)	87,095	154,642
Average annual production per:		
Marine fishermen (kg)		1,100
Inland fishermen (kg)		847
Fish farmer (kg)		214

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Complete statistics for 1961 are not available but the figures that indicate that the gains made in the past 15 years are primarily in the commercial marine fishing sector, these gains produced increases in foreign exchanges, but little change in the marine protein available for the Indonesian households. Annual per-capita fish consumtion remains at 10 kg, with gains in productions being almost exactly matched by population growth.

2) Estimated average annual net income from fishing:

Marine fishermen	$ 275
Inland fishermen	$ 243
Fish farmer	$ 212

These estimates based on current pond-side and dock side fish prices.

The Small Scale Fisheries output per-unit of effort had remained essentially static during these 15 years, as demonstrated by the inland production figures, (inland fishery is entirely artisanal).
In fact, inland production has decreased in real terms over the period, and in per-capita availability terms it had decreased by approximately one half.

The needs of the Small Scale Fisheries were legion, but the following illustrate the scope of the problem :

(a). Only 4% of all the fishing boats in Indonesia were engine powered, the remainder were powered by sail or oars. As a result, and modern technology was difficult to apply. Average catch per-unit of effort in Indonesia was less than half the catch of the next lowest producer in Southeast Asia, Thailand.

(b). Outside Java, ice production supplied only 10% of the needs of the fishing indatry, and at prohibitive prices. This had contributed to appalling spoilage factor of about 20%.

(c). Only 23% of the maximum sustainable yield of the marine resource was harvested annually due to a number of factors which include poor fishing techniques, poor distribution and marketing, and a lack of a fishing management strategy which allowed overfishing in some areas and little or none in others.

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(d). Fish ponds were small, everaging less than one hectare in size on Java, and unit production was the lowest in Southeast Asia, averaging less than 300 kg per-hectare per-year as compared to more than one metric ton in the neighboring Philippines.

(e). Rice field fish production had remained essentially constant for 19 years, while similar production in the Philippines had mushroomed.

(f). Macrobrachium rosenbergii (Mb), production of the Malaysian giant freshwater prawn languished in Indonesia, its natural habitat, while in Hawaii it was becoming a profitable commercial activity.

(g). Floating fish cage operators in Kalimantan and Jambi were practicing crude cage culture with very low production, while fish cage operators along the Mekong River on Indo-China peninsula were producing 100 kg of fish per-cubic meter (m3) of cage enclosed water.

In 1977, at the request of the Goverment, USAID and GOI planners conducted an in-depth review of the fisheries subsector in an attempt to ascertain why overall fisheries production had stagnated. Among other things that care to light was that there had been dramatic increases in shrimp and tuna production mostly by foreign fleets-bur very little increases in food fish production by small scale fishermen. Major problems included infrastructure deficiencies, e.g. insufficient number of properly equipped fishing port, transport facilities, conveniently located ice plants; geography (generally, heavy fish concentrations are long distances from population centers); and low production in the major tambak areas of Java due to siltation, low action in some areas, pasts and predators. In addition, production units were small averaging only 0.8 hectares in size per-family. It was generally considered that 4 hectares were required to support a family of 5 in Indonesia.

Armed with the above knowledge, the planners reviewed all current and recently completed foreign assistance fisheries projects in Indonesia and attempted to measure their impact. It was found that most of the projects had made positive impacts on production in their immediate target areas,

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but little replication had taken place. The planners then prepared a master fisheries development plan, designed to overcome many of the production constraints enumerated above. As the result of the review, USAID and GOI agreed to address those constraints most amenable to change on a broad front. Step one of the USAID response was to institute the Tambak Irrigation study, a subproject of AID Loan 497-T-040. That subproject was designed to recommend alternative land use of the Tambak areas that couldnot be transformed into economical production units, and prepared plans for a Tambak brakish water irrigation system for the Tambak areas that were capable of being upgraded to a profitable operation.

B. Detailed Description.

1. Introduction

The project created new date and information based in areas of the fisheries subsector where only fragmentary and unreliable, if any, date existed before. Additionally, the project would directly benefit th small scale fish producers and consumers in the immediate subproject areas. The data collected ad the new techniques developed were expected to provide the basis for geographically tailored to, follow on production oriented projects that would significantly increase Indonesia's fish production.

2. Sector Goal.

The sector goal was to increase annual per-capita fish consuntion to 30 kg while improving the quality, and variety of food available to Indonesians. To achieve this goal will require a threefold increase in total fish availability, which can be provided by a 50% increase in production while simultaneously decreasing the losses due to spoilage. Eventual goal achievement may be realized only by removing many of the existing production constraints, with the rational expectation that increased production should eventually reduce market price to a level that the consumer can afford.

3. Project Purpose.

The project purpose was to introduce new and improve exixting technology and create a new statistical base throughout the small scale fisheries subsector that would enable national planners to increase production through redirecting their fisheries assistance and resource priorities to increase the food fish production in the immediate subprojects areas.

End-of project status consisted of :

(a). Reduction in annual fish losses due to spoilage by 30% below current marketing loss rates in Maringgai, Lampung Province, (site of pilot flake ice plant).

(b). Fish farmers would have commenced independent construction of floating fish cages near Palembang and Jambi, with at least 30 at the time, cages already contructed.

(c). Marine fish catch, per-unit of effort, and marketing would have increased about 5% above current rates along the South Coast of Java.

(d). Five percent of fresh water fish farmers in Java would be producing fresh water prawns.

(e). Twenty-five percent of irrigated rice fields North Sumatera would be producing at least one annual fish crop.

(f). Ten percent of the Tambaks on Java and S.Sulawesi would utilize the GOI Tambak Demonstration Ponds (DEMPONDS).

The major assumption for achieving the project purpose were that community inputs such as fish feed, credit facilitate, and fertilizer can be available; that hatcheries would attain their production goals; and that fish producers would adopt and adapt to the new technology introduced; the GOI would provide extensionists and necessary support.

4. Outputs.

Major planned outputs include the following :

(a). A pilot flake ice plant built at Maringgai. The plant would supply ice to local wholesalers, retailers, about 200 fishermen in the fisheries cooperative, and an additional 100-200 unaffiliated fishermen. Complete user statistics and economic data would be developed for the files of DGF and USAID. Containers for holding and handling ice would be demonstrated.

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b. A functional artisanal fishery management system instituted to include fishing seasons, limits, species and marketing data, as well as design data for artisanal fishing boats and fishing gear upgrading.

c. Floating demonstration fish cages at Jambi and complete production, marketing data and methodology, including feeding regimes on the most productive and profitable species to culture, in the floating cages.

d. Fresh water shrimp production methodology formulated and demonstrated to fish farmers in Java. Hatcheries at Adiraja, Pangandaran and Prigi upgraded and producing 5,000,000 fry annualy.

e. The fish hatchery at Karasaan and Ambarita upgraded and producing 9,000,000 fry per-year, and complete production methodology including pesticida controls devised and supplied to DGF and USAID.

f. Assistance to the existing tambak extension service on Java (Karawang and Kr.Anyar Bengli), and South Sulawesi (Pangkep), with services provided to 5,000 tambak operators.

Major assumptions for achieving outputs are:

1. Water quality and quantity at Karasaan and Ambarita carp hatchery will be sufficient for needs.
2. Public land and a satisfactory water supply will be available for the flake-ice plant.
3. Sufficient operating funds will be provided by the GOI
4. Suitable sites will be found for the floating cages and an adequate supply of fish meal is available.
5. Adequate water system and water quantity will be sufficient for Mb.shrimp hatcheries in Adiraja, Pangandaran and Parigi.
6. The DGF will provide a sufficient number of fisheries extensionists to disseminate the new technology.
7. Adequate counterpart staff and facilities will be supplied by the DGF
8. Fishermen can be induced to use ice and pay the additional cost involved
9. That adequate data will exist to design a functional artisanal fishery management system.

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10. That the new management system can be designed in a socially acceptable fashion.
11. It is assumed that adequate markets and fish distribution systems exist to market fish at a profit to fisherman.

5. Inputs.

USAID provided a $ 3 million Grant to finance 235 man-months of technical assistance, 144 months of long and short-cerm participant training commodities counsisting of project vehicles, a flake-ice plant with tools, spared and generating equipment, seientific and technical equipment for two shrimp ha cheries and two fish hatcheries and four floating fish cages.

The GOI input included $ 1,3 million equivalent for construction of an ice plant building,floating demonstration fish cages, and two hatcheries, the provision of five office facilities for project technicians, thirteen participants to continue project efforts after the end of USAID involvements, and counterpart technicals at headquarter and local levels. The magnitude of the inputs was expected to be sufficient to produce the predicted output. Reasonable allowance had been made for contingencies and inflation.

Major assumption concerning inputs were;The GOI provided adequate funds and assistance-in kind was made available to fully support the project technicians.

B. PROJECT DESCRIPTION LOGICAL

Project Title and Number : SMALL SCALE FISHERIES DEVELOPMENT PROJECT C.497-0268.

PROJECT DES

LOGICAL

ject Title & Number: SMALL SCALE FISHERIES DEVELOPMENT PROJECT C 497-0286

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR
Program or Sector Goal: The broader objective to which this project contributes: Increase annual per capita fish consumption to 30 kg. by increasing the quantity, quality, and variety of food fish available to the consumer.	Measures of Goal Achievement: Annual food fish availability increased by 50% by 1995.
Project Purposes: To: introduce new technology and create a new statistical base throughout the fisheries sub-sector that will enable national planners to redirect their fisheries assistance priorities in order to increase fish production; and to increase the food fish production in all production categories in the immediate sub-project areas.	Conditions that will indicate purpose has been achieved: End of project status. 1. a. Annual fish losses due to spoilage will be reduced 50% below current loss rates in Maringgai b. Fish farmers will have commenced spontaneous construction of floating fish cages, with 20 cages constructed in S. Sumatra c. Marine fish catch per unit of effort will have increased 5% above current catch rates along the South Coast of Java d. Five percent of fresh water fish farmers will be producing fresh water prawns in Central Java. e. Twenty five percent of upland rice fields will be producing at least one annual fish crop in North Sumatra. 2. f. Ten percent of Tambak on Java will utilize GOI Tambak Demo 2. Complete statistical and scientific data will exist in DGA on each of the above.
puts: 1. A pilot ice plant at Maringgai 2. Flake ice user statistics 3. A functional artisanal fishery management system 4. Floating fish cages in Jambi 5. Species and feeding regimen statistical data 6. Freshwater shrimp production methodology 7. A rice/fish culture extension service in North Sumatra 8. Rice/fish production methodology 9. A Tambak extension service in Northern Java and South Sulawesi 10. Technicians Trained.	Magnitude of Outputs: 1. a. Ice plant at Maringgai built and operating. b. All wholesalers, 50% of retailers, and 200 fisherman ice users 2. Statistical base on production effects of ice usage 3. a. Fishery management system established b. 400 artisanal boats upgraded and practicing improved concepts 4. a. Twenty Floating fish cages constructed b. Cages demonstrated to 500 fish farmers 5. a. Three most profitable species identified b. Feed formulation for 3 species 6. a. Production methodology formulated and demonstrated 100 fish farmers b. 5,000,000 shrimp fry produced annually in project hatchery 7. Hatchery at Kerasaan upgraded and improved 8. Rice field culture extension service established 9. Extension service established and provided to 8,000 tambak farmers 10. Thirteen technicians completed training
Inputs: USAID 1. Commodities 2. Technical Assistance 3. Participants sent for training 4. Project vehicles GOI 1 Buildings for Pilot Ice Plant loating fish cages ounterpart staff ffice facilities 5. Commodities 6. Participants	Implementation Target (Type and Quantity) USAID 1. Refrigeration plant; scientific equipment 2. 192 man-months of technical assistance 3. 135 months of long and short term training 4. Seven Project vehicles 5. Grant funds of $3,000,000 GOI 1. Ice plant building 2. 3 Floating fish cages; feed; fingerlings 3. 28 Counterpart technicians 4. 6 Office facilities, fully equipped 5. Insulated fish boxes-test fishing gear; feed and fingerlings 6. Air transportation for 4 participants 7. Project funds 1,300,000 dollar equivalent

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III. SUB-PROJECT "CAGE CULTURE AND SEED PRODUCTION"

A. Purpose and scope of work.

A highly production method of floating fish cage culture that is suitable for application in Indonesia, has been developed along the Mekong River of Indo-China peninsula. As practiced along the Mekong, the method essentially consists of building large floating cages of an economical and feasible design. The cages is stocked with fingerlings at a density of 75 to 100 per-cubic meter of enclosed water. Growth periods vary according to the species of fish being raised and the density of stocking. In the case Common carp, the growing period is ten months. The carp reach an average weight of 1,3 kg, for a total yearly cage output of to 22 metric tons of fish, live wight. This far exeeds the output of freshwater pond culture, even at many advanced experimental station.

The subproject activity is currently designing and building floating fish cages of a design similar to the floating cages on the Mekong River and is conducting experiments at Jambi and Palembang. The experiments are attempting to ascertain the best low priced, local species of fish to cultivate and the appropriate feeding regimes for the selected species, utilizing locally and easily available feeds. These feeds include trash fish, rice bran and other vegetable matter. This subproject is expected to create local demand for one or more of the following: a credit program for cage construction and operating expenses; technical assistance requirests; a combined credit/technical assistance program in production, cage construction and extension.

B. Project proposal.

(1). Introduction.

Jambi and Palembang are situated in areassurrounded by rivers, canals and natural lakes. Local species are usualy captured and reared in cages, among those are ornamental fish which, are collected for market. The production of cage culture, however, is very low. This is due to the fact that farmers are lacking of knowledge, experience and skill in the cages culture techniques, in feeding practices and in stocking density.

Extension programme by means of demonstration on cage culture techniques is highly recommended as one effort in improving the seed production.

2. Objectives.

The objectives of the project were aimed.

2.1. To improve production of locally practiced cage culture i.e. Leptobarbus hovenii in Jambi, Pangasius pangasius and Notopterus chitala in Palembang.

2.2. To rear Leptobarbus and Pangasius brooders in cages in Jambi and Palembang respectively, and also to rear Notopterus chitala in fences in Palembang.

2.3. To implement breeding and larvae rearing of
- a). Leptobarbus hovenii in Jambi
- b). Pangasius pangasius in Palembang
- c). Notopterus chitala in Palembang

2.4. To collect local species from the natural water and reared in cages for broodstocks.

2.5. To conduct extension program and Demonstration.

3. Activity (1984-1985), in Jambi.

3.1. To improve production of cage culture of Leptobarbus hovenii, locally available food ingredients were utilized for feeding.

- a). Thirty six cages of 2x3x1,5 m3, complete with floating materials were installed in stagnant water and runing water, 18 cages were installed in Mudung Lake (stagnant water) and the rest were set up in Batang Hari River.
- b). The stocking density in each location was divided into two groups (Treatment), one of which stocking group was composed of 3 cages (Replication).
- c). Three types of diets were applied. The first one contained nutritionally balanced diet with high protein contents.

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.The second diet was formulated from locally available food, ingredients. The last type of feeding composed local food ingredient mixed with vegetable cassava leaves.

d. Feeding rate for the first and second type of the diets was given at 4% body weight/day, and supplemented with vegetable or cassava leaves for the last type.

e. Sampling activity was done every month by using about 20% of stocks.

3.2. Broodstock Rearing in cages.

Two cages of 4 x 8 x 1,75 m3 complete with floating materials were installed for rearing *Leptobarbus hovenii* brooders. One cage was set up in the stagnant water of Mudung Lake. The other was set up in the Batang Hari river(running water).

a. Stocking density was 2 fish/m2 in which male and female were mixed together.

b. The quality of food composition was similar to pellet food produced by BPPD in Jambi. The formula has succesfully been practiced in rearing *Leptobarbus* brooders in cage. The maturity of brooders was induced by means of breeding method in 1983. The pellet was composed of :

- 30% fish meal
- 20% bean meal
- 20% rice bran
- 6% palm sagu
- 10% ipomea fresh
- 1% Vitamin premix
- 3% minerals
- 10% coconut cake

Feeding rate was made up at 5% body weight/day The effect of treatment was monitored every other month.

3.3. Breeding Technique and Larval rearing
- Selection of brooders
- Injection technique
- Fertilization and Hatching eggs
- Larval rearing
- Nursing fry to obtain fingerling size

3.4. Collection local species from the open waters
- For stocking and rearing in cages, and for preparing as broodstock.

3.5. Extension service and Demonstration
- To advice extension workers in term of fish cage culture and seed production.
- To established training programme for farmers in cage culture technique, food and feeding preparation and type of material for cage construction.

<u>In Palembang.</u>

1. Utilization of local feeding in the improvement of production:
   a. Eighteen cages of 2x3x1,5 m3 complete with floating materials were installed in three location of running waters (i.c. Gandus, Talang Aru and Lebung Karangan).
   b. Three species were reared in the respective location e.g.
      b.1. <u>Leptobarbus</u> fingerling were reared in two cages with stocking density of 15 fishes/m2 and 30 fishes/m2.
      b.2. <u>Puntius shwanifeldi</u> fingerling were reared in two cages with stocking density of 100 fishes/m2 and 150 fishes/m2.

b.3. Mystus numerous fingerlings were reared in two cages, with the stocking density of 100 fishes/m2 and 200 fishes/m2.

- Two types of diets were applied, the first consisted of locally available ingredients and was fed to Leptobarbus and Puntius schwanifeldi, at feeding rate of 4% of body weight/day. The second diet contamed nutritionally balanced with high protein content, was fed to Mystus numerous, feeding rate of 5% body wt/day.
- Sampling was taken about 20% of stock and was treated every month, using about 20% stocks.

2. Broodstock Rearing.

2.1. Leptobarbus brooders were reared in two cages of 3x4x1,5 m3, with stocking density of 2 fish/m2 in Lebung Karangan.

- 20% protein content of pellet was given at the rate of 3% body wt/day, and added with vegetable of 10% body wt/day.

2.2. Pangasius brooders were reared in one cage of 2x3x2 m3 in which 32 fishes, are kept in Gandus, the average weight for each was about 2 kg.

- 30% protein content of pellet was fed at the rate of 5% body wt/day added with trash fishes of 10% body wt/day and given twice a week.
- The effect of treatment was monitored every other month.

2.3. Notopterus chitala brooders were captured from the natural waters, and were reared in two fences of 10x20x4 m3. In Tanjung Pering, the stocking density was 1 fisher/5m2.

- Small fisher were fed at a rate of 10% body wt every other day.
- Bamboo sticksor wooden poles stuck on every two meters in the fences to enable the eggs attached.

3. <u>Breeding Technique and Larval rearing</u>.
   - Preparation of Small Scale Hatchery and accomplishment of some equipments.
   - Selection of brooders.
   - Administration of injection technique.
   - Fertilization and hatching practices
   - Larval rearing
   - Nursing fry produce fingerling.

4. <u>Collecting local species from the nature</u>.

   For producing broodstocks local species were captured and were then reared in cages.

5. <u>Extension Programme and Demonstration</u>
   - To advice extension workers in terms of fish cage culture and seed production.
   - To utilize locally available feeding, and demonstrate the fish feeding technique to fish farmers.

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ACTIVITY PROGRAMME PERIOD

No.	Activity	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Aug
1.	Planning and preparing Project Programme	—											
2.	Preparing and setting Facilities	—	—										
3.	Rearing broodstock		—	—	—	—	—	—					
4.	Breeding, larval rearing				—	—	—	—	—				
5.	Rearing for production			—	—	—	—	—	—	—	—	—	—
6.	Collecting local fishes			—	—	—	—	—	—	—	—		
7.	Extension and Demonstration						—	—	—	—	—	—	—

Activity in Jambi 1985-1986.

1. Improved production in cage culture by utilizing local feed which could be foun easily.

   1.1. Leptobarbus hovenii

   a. Sixteen cages of size 2x3x1,5 m3, with complete floating material were set in two locations. The first 8 cages were set in Danau Sipin (stagnant water) and the rest were set in Batang Hari River.

   b. Stocking density in each location was divided into two groups (treatment) one of 20 fishes/m2 and the other of 30 fishes/m2.

   c. Two types of feed were used. The first type was complete and with high protein contents. The second type used locally available food material mixed with vegetable or cassave leves.

   d. Each type of feed was composed of two treatments and two replecations.

   e. Sampling activity was done every month, using about 20% of stocks.

   1.2. Puntius goniononotus.

   a. Sixteen of size 2x2.5x1 m3 with complete floating material were set in two locations, stagnant water and running water.

   b. Stocking density in each location was divided into two groups. One of 50 fishes/m2 and the other of 100 fishes/m2.

   c. Treatment, replecation, food composition and feeding activity were the same as Leptobarbus culture.

   d. Period of work 8 months (September 1985-April 1986).

2. Rearing Broodstock in cages.

   2.1. Leptobarbus hovenii.

   a. Two cages of size 4x8x1.5 m3 with complete floating material were set for rearing Leptobarbus hovenii brooders. One cage was set in Mudung Lake (stagnant water). The other one was set in Batang Hari River (running water).

b. Stocking density was 2 fishes/m2 with males and females mixed together.

c. Food composition was the same quality as pellet food of BPPD in Jambi that has been successful in rearing Leptobarbus brooders in cage to get maturity and achieving by artificial method.
The composition of pellets was fish meal (30%), soy bean meal (20%) rice bran (20%), palm sagu (6%), ipomea fresh (10%), vitamin premix (1%), and mineral (3%).

d d. Feeding rate was set at 5% body weight/day.

e. Checking activity will be done every two month.

f. Period of work : whole year (1985-1986).

2.2. Labeo krysophekadion (Blâck shark)

- Thirty Brooders were reared and stocked together in each cage of Leptobarbus brooders (polyculture). Some food composition and feeding activity were prepared.

2.3. Botia macracantha

a. One hundred Botia brooder were rearied in the aquariums and concreate ponds which were set in the hatchery.
b. Stocking density was 10 fishes/m2 with males and females mixed together.
c. Living food or fresh food (Tubifex) were used, feeding rate was set at 10% body weight/day (wet weight).
d. Period of work : whole year (1985-1986).

3. Breeding technique and Larval rearing.

Breeding activity was done during rainy season (November 1985-April 1986).
The activities included :

- Selection of brooders
- Injection Technique activity
- Fertilization and gatching aggs
- Larval rearing
- Nursing fry to fingerling size

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4. Collecting the local fish species from the natiral

For stocking and rearing in cages, pond and concreate pond, prepared for broodstock. Selection activities were:

- Selection of physical quality
- Selection of size and age
- Selection of species
- Period of work: whole year (1985-1986)

5. Extension service and demonstration

- To advice extension officers in scope of fish cage culture and seed production.
- Established local training programme for 50 fish farmers and 25 technicians from DGF staff in cage culture techniques, food and feeding and type of material for cage construction.
- Extension 50 fish farmers (100 cages) for rearing fish in floating cages.
- Period of work: whole year (1985-1986).

In Palembang

1. Improving production in cage by utilizing local feeds, (August 1985-September 1986).

1.1. Leptobarbus hovenii.

a. Four cages of size 2x3x1.5 m3 with complete floating material were set in Musi River (Gandus).

b. Stocking density was devided into two groups. The first two cages were 20 fish/m2 and the other were 40 fish/m2.

c. Local food materials were used for feeding by making cooked food.

d. Feeding rate was set at 5% body weight/day (dry weight).

e. Fish sampling activity will be done every month about 20% of populations.

1.2. Puntius schwenifeldi.

a. Two cages of size 2x3x1,5 m3 with complete floating materials were set in Gandus.

b. Stocking density was set at the rate 100 fishes/m2 and 150 fishes/m2.

c. Food composition and feeding rate as the same formula as Leptobarbus rearing.

1.3. Pangasius sutchi

a. Two cages size 2x3x1.5 m3 with complete floating matrials were set in Gandus.

b. Stocking good materials were used for feeding by making cooked food.

c. Sampling activity was done every month about 20% of population.

1.4. Oxyelotris marmoratus.

a. Two cages of size 2x3x1.5 m3 with complete floating materials were set in Talang Aur(running water).

b. Stocking density was adjusted at the rate of 100 fishes/m2 (25 kgs).

c. Trash fish was used for feeding at the rate of 10% body weight every other day.

d. Sampling activity was done every month about 20% of population.

2. Rearing of Broodstock in cages.

2.1. Leptobarbus hovenii

a. One wooden cage of size 4x8x1,5 m3 with complete floating material was set for rearing Leptobarbus brooders in Gandus (running water).

b. Stocking density was 2 fishes/m2 with males and females mixed together.

c. Food composition and feeding rate was the same as Jambi.

d. Checking activity was done every other month.

e. Period of work: whole year (1985-1986)

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2.2. Pangasius pangasius

a. Two wooden cages of size 2x3x1.5 m3 with complete floating materials were set for rearing Pangasius pangasius brooders in Gandus.

b. Stocking density was 10 fishes/m2 with males and females mixed together.

c. Cooked food which composed of are: fish meal 30%, broken rice 50%, rice bran 20%, was used for feeding at the rate of 5% body weight/day (dry weight), including Trash fish 10% body weight twice a week.

d. Checking activity was done every month.

e. Period of work: whole year (1985-1986).

2.3. Botia macracantha.

a. One hundred Botia brooders were reared in the aquariums and concrete ponds which were set in the hetchery.

b. Stocking density was 10 fishes/m2 with males and females mixed together.

c. Living food or fresh food (Tubifex) was used, feeding rate was set at 10% body weight/day (wet weight).

d. Period of work: whole year (1985-1986).

3. Breeding technique and Larval rearing.

Breeding activity was done during rainy season (November 1985-1986).
The activities were:

- Select the brooders
- Injection technique activity
- Fertilization and hatching eggs
- Larval rearing
- Nursing fry to fingerling size.

4. Collecting the local fish species from the natural

For stocking and rearing in cages, pond and concrete pond, and prepared for broodstock. Selection activities were:

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- Selection of physical quality
- Selection of size and age
- Selection of species
- Period of work: whole year (1985-1986).

5. <u>Extension service and demonstration</u>.
   a. To advice extension officers in scope of fish cage culture and seed production.
   b. Established local training programme for 50 fish farmers and 25 technicians from DGF staff in cage culture techniques, food and feeding and type of material for cage construction.
   c. Extension for 50 fish farmers (100 cages) on rearing fish in floating cages.
   d. Period of work: whole year (1985-1986)

Outlined Programme for Small Scale Fisheries Development Project
Sub-project: "Cage Culture and Seed Production."

Activities	1984 - 1985		1985 - 1986	
	Jambi	Palembang	Jambi	Palembang
I. To improve production of fish cage culture by utilizing locally food materials.	- Leptobarbus - Common carp	- Leptobarbus - Puntius schawanifeldi	- Leptobarbus - Common carp - Puntius jawanicus - Tilapia	- Leptobargus - Puntius schawanifeldi - Sand goby - Notopterus chitala
II. Rearing Brooders	- Leptobarbus	- Pangasius pangasius	- Leptobarbus - Ornamental fish (Botia sp., Black shark, etc.)	- Pangasius pangasius - Leptobarbus - Notopterus chitala - Sand goby - Ornamental fish (Botia sp., etc.)
III. Breeding and larval rearing	- Leptobarbus	- Pangasius pangasius - Pangasius sutchi	- Leptobarbus - Panntius genionotius - Ornamental fish	- Pangasius pangasius - Pangasius sutchi - Leptobarbus - Ornamental fish

Activities	1984 - 1985		1985 - 1986	
	Jambi	Palembang	Jambi	Palembang
IV. Collecting local species preparing for broodstock	- Leptobarbus - Lissochilus sp - Ornamental fish (Botia, Black shark, Black Lancer, etc.)	- Leptobarbus - Pangasius pangasius - Ornamental fish - Sand Goby	- Leptobarbus - Lissochilus sp - Ornamental fish (Botia, Bala shark)	- Leptobargus - Pangasius pangasius - Notopterus chitala - Sand Goby - Ornamental fish (Botia, Bala shark etc.)
V. Training and Extension Services	- Local training (23 participants) - Overseas training (24 participants) - Extension to 20 fishfarmers (30 cages)	- Local training (23 participants) - Overseas training (24 participants) - Extension to 25 fishfarmers (45 cages)	- Local training (50 participants) - Extension program 50 fishfarmers (100 cages)	- Local training (50 participants) - Extension program 50 fishfarmers (100 cages)
VI. Additional programme - Induced Breeding Ikan Batak in Medan	-	-	- collecting the Breeders - rearing in cage and running water pond for getting maturity. - Injection procedures, Hatching eggs and larval rearing. - Restocking in Toba Lake.	

- Give advice in Fishs Culture and Breeding for DGF staffs.

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IV. SUMMARY OF ACTIVITY

During the twenty fire months of my contract(August,1985-September 1986).I had made my effort to follow up the project implementation in consistent to the schedule. However in some period we got problem about the delay in making budget. However we tried to solve those problems by using facilities from Dinas Perikanan and collaborating with the PPPD staffs to synchronize the programme activities.The activities had so far been implemented such as :

I. Improved production in cages

In Jambi experimental cages of Leptobarbus hovenii located at Mudung Lake has been installed by using eight wooden cages of 2x3x1 m3 provided from Dinas Perikanan. Stocking density was divided in two groups,one contains 15 fishes/m2 and the other contains 30 fish/m2.Each group consists of two cages.Two types of diets were used.The first one contains locally available ingredients and formulated from 45% shrimp meal;2,50% concentrate; 1,25% vitamin;1,25% mineral;25% rice bran;10% waste of soy bean; 15% waste of coconut.Feeding rate was given at 5% body wt/day. The other group which consists of cages were fed with the same pellets(low quality)supplemented with vegetable and was given freely.Four experimental net cage of 1,5x2x1,5 m3 rendered for Common carp were also set up in Mudung Lake.The stocking density was applied to two one of which contains 35 fish/m2 and the other contains 70 fish/m2.Each treatment was applied two cages. Local food ingredient was formulated similarly to composition of pellet that was fed to the Leptobarbus hovenii.Length and weight measurement was carried out every month,and the food intake was correlated with the weight gains.

On November 12,1985:Leptobarbus fingerling were set in four experimental cages of size 2x3x1,5 m3 in Sipin Lake.Stocking density was divided into two groups.The first one contained of 35 fishes/m2 and the other one contained 60 fishes/m2.

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Each group consists of two cages.Locally available ingredients were used for feeding at the rate 4% body weight/day(dry weight). Length and weight measurement was carried out every month and the food intake was correlated with the weight gains.

The details are shou below :

Leptobarbus hovenii (fed with pellet of low quality)

Cage No. / Details.	I (grm)	II (grm)	III (grm)	IV (grm)	Remark
Average wt.	100	1[illegible]0	200	219	Water quality
Total wt(1st month)	15.000	35.000	15.000	3[illegible].[illegible]	during this month
Total wt.gains	1.000	3.000	4.500	15.000	was not good
Total food in take	22.000	52.000	23.250	45.[illegible]	condition.
Food conversion rate	[illegible],5	17,[illegible]	5,16	3,[illegible]	2nd month .
---"---	3,5	2,25	3,15	3,5	1st month.

Leptobarbus hovenii (pellet of low quality;vegetable)
2nd month.-

Cage No. / Details.	I (grm)	II (grm)	III (grm)	IV (grm)	Remark
Average wt.	200	175	75	71	Water quality
Tot.Wt.(1st month)	24.000	37.200	7.[illegible]	1[illegible].[illegible]	was not good
Total wt.gains	1,000	4.000	1.430	[illegible].000	condition.
Total food intake	37.500	63.000	15.500	25.[illegible]	2nd month.
Food conversion rate	37,5	13,13	[illegible],4	[illegible],1	2nd month.
---"---	1,5	2,75	1,36	[illegible],25	1st month.

Common carp (3rd month).-

Cage No. / Details.	I (grm)	II (grm)	III (grm)	IV (grm)	Remark
Average wt.	55,7	52,9	52,2	54,3	Harvested all
Tot.wt.(2nd month)	4.600	7,900	4.150	7.900	of stock chang-
Total wt.gains	– 700	– 500	+ 550	– 300	ed to be new
Total food intake	6,900	12,000	6,300	12,000	cages.
Food conversion rate	–	–	–	–	3rd month
---"---	2,02	4,63	1,69	[illegible],37	2nd month
---"---	1,92	1,70	3,0	[illegible]	1st month

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Leptobarbus experimental cages in Sipin Lake

Month	Total No.	Total wt.	Average wt.	Total food grm/month	Average food grm/day	Supplementary food
Cage No. I						
Started (12/12/1985)	225	6,300	28	900	300	
1st month (14/ 1/1986)	225	7,857	35	12,000	400	
2nd month (13/ 2/1986)	225	14,062	62,5	16,860	562	
3rd month (13/ 3/1986)	225	15,750	70,0	24,000	800	
4th month (13/ 4/1986)	225	18,000	80,0	27,000	900	
5th month (13/ 5/1986)	225	22,500	100,0	33,750	1.125	
6th month (13/ 6/1986)	[illegible]	[illegible]	115,0	[illegible]	[illegible]	
7th month (13/ 7/1986)	225	30,375	135,0	45,562	1,519	
8th month (13/ 8/1986)	225	79,875	355,0	119,812	3,994	
Cage No. II						
Started	300	12.000	35	15,000	500	
1st month	300	15,400	43	18,600	620	
2nd month	300	34,200	95	51,300	1,710	
3rd month	300	37,800	105	56,700	1,890	
4th month	300	[illegible]	120	64,800	[illegible]	
5th month	300	40,500	135	72,900	2,430	
6th month	300	54,000	150	81,000	2,700	
7th month	300	61,200	170	91,800	3,060	
8th month	300	131,400	365	197,100	6,570	

In Palembang

Four wire cages 2x4x1,5 m3 were installed for rearing Leptobarbus hovenii and puntius schwanifeldi at Gandus Substation. The first two cages were stocked with Leptobarbus with the stocking density of 15 fish/m2 and 30 fish/m2. The last two cages were stocked for puntius and stocking density were 100 fish/m2 and 150 fish/m2. Cooked food(boiled) consists of 25% broken rice; 20% rice bran; 20% waste of soy beam; 20% fish meal; of low quality, and 15% vegetable. Feeding rate was made at 5% body weight/day. The effect of treatment was carried out every month. The weight gain was correlated to food intake.

Two cages of size 2x3x1.5 m3 were used for rearing Notopterus borneesis (small size) at Talang Aur Sub-station for experimental observation. Stocking density was 5 fishes/m2. Trash fish or small fish were used for feeding about 10% body weight/day. Sampling activity were done for observing the increased weight every month.

Pangasius pangasius fingerlings were set in two experimental cages of size 2x3x1,5 m3 at Gandus sub-station on April 15, 1986 stocking density were 35 fishes/m2 and 50 fishes/m2. Locally available ingredients in which formula; fish meal 40%; rice bran 30%; corn meal 10%; broken rice 18%; vitamin 2%; (cooked form), were used for feeding at the rate 5% body weight/day(dry weight). Sampling activity for length and weight measurement was carried out every month. The details are shown below.

Leptobarbus and Puntius schwanifeldi reared in cages

Cage No. / Details.	Leptobarbus I (grm)	Leptobarbus II (grm)	Remark	Puntius I (grm)	Puntius II (grm)	Remark
Average wt.	82,5	92,5	1st month	62,5	3	1st month
------"------	165	120	2nd month	75	6	2nd month
Total wt.	19.800	28.200	2nd month	60,000	7,200	2nd month
Total wt.gains	9,800	6,480	2nd month	9,500	3,600	2nd month
Total food intake	15,000	33,600	2nd month	75,750	5,400	2nd month
Total conversion rate	1,53	5,18	2nd month	7,97	1,5	2nd month
-------"------	2,25	1,75	1st month	0,86	0,75	1st month

Experimental on Pangasius pangasius rearing in cages.-

Month	Total No.	Total wt.	Average wt.	Total food grm/month	Average food grm/day	Remark
Cage No. I						
Started (4 /15/1986)	215	9,675	45	14,512,5	484	Feeding rate 5% body wt/day
1st month (5 /15/1986)	215	18,330	85,26	27,495	916,5	
2nd month (6 /15/1986)	215	22,575	105	33,862,5	1.128,75	
3rd month (7 /15/1986)	215	32,250	150	48,380	1,612	
4th month (8 /15/1986)	215	50,525	235	75,788	2,526	
5th month (9 /15/1986						
Cage No. II						
Started (4 /15/1986)	300	3,750	12,5	5,625	187,5	
1st month (5 /15/1986)	300	10,500	35	15,750	525	
2nd month (6 /15/1986)	300	18,000	60	27,000	900	
3rd month (7 /15/1986)	300	28,500	95	42,750	1,425	
4th month (8 /15/1986)	300	45,000	150	67,500	2,250	
5th month (9 /15/1986)						

II. Brooders Rearing in cages.

In Jambi.

Leptobarbus brooders had been reared in two wooden cages of size 4x8x1.5 m3. One cage was set in Mudung Lake.- The other one was set in Sipin Lake. Stocking density were 2 fishes/m2. They were fed with pellets with protein content about 30%. Feeding rate were set at 3% body weight/day and vegetable were added about 10% body weight/day twice a week.

In Palembang

Pangasius pangasius brooders were reared in one wooden cage of size 2x3x1.5 m3 at Gandus sub-station. Stocking density was 10 fishes/m2. Cooked food which composed of; fish meal 40%; rice bran 40%; broken rice 18%; vitamin 2%; werused for feeding at the rate 5% body weight/day, and trash fishes were fed about 10% body weight/day twice a week.

Leptobarbus hovenii brooders also had been reared in one wooden cage of size 4x8x1.5 m3 at Gandus, stocking density were 2 fishes/m2. Cooked food with protein content about 25% were used for feeding at the rate 4% body weight/day, and vegetable were added about 10% body weight/ twice a week.

Notopterus borneensis brooders have been rearing in two bamboo fence of size 10x20x4 m3 at Tanjung Pering and Lembung Karangan with males and females mixed together. Stocking density was 1 fish/5 m2. Small trash fishes were used for feeding, wooden poles were fixed within the fence for eggs attached every two matre interval.

III. Breeding Activity.

In Jambi

In collaboration with BPPD and BBAT staf in Jambi we bred Leptobarbus hovenii by means of induced spawning method. The brooders were selected for mature females and male. The mature females were selected for hormone injection. Two injections were needed, the first injection was given 0,5 dose and the second injection was 2.5 dose + 100 IU of HCG.
The brooders would spawn during 10-13 hours after the first injection. After being nixed with sperm (dry method), fertilized aggs were hatched in the hapas and aquariums which were set in the indoor hatchery.
The hatching rate was estimated 50-80% and about 500,000 of newly fry were obtained. Injection technique are shown below :

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[illegible]

[illegible] date	(kg)	1st injection [illegible] (0.5)	[illegible]	2nd injection [illegible] (2.5)	[illegible]	[illegible] Injection	Ovulated (hours)
1/31/[illegible]	1,7	0,85 (kg)	-	4,25 (kg)	[illegible]	[illegible] hours	13 hours after 1st injection
	2,8	1,4 (kg)	-	7,0	200	---"---	12 hours after 1st injection
[illegible]	[illegible]	1,1 (kg)	-	[illegible]	[illegible]	[illegible] hours	10 hours after 1st injection
	[illegible]	1,0 (kg)	-	[illegible],0	100	---"---	---"---
12/5 /[illegible]	1,7	0,[illegible]5 (kg)	-	4,8	100	[illegible] hours	10,5 hours after 1st injectio
1 /[illegible]/[illegible]	1,7	0,85 (kg)	-	[illegible]	[illegible]	[illegible] hours	13 hours after 1st injection
	[illegible],7	0,85 (kg)	-	4,25	100	---"---	---"---
[illegible]	[illegible]	[illegible] (kg)	-	[illegible]	[illegible]	[illegible] hours	13 hours

[illegible]

[illegible]

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In Palembang (Induced spawning on *Pangasius pangasius*)

In collaboration with BPPD staff in Palembang, the breeding of *Pangasius pangasius* were practised by using induced spawning method. Mature females were selected carefuly for injection activity. Injection technique was practised at Gandus during the spawning season (November - March) Common carp and *Pangasius pangasius* were used for donor two injections were needed for females. The first injection was given 1 dose with 200 IU of HCG, the second injection was 3 dose + 500 IU. The brooders would spawn during 18-24 hours after the first injection. Eggs were fertilized with sperm by dry method (stripped eggs+sperm). Fertilized eggs were hatched in the hapas which were set in the indoor hatchery completely with aeration system. The hatching period was about 40-44 hours. The hatching rate was estimated 40-80%, and about 350,000 of newly fry were obtained.
The injection technique are shown below:

Natural spawning of Notopterus borneensis

Notopterus boeneensis brooders were reared in two bamboo fences in Tanjung Pering and Lebung Karangan with males and females mixed together, wooden poles were fixed within the fence for the eggs attached to. At the begining of December 1985. The water level in Tanjung Pering rose to 3 metre. Notopterus brooders were spawned in the fence by natural spawning. Their eggs were attached to wooden pole at the lower part about 30 - 50 cm. from the bottom. Eggs (nests) were transfered for hatching in the hatchery in Palembang. Some of them hatched out and grew up to become fingerling. Live moina were used for feeding. The larval rearing technique as the same as Pangasius pangasius.

IV. Collecting local species from natural water.

Botia macracanthra. were collected and reared in the aquariums and concrete pond in the hatchery in Jambi and Palembang for producing broodstock. Lived food (Tubifex) were fed intensively.

V. Conducting Training Programme and Extension Services.

1. Local Training

Practical Training was conducted in Jambi and Palembang from 5 to 17 March 1985 on Cage Culture Techniques, with special reference to breeding techniques on Leptobarbus hovenii and Pangasius pangasius. There were 23 participans attended the training and consisted of technical personnel or hatchery staff from different provinces, i, e. Jambi, Palembang, West Java, South Central and East Kalimantan, west Nusa Tenggara. The subject included fish culture, polyculture and integrated fish farming, fish breeding, cage construction, food preparation and formulation, open water management, fish handling and transportation, and larval rearing.

2. Overseas Training.

A comparative study tour was conducted to Thailand and Singapore on 3 to 25 may, 1985 on Aquaculture techniques with particular attention to fish breeding in which practical induced spawning and visit on hatcheries and culture of different species were carried out. The participants consisted of fish farmers and fisheries personnel from different provinces i.e. Jambi, Palembang, West Sumatera, East and Central Kalimantan, West NUsa Tenggara, Central Java, West Java and Yogyakarta.

3. Leptobarbus cage culture programme in Jambi.

On August, 1985 fifteen fish farmers were invited for a meeting and discussed, about Leptobarbus culture in floating cage. The first five fish farmers lived in Sipin Lake area. The second five farmers come from Mudung Lake. The last five persons stay along Batang Hari River. The purpose of programme was to stimulate the fish farmers to take interest in fish culture. The project will provide fingerling and food for feeding during eight month period. The floating cage of size 2 x 3 x 1,5 m3 must be provided by farmers. After harvested the production would belong to them, As a result of the discussion, the first two groups (Sipin Lake and Mudung Lake) agreed to join and follow the programme which stared on September 15, 1985. For the first farmers group from Batang Hari River could not join the programme because they could not provide floating cage. However we tried to establish floating cages for culture of Leptobarbus in Batang Hari River as demonstration cages. The activity are shown below :

Diagram for induced spawning on <u>Pangasius pangasius</u>

Species Pangasius ♀ Date	Wt. (kg)	1st injection PG (dose) 1	1st injection HCG (IU)	2nd injection PG (dose) 3	2nd injection HCG (IU)	Interval between 1st – 2nd injection	Ovulated (hours)
12/31/1984	2,6	2,6 (kg)	200	7,8 (kg)	500	10 hours	22 hours from 1st injection
11/20/1985	3,5	3,5	200	10,5	500	11 --"--	18 hours
	3,0	3,0	200	9,0	500	11 --"--	18 --"--
12/15/1985	3,0	3,0	200	9,0	500	11 ---"--	18 --"--
	2,5	2,5	200	7,5	500	11 ---"--	22 --"--
1/5 /1986	4,5	4,5	200	13,5	500	11 ---"--	22 --"--
	3,5	3,5	200	10,5	500	11 ---"--	21 --"--
1/31/1986	3,5	3,5	200	10,5	500	11 ---"--	18 --"--
	3,0	3,0	200	9,0	500	11 ---"--	18 --"--
	2,7	2,7	200	8,1	500	11 ---"--	22 --"--
	2,7	2,7	200	8,1	500	11 ---"--	22 --"--

♂ : Stripped sperm by using dry method fertilization

DONOR : Using <u>Common carp</u> and <u>Pangasius pangasius</u>

Leptobarbus hovenii(fed with pellet of low quality)

Cage No. / Details.	I (grm)	II (grm)	III (grm)	IV (grm)	Remark
Average wt.	100	100	200	210	Water quality
Total wt(1st month)	15.000	35.000	15.000	30.000	during this month
Total wt.gains	1.000	3.000	4.500	13.000	was not good
Total food in take	22.000	52.000	23.250	45.000	condition.
Food conversion rate	22,5	17,5	5,16	[illegible]	2nd month .
---"---	3,5	2,25	3,15	3,5	1st month.

Leptobarbus hovenii(pellet of low quality+vegetable)
2nd month.-

Cage No. / Details.	I (grm)	II (grm)	III (grm)	IV (grm)	Remark
Average wt.	200	175	75	71	Water quality
Total wt.(1st month)	24.000	37.200	7.500	12.000	was not good
Total wt.gains	1.000	4.800	1.430	[illegible]	condition.
Total food intake	37.500	63.000	13.500	25.500	2nd month.
Food conversion rate	37,5	13,13	[illegible]	6,1	2nd month.
---"---	1,5	2,73	1,38	2,25	1st month.

Common carp (3rd month).-

Cage No. / Details.	I (grm)	II (grm)	III (grm)	IV (grm)	Remark
Average wt.	55,7	52,9	52,2	54,3	Harvested all
Totalwt.(2nd month)	4.600	7,900	4.150	7.900	of stock chang-
Total wt.gains	- 700	- 500	+ 550	- 300	ed to be new
Total food intake	6,900	12,000	6,300	12,000	cages.
Food conversion rate	-	-	-	-	3rd month
---"---	2,02	4,43	1,69	3,37	2nd month
---"---	1,92	1,70	3,0	[illegible]	1st month

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II. Latif M

Started	225	3,375	15	5,100	170	--"--
1st month	225	8,550	38	10,500	350	--"--
2nd month	225	10,125	45	12,150	405	--"--
3rd month	225	12,375	55	18,600	620	--"--
4th month	225	16,312	72,50	24,450	815	--"--
5th month	225	16,875	75	25,300	843	--"--
6th month	225	22,500	100	33,750	1.125	--"--
7th month	225	24,750	110	37,125	1,237	--"--
8th month	225	28,125	125	42,175	1,406	--"--
9th month	225	32,625	145	48,938	1,631,5	--"--
10th month	225	72,563	322,5	108,844	3,625	--"--
11th month	225	112,500	500	168,750	5,625	--"--
12th month			.			--"--

III. Sargawi

Started	225	3,375	15	5,100	170	--"--
1st month	225	7,200	32	[illegible]	[illegible]	--"--
2nd month	225	[illegible]	40	10,800	360	--"--
3rd month	225	13,500	60	20,250	675	--"--

4th month	225	18,000	30	27,000	900	Vegetable Hyd-
5th month	225	27,000	120	40,500	1.350	rilla sp.0,5
6th month	225	31,500	140	47,250	1,575	kg/day.
7th month	225	45,000	200	67,500	2,250	--"--
8th month	225	55,800	248	83,700	2,750	--"--
9th month	225	60,300	268	90,450	3,015	--"--
10th month	225	97,650	434	146,475	4,882	--"--
11th month	225	135,000	600	202,500	6,750	--"--
Ev. Hasan R.						
started	225	3,375	15	5,100	170	--"--
1st month	225	7,200	32	8,640	288	--"--
2nd month	225	8,650	38,5	10,400	345	--"--
3rd month	225	10,125	45	15,190	506,25	--"--
4th month	225	16,069	71,4	24,000	800	--"--
5th month	225	21,690	96,4	32,500	1.084	--"--
6th month	225	27,315	121,4	40,980	1,366	--"--
7th month	225	33,750	150,0	50,625	1,687,5	--"--
8th month	225	41,782,5	[illegible]	62,673	[illegible]	--"--
9th month	225	51,750	230	77,625	2,[illegible]	--"--
10th month	225	99,000	440	148,500	4,950	--"--
11th month	225	146,250	650	219,375	7,31[illegible]	--"--

List of Fishfarmer joined with *Leptobarbus* and *Pangasius-pangasius* Culture Programme.

Number	Name	Address	Size of Cage/Pond		Construction (Year)
1	2	3	4		5
	A. KABUPATEN MUARA ENIM				
	1. S u a s	Ds. Embacang	Kolam	500 m2	1978
	2. B a t u n	idem	-"-	500 m2	1979
	3. Nangsidi	Ds.Pandan Enim	-"-	500 m2	1975
	4. Sinar Ali	Tj. Karangan	-"-	500 m2	1980
	5. Ali Upar	-"-	-"-	500 m2	1982
	B. KABUPATEN OGAN KOMERING ILIR				
	1. Zulkifli M.Ali	Ds.Tanjung Gelam	Sangkar	24 m2	1983
	2. H o l i l	Ds. Indralaya	-"-	24 m2	1979
	3. H. M a z e n i	Ds. Saka Tiga	-"-	48 m2	1981
	4. H a r i s o n	Ds. Sudimampir	-"-	12 m2	1982
	5. S o r i	-"-	-"-	12 m2	1982
	6. M. D a n i e l	Ds. Indralaya	-"-	24 m2	1980
	7. M. J a m i l	Ds. Sungai Pinang	-"-	24 m2	1984
	8. R u s p i	Ds. Indralaya	-"-	24 m2	1982
	9. M. A l i	Ds. Indralaya	-"-	18 m2	1983
	10. E d d y	-"-	-"-/Pen	600 m2	1982
	11. M a r z u k i	Ds. Saka Tiga	-"-	[illegible] m2	1982
	12. H. M. Saul	Km. 18.(arah prabumulih)	Kolam	1.200 m2	1982
	13. S.A. K a r i m	Ds. Ulak Depati	Sangkar	[illegible] m2	1983
	14. M i m i n	Simpang Plb. Dalam	Kolam	2.000 m2	1984

2	3	4		5	6
C. KABUPATEN MUSI BANYUASIN:					
1. H. A. Bastari	Km.9 (arah tl. Betutu)	Kolam	2.500 m2	1985	2
2. Husin Ciputra	Ds. Langkan	Kolam	5.000 m2	1985	1
3. A n s o r i	-"-	-"-	2.000 m2	1984	1
4. A b a k	-"-	-"-	2.000 m2	1984	1
5. K a r s o	Ds. Pasir Putih	-"-	2.000 m2	1981	1
6. D o r i	-"-	-"-	2.500 m2	1983	1
7. I r i a d i	-"-	-"-	2.000 m2	1983	1
8. Burhanuddin	-"-	-"-	2.000 m2	1985	1
9. A r p a n	-"-	-"-	3.000 m2	1984	1
10. S a m u j i	Dusun Limau	-"-	7.500 m2	1985	2
11. R u d y	Ds. S u a k	-"-	2.000 m2	1984	1
12. Y a m a d	Ds. Mariana.	-"-	3.000 m2	1982	1
13. Arifin Hasan	Ds. Sidodadi	-"-	600 m2	1983	1
D. KOTAMADYA PALEMBANG:					
1. R a w i	Bungaran II	Kolam	2.500 m2	1985	2
2. K a r i b i n	-"-	-"-	2.000 m2	1985	1
3. A. Dullah Darwis	-"-	-"-	1.000 m2	1985	1
4. M. A m i n Sr.	Suak Bujang (Gandus)	-"-	2.500 m2	1982	1
5. M. Djaelani Salam	-"-	-"-	6.000 m2	1984	2
6. M. R u d y	Bukit Lama	-"-	1.500 m2	1980	1
7. A n d r i	Bukit Sangkal	-"-	1.000 m2	1984	1
8. M a d i n	Sekip Ujung	-"-	2.500 m2	1982	1
9. Siman Jetamun	Silabrante (8 Ulu)	-"-	2.000 m2	1982	1
10. D a h o n i	13 Ulu (Plaju)	-"-	1.000 m2	1984	1
11. H. M. A l i	-"-	-"-	1.000 m2	1982	1
12. A m i n Hs.	16 Ulu (Plaju)	-"-	1.000 m2	1984	1
13. A k i n s	Ilir Timur I (sw.Batang)	-"-	3.000 m2	1984	1

5. Additional Activities

5.1. Undertaking a survey on biological conditions of Lissochillus sp. (Ikan Batak) in Toba Lake area of North Sumatera. To increse population of Lissochillus sp., artificial breeding by means of induced spawning was recommended. (See attachment) - Annex A

5.2. Undertaking a survey on biological and fisheries potential in Kalimantan area. To improve productions of freshwater fish in open water area and in captivity, Fishery management, species selection, and fish culture technique were recommended. (See attachment). Annex B

5.3. Conducted Local Training Programme for Biologists and Extension workers, in Jambi and Palembang on "Fish culture and Induced Spawning Technique ".
Two handbooks/manuals on fish culture technique have been published in Bahasa Indonesia :

5.3.1. Pemijahan Ikan Jelawat dan Ikan Patin dengan cara hepofisasi (Annex C)
(Induced Spawning of Jelawat and Patin)

5.3.2. Pengelolaan Perikanan Perairan Umum (Annex D)
(Open water fisheries Management)

5.4. Conducted comparative study tour to Thailand and Singapore for 3 weeks, on freshwater aquaculture. The study was participated by 24 participants consisted of fish farmers and The fishery personnel. (Annex)

5.5. To involve in Feed nutrition and Rice cum fish culture training programme for extension workers and fishfarmers, by giving instruction on " Fish culture and fish breeding technique ".

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5.6. To involve in Hatchery management workshop, holding in Yogyakarta by giving instruction on " Induced Breeding Technique of Pangasius sutchi, Pangasius pangasius and Leptobarbus Hovenii ". Technical paper for these species was presented. (See attachment) (Annex F)

5.7. Frequently requested to provide technical input for activities which concerned with Hatchery/Fish Cultures.

5.8. Three Technical books on "Induced spawning and natural spawning technique"were published. Those one:

- 5.8.1. Induced spawning on Leptobarbus Hovenii , carried out in Jambi. (Annex G)
- 5.8.2. Induced spawning on Pangasius pangasius, carried out in South Sumatra. (Annex H)
- 5.8.3. Natural spawning of Notopterus borneensis, carried out in South Sumatra. (See attachment) - Annex I

5.9. Leaflets for Leptobarbus Hovenii and Pangasius pangasius culture in Bahasa Indonesia was published and distributed to the fishfarmer and extension workers. (Annex J)

V CONCLUSION

During twenty five months period of my contract (August, 1984, September; 1986), the activities concentrated in fish cage culture, rearing broodstock breeding, collecting local species prepared for broodstocks and extension services,

1. Improved Production.

   In Jambi experimental cages of common carp and Leptobarbus were set in Mudung and Sipin Lake. Available local food ingredients were used to feed the species. The length and weight were measured every month. The food intake was correlated to the gains. Feeding rate was set at 5 % of body weight/day. In Palembang, Experimental cages of Leptobarbus hovenii Pontius schwanifeldi, Pangasius pangasius, Notopterus borneensis were set in Gandus and Talang Aur Available local food ingredient (cooked form) and fresh fish were used for feeding.

   The growth rate of common carp, Pangasius pangasius and Leptobarbus hovenii were very good (shownin data), although thefood material were short for some period. For Pontius schwanifeldi the wire cages were broken after activities had been done only three months.

2. Rearing Broodstock in Cage and Fench.

   Matured species of Leptobarbus Hovenii, Pangasius pangasius, Notopterus borneensis and Botia macracanthra were reared in Jambi and Palembang in the floating cages respectively, and were prepared for brooders.

3. Breeding Activity.

   In Jambi

   We collaborated with BPPD and BPAT staff in breeding Leptobarbus hovenii in which case induced spawning technique was applied. Eggs were ovulated in the optimum period of 11 - 13 hours after the first injection.

Fertilized eggs were hatched in the hapas which were set in the wooden tank, Fibreglass tank and aquariums in the indoor hatchery. Hatching rate between 50-80%. Hatching period about 15-18 hours. The larvae were fed with boiled egg yolk and live moina.
About 500,000 newly fry were obtained.
In Palembang, we also collaborated with BPPD staff in Breeding Pangasius pangasius by means of induced spawning technique. Two injections were needed for mature females. Eggs were ovulated in the optimum period of 18-24 hours after the first injection.
Fertilized eggs (adhesive) were hatched in hapas which were set in the fibre-glass tank in the indoor hatchery. The hatching period was about 40-44 hours. The hatching rate was estimated at 40-80%, and about 350,000 of newly fry were obtained.

Natural spawning of Notopterus borneensis

Notopterus brooders were reared in two bamboo fence in Tanjung Pering and Lebung Karangan (open water) with males and females mixed together, within the fence. Wooden poles were fixed for the eggs attached. To the brooders in Tanjung Pering location were spawned during rainy season (December 1985 - February 1986). Eggs were collected and transferred for hatching in the indoor hatchery. Aquariums and fibre glass tank were used for hatching. The hatching period was about 6 - 7 days at the water temperature of 27 - 29°C. Live Moina were used for feeding.

4. Collecting Local Species from The Natural Water

Botia macracanthra were collected and reared in the aquariums and concrete pond in the indoor hatchery in Jambi and Palembang for producing broodstock. Live food (Tubifex) were fed intensively.
Unfortunately the species were very easyily contracted with deseases especially "White Spot", and due to unintensive care the prospective brooders died after stocking for three months.

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5. Conducting Training Programmes and Extension Services

5.1. Local training on cage culture and induced spawning technique with particular interest in fish breeding of Leptobarbus Hovenii and Pangasius pangasius was held for two weeks in Jambi and Palembang.
The training was participated by 23 hatchery personnels and biologists.

5.2. A comparative study tour to Thailand and Singapore was conducted for three weeks on freshwater aquaculture. The study was participated by 24 participants consisted of fish farmers and fishery personnel.

5.3. Extension programmes was conducted by Leptobarbus Hovenii cage culture in Jambi.
Fingerling and food (pellets) were provided to 5 fish farmers in Mudung Lake. After completed the period of work (10 months) the production would belong to the fishfarmers.
In Palembang 12,000 fingerlings of Leptobarbus Hovenii and Pangasius pangasius, supplementary food, hapa net including leflet were distributed to 50 fishfarmers for encouraging them to extensify fishculture programme

The output of sub-project implementation to date can be summarized below :

Activities (1984 - 1986)	Implemented (%)
1. Increase production by improving local diet	40 %
2. Seed production	
- rearing broodstock	75 %
- breeding	85 %
- larvae rearing	25 %
- collecting local species for broodstock	50 %
3. Training and extension services	50 %

VI RECOMMENDATION

1. Utilization of locally available food materiel i.e. vegetables or herbage, trash fish etc.
   Should be encouraged to the fish farmers in their effort to intensify the fish culture
2. Provision of fingerlings of the most suitable species should be developed.
3. Intensive extension programme on fish culture technique and fish nutrition should be provided to key-fish farmers
4. Preparation of prospective brood stochs thruld be intensified in order to replace the used brooders which usually perished after the induced spawning activities.
5. Other species, like Pangasius sutchi should also be encourage for culture, since such species is suilable for cage and foond culture, and can giow very fast with feeding regines consist of vegetable and other kitchen or market wastes.
6. To establish rearing pond as a transition growth period before the seeds are transferred to the cage culture.
7. To provide the necessary funds either for construction of nusery pond and also materials/equipment for extension programme.
8. The project should be extended for at least 3 futher and should years, consendeal with the "Seed production" to providi fingerlings for the fish farmers.

2.1. Suitable species should be introduced

LEPTOBARBUS HOVENII BROODERS REARING

I. Cage : Wooden cage of size 4 x 8 x 1,5 m2.

II. Stocking density : 2 fish/m2.

III. Food : Pellets which composition as folowing :

Fish meal .... 30 %

Soy bean meal .... 20 %
Rice bran .... 20 %
Copra cake .... 10 %
Wheat flour .... 6 %
Ipomea .... 10 %
Vitamin .... 1 %
Mineral .... 3 %

IV. Feeding rate : 3 % body weight/day

Incoulding vegetable (Ipomea or cassava leaves) twice/week.

Diagram VI. FOOD COMPOSITION FOR REARING PANGASIUS PANGASIUS BROODERS.

Fish meal .... 40 %
Broken rice .... 18 %
Rice bran .... 40 %
Vitamin premix ..... 2 %

Remark : - Cooked food
- Feeding rate 5 % body weight/day
- Additional trash fish 10 % body weight/twice a week.

------ooOoo-----

Larval Rearing of *Leptobarbus hoevenii*

A g e	: Activity and Facilities
Fertilization	: - Stripped eggs, sperm, dry method
Hatched out	: - In hapa, aquarium, during 18 - 20 hours period at water temperature 26 - 28 °C
1 - 2 days	: - Rearing in the hatching containers
3 days	: - moved from hatching containers to aquarium, fibre glass tank or small concreate pond.
	: - Started feeding with boiled egg yolk every 6 hours interval
4 days	: - adding some water about 2 - 3 " up.
5 - 15 days	: - feeding with lived moina twice a day
	: - cleaned the bottom of containers by syphoned technique
15 - 60 days	: - feeding with supplementary food; fish meal 5 : soy bean meal 2 : rice bran 2 : wheat flour 1 : (by weight)
Remark	: Every step completely with aeration system.

Larval Rearing of Pangasius pangasius

Age	: Activity and Facilities
Fertilization	: - Stripped egg, sperm, dry method.
Hatched out	: - in hapa, in door hatchery, during 40 - 44 hours at water temperature 27 - 29 0 C
Newly Larvae	: - Moved to aquariums or fibre glass tank
	: - put antibiotic about 250 mg/aquarium.
	: - put some salt(Sodium chloride).
2 - 16 days	: - feeding with lived moina twice/day
	: - To clean . the bottom of aquarium by syphonedtechnique
	: - Changed the water about a half of aquarium.
	: - Put some salt (Sodium chloride)
	: about 0,1 %
15 - 20 days	: - feeding with tubifex, red worm Twice/day.
	: - Changed water, cleaned the bottom of aquarium, anti-
	: boitic, and salt still doing.
30 ---- days	: - Size about 1,5"
	: - Moved to the nursery cages(in the river or earthen pond)
	: - Feeding with supplementary food(cooked food) or grinded
	: trush fish.
Remark	: Temperature should be controled about 28 -30 °C

Food Composition for rearing *Pangasius pangasius* fingerling.

Fish meal	40	%
Broken rice	18	%
Rice bran	30	%
Corn meal	10	%
Vitamin premix	2	%

Remark : - Cooked food
- Feeding rate 5 % body weight/day
- Twice/day

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ANNEX A

TRIP REPORT ON THE OBSERVATION
OF BIOLOGICAL ASPECTS OF Lissochillus sp
AT LAKE TOBA

XD-AAU-208-A
ISN-46938

TRIP REPORT

OBSERVATION AND BIOLOGICAL STUDY ON
Lissochilus sp (Ikan Batak)
at
LAKE TOBA, NORTH SUMATERA
9-13 OCTOBER 1984

Prepared by

Samruay Meenakarn

Fish Breeding Advisor

DGF-USAID Small Scale Fisheries Development Project
Cage Culture and seed production sub-project
Jakarta, October 1984

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1. PURPOSE

To observe and study Ikan Batak in Lake Toba in the view of Fisheries Biology and Planning to increase seed production by way of developing technique.

2. ITINERARY

Place	Arrive	Depart
Palembang		9-10-1984
Medan	9-10-1984	10-10-1984
Lake Toba	10-10-1984	12-10-1984
Medan	12-10-1984	13-10-1984
Palembang	13-10-1984	14-10-1984
Jambi	14-10-1984	

3. PEOPLE MET

Ir. Kusno Rahardjo	Chief of Fisheries Office Medan.
R. Sihotang	Fisheries Office Staff
H.J. Simanjuntak	Fisheries Office Staff
M.S. Pardede	Chief of Lake Toba Fisheries Station
James Lucas	Technical Assistance (USAID).

4. SUMMARY OF OBSERVATION

In accordance with to USAID and DGF programme to increase production and population of Ikan Batak (Lissochilus sp) in Lake Toba North Sumatra, I have opportunity to observe and to collect information of this fish in Medan and Lake Toba from 9 to 13 October 1984.

I arrived Medan on 9 October 1984 and visited fisheries office and to discuss with Mr.Kusno, Chief of the Office and his staff. We discussed about Ikan Batak and Lake Toba with regard to the Fisheries biology condition. Since there is only weekly fish market which is every Wednesday in Porsea district, Parapat, Mr.Simanjuntak and I went then to Porsea fish market,on October 10, 1984.

We saw 13 Ikan Bataks sold by only one seller in the market The biggest size was found only 1 fish weighing about 1 kg and 41 cm long (total length). I took it for the study of gonad condition and digestive system by cutting the abdomen off. I saw that the ovary had already developed to final secondary stage (developing ovary). In ordinary condition it would develop until the fourth stage (ripe), that could be spawning within 2-3 months. The intestine was long, about 3-4 times of body length, so it was assumed that the fish belongs to herbivore.

We tried to meet and discuss with fishermen who caught these fishes, by getting information from the seller, but unfortunately we could not contacted them. I told Mr.Simanjuntak to follow this program and seek some information from them with regard to the fishing location, spawning ground, fishing gears and the season of catching.

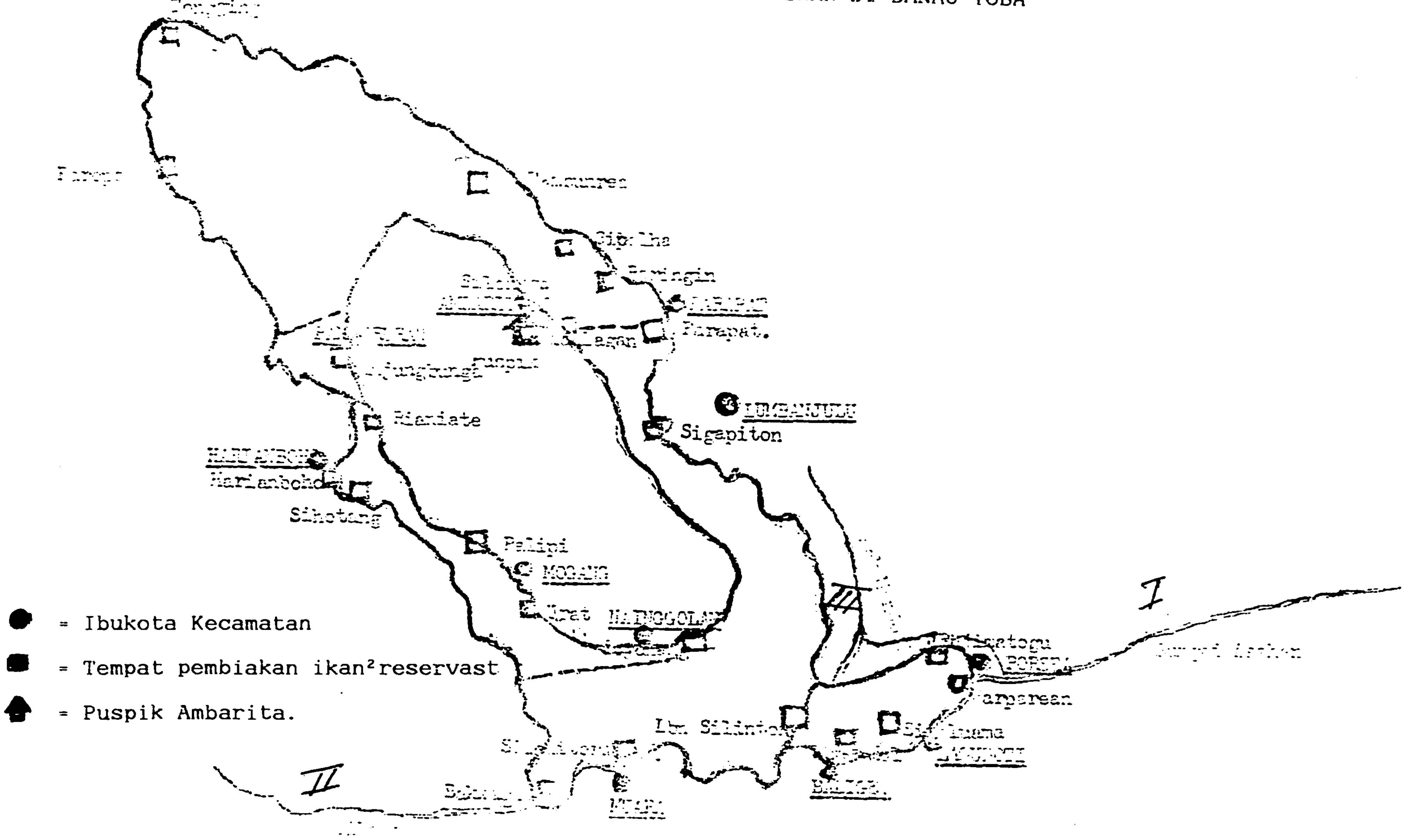
Lake Toba was observed by speed boat and fishermen were interviewed, and some information was collected, Normally Ikan Bataks caught from the three main rivers where the water are running the whole year. One of them is the outlet from Lake Toba (Asahan) and the last two are the inlets

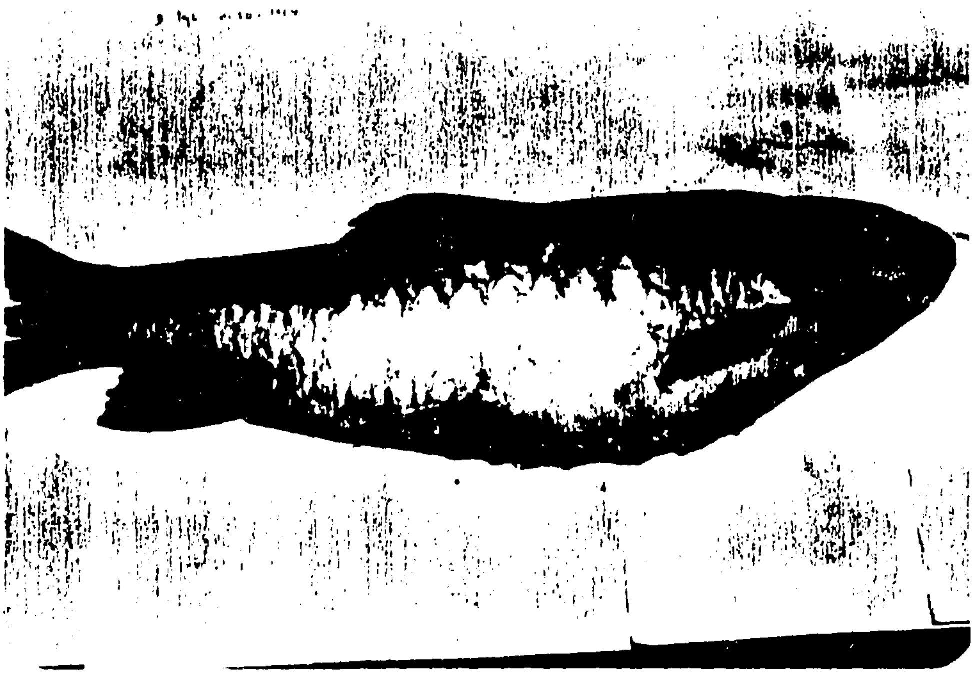
5. RECOMMENDATION.

Based on the discussion and observation during my trip there is possibility to increase population of Ikan Batak by means of induced spawning (Artifisial breeding) in the future. Other programs should also be implemented

1. Biological study in Lake Toba and three main rivers.
2. Collecting and rearing of Ikan Batak (Lissochilus sp) or Acroscheilus sp (Weber) in floating cages or running water pond.
3. Feed composition and feeding experiment.
4. Hatchery and larval rearing.

LOKASI TEMPAT PEMBIAKAN IKAN DI DANAU TOBA





Ikan Batak (Lissochilus sp)

Weight 1.1 kg
Total length 41 cm.±

Developing Ovary. (second stage)

ANNEX B

TRIP REPORT ON IDENTIFICATION
OF POTENTIAL FRESHWATER AQUACULTURE
IN KALIMANTAN

REPORT

IDENTIFICATION OF POTENTIAL FRESHWATER AQUACULTURE IN KALIMANTAN

PREPARED BY
SAMRUAY MEENAKARN
USAID-FISH BREEDING ADVISOR
AND
DR. JOSEPHINE WIRYANTI
DGF-COUNTERPART

SMALL SCALE FISHERIES DEVELOPMENT PROJECT
DECEMBER, 1985

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Our appreciation goes to :

1. Mr. Fahrul Rozi Sadjeli, Chief of
   Provincial Fisheries Service, South Kalimantan.
2. Mr. I.A. Mursid, Chief of
   Provincial Fisheries Service, East Kalimantan.
3. Mr. Hendrik Sihombing, Chief of
   Provincial Fisheries Service, Central Kalimantan.
4. Mr. Sutikno, Chief of
   Provincial Fisheries Service, West Kalimantan.
5. Mr. Herman Prayitno, official of
   Natural Resources Conservation Service, West Kalimantan.
6. Messrs Lim Khim Coa and The Hen Rie,
   personnel of P.T. Pantai Pacific Indah, West Kalimantan.

and their staff of the respective provinces for the information, and assisstance given during our visit.

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6. Design of nursery ponds at Sei Tatas Unit.

1. INTRODUCTION.

Based on quiries made by the Provincial Fisheries Services of Kalimantan, regarding the possibility of provinces other than Jambi and Palembang, where a pilot project on development of open water management is being implemented, to take advantage in dissemination of technology transfer, the DGF had requested from the USAID to concur in Mr.Samruay Meenakarn's visit to the four provinces of Kalimantan.

Kalimantan,a vast region consists of four provinces, South, East, Central and West, is considered to be the most potential in terms of freshwater fisheries. The open water comprises river, lake, swamp and other types of open water i.e. dam, tidal area, etc.

There are more than 300 species and a quite number of those of economical importance exist in the open water. Traditionally, the production of freshwater is obtained by catching.

Those species like : *Leptobarbus hoevenii* (Jelawat), *Anabas* sp (Betok), *Ophiocephalus striatus* (Gabus), *Cyprinus carpio* (common crap), *Helostoma temmincki* (Tambakan), *Trichogaster pectoralis* (Sepat siam), *Notopterus chitala* (Belida),*Macrones nemurus* (Baung) etc are economically important. Production is very high during only a short period (4 months during May to August) of dry season when the water level is low, whereas during the rainy season when the water is up, the fish are difficult to capture. Current report has indicated that in some areas the freshwater catch has decreased every year, hence it can be anticipated that in those areas the production will be significantly scarce in 5 to 10 years time. Although pond and cage culture has been practiced in some regions, especially in those of transmigration settlements, yet the production can not be expected to be satisfactory.

The main aspects that hinder the development of aquaculture in most provinces are due to 1). lack of seed available, particularly that of suitable species which are of commercially important like : Leptobarbus hoevenii, Cyprinus carpio, Tilapia nilotica and Osphronemus gouramy etc, 2). lack of knowledge in feeding practices and fish culture technique. Other constraints also contribute the hindering factors are :

- traditional fishing method that is still commonly practiced by using toxic substance (tuba) and fish traps that will disturb migration of fish.
- natives are not very much interested in culture, they would rather catch instead.

Purpose of visit :

The visit of consultant was requested with justification that :

a. In conjunction with the extended Small Scale Fisheries Development Project, the DGF would take advantage of further transfering the consultant's expertise to other part of country other than Jambi and Palembang, in the development of open water management.

b. As part of continuing effort to develop aquaculture of selected species of commercial importance i.e. Leptobarbus hoevenii, Cyprinus carpio, Oxyeleotris mamorata, Notopterus chitala, the consultant was requested to provide technical inputs by means of supervision and guidance in the development of open water management and aquaculture technique applicable to the areas.

The objective of the trip was therefore aimed to observe and identify potential sites and species feasible for development programme, and to provide technical solution of overcoming the problems which abound in respective regions.

Additionally, it is of interest to study life habit of fish which is of high commercial value, Scleropages formosus, in terms of habitation, breeding habit, and possibility of applying breeding technique of such a species. The trip was scheduled as Annex 1.

Recommendation being made for each province, to overcome problems in their management of aquaculture. Due to limited period, we were not able to visit other remote sites, nevertheless we hope that this report will provide information of the situation of freshwater fisheries in each province of Kalimantan and will throw a light in the effort of solving problems in the development of open water management.

2. DETAIL OF VISITS.

2.1. South Kalimantan.

In South Kalimantan the open water covers about 1000 HA comprises mostly swamp, rivers, lakes, dams and tidal areas. There are about 2,000,000 fishermen and fishfarmers engaged in freshwater fisheries.

Different variety of species are produced from different habitat i.e. in the swampy areas species like : Trichogaster pectoralis, Helostoma temmincki, Ophiocephalus striatus and Anabas sp are extensively found, while other species of Cyprinus carpio, Pangasius pangasius, Leptobarbus hoevenii, Notopterus chitala and Oxyeleotris mamorata are predominantly caught from the river and lake.

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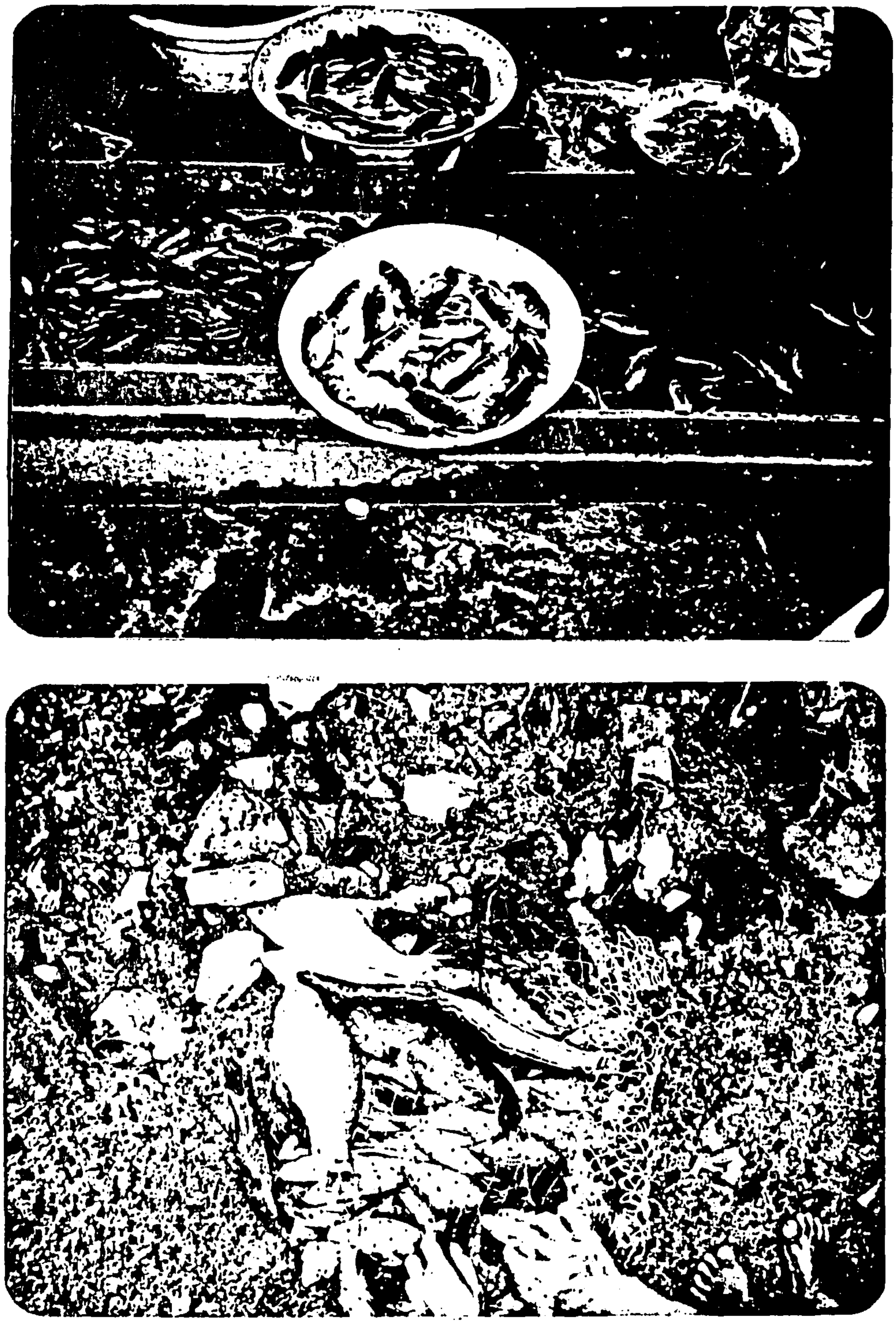
Those species are of good market, except *Oxyeleotris marmorata* which is supposed to be important for export market in Jakarta (Rp.5,000/kg) and Singapore (US$ 9/kg).

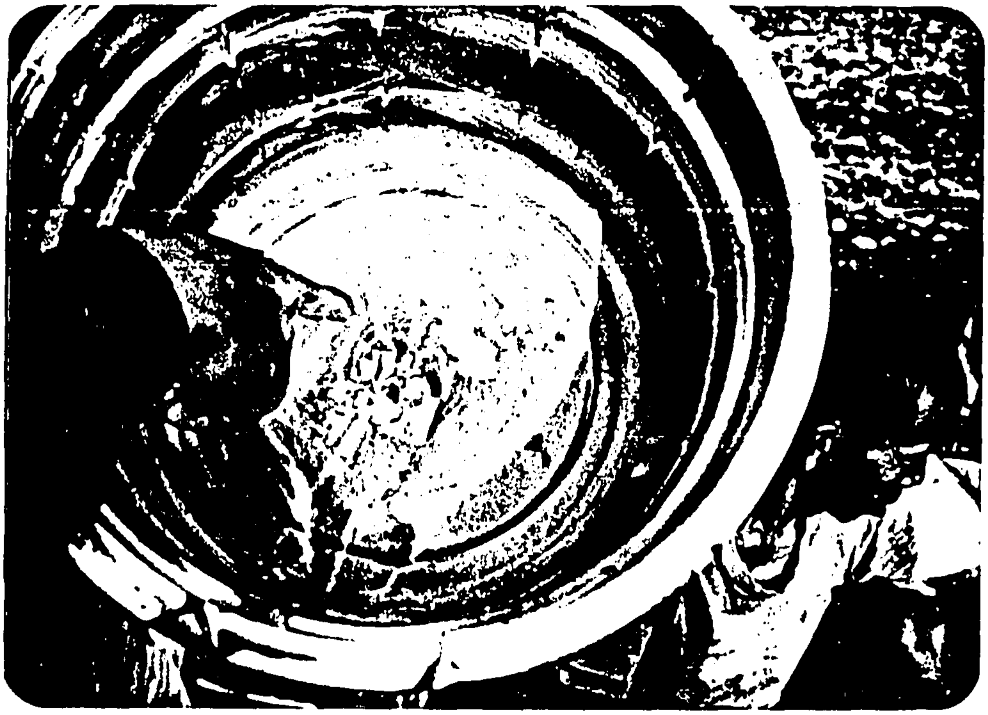


Pictures 1.a & b. Species of commercial value.

a. <u>Notopterus</u> <u>chitala</u>, weighing 12-18 kg is commonly captured, and able to reach the market price of Rp.5,000 to Rp.6,000/ka.
   During dry season the production is high,while at the beginning of the rainy season when the spawning season takes place (October-November), only small size of fish is normally captured.

Picture 2. A matured spawner of <u>Notopterus</u> <u>chitala</u>

Picture 3. Stripping off a spawner of
Notopterus chitala.



Picture 4. Egg of *Notopterus chitala*.

b. Leptobarbus hoevenii, is eminently of good market with average price of Rp.6,000/kg. The catch is nowadays decreasing, thus it is recommended that the culture of this species need to be developed.

c. The production of Oxyeleotris marmorata is very high but they have no domestic market. Iced or frozen marketable size of fish (400-1000 gr) has been exported. Producers price however is very low, for only Rp.500 - Rp.700/kg.

   Exporting live Oxyeleotris mamorata,therefore, need to be encouraged. There is only one exporter of fish operating in this province who is in turn being supplied my middlemen who collect the life fish from fishermen. The fishermen normally utilize fingerling of Oxyeleotris mamorata to feed Ophiocephalus striatus or Anabas sp.

   Ornamental fish i.e. Bothia macracantha or Scleropages formosus and other species are only recently being collected.

d. Ophiocephalus striatus is dominantly sold in fish market, and some of the product being cured for dried salted. Fishfarmers have also attempted to rear the species in cages. One of problems in rearing Ophiocephalus striatus is, the difficulty in finding small fish for feeding. This may be overcome, by utilizing marine trash fish which abudantly captured. As by-catch, the product has no cost at all in the landing place and is usually discarded.

   It is conceivable that in many cases the freshwater resouces have been overexploited. People consume fish from catch production and the price considerably quite high.The fish culture is not well developed. It is therefore, recommended that appropriate fish culture technique and suitable species should be applied for each different type of water sources.

Improvement of existing hatchery is recommended to provide suitable seed of species that have commercial value. Also improvement of skill and knówledge of fishery personnel related to aquaculture and hatchery management technique should be pursued. It was also informed that Provincial Authority is presently implementing a technical aid programme supported by the USAID on aquaculture, and part of the grant is procured for establishment of an outdoor hatchery.

Riam Kanan Recervoir.

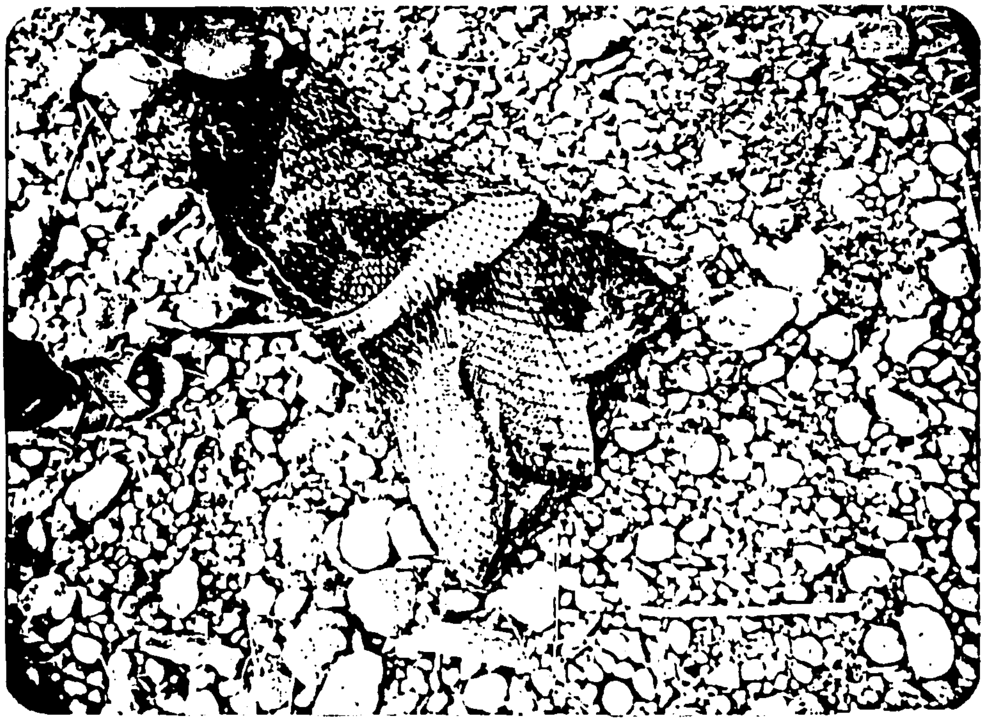
On November 17, 1985 we visited a man-made lake Riam Kanan, about 10,000 m^2 large, which utilized for electricity generator since 1973. The depth of the lake fluctuates between 50 m during dry and 61 m during wet season. Production of fish could reach up to 3 tons per-day during peak season, and most species landed from the lake are : Puntius schwanifeldi (Lampam), Ophiocephalus micropeltes (Toman) Osphronemus gouramy (Guramy) and Notopterus chitala etc.

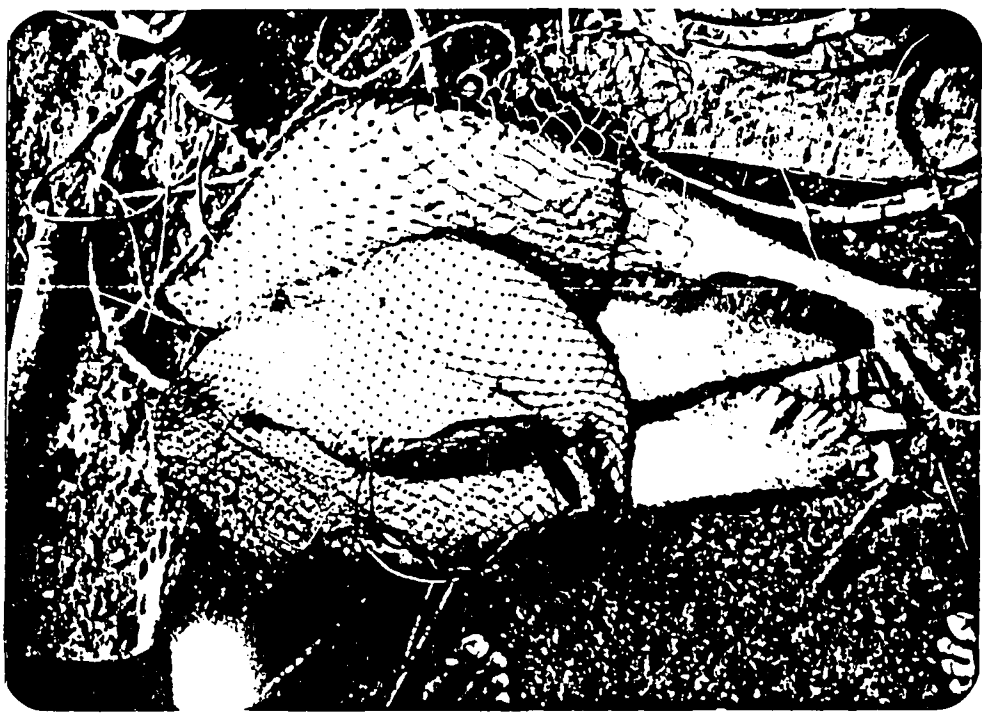
Most popular species that fishermen always try to capture are Notopterus chitala which can reach a weight until 12 - 18 kg, Osphronemus gouramy and Ophiocephalus micropeltes.

Oxyeleotris marmorata is not very much popular for local consumption but there is one collector who is operating iced or frozen product for export market. The fishermen utilize fingerling of Oxyeleotris marmorata for bait of Notopterus chitala.

As by-catch, Oxyeleotris marmorata has very low market price of Rp.500 - Rp.1,000/kg.

Pictur 5. Riam Kanan Reservoir.





Pictures 6.a & b. Fish catch of lake Riam Kanan

Local Hatchery at Banjarbaru.

The hatchery situated in a-7 HA of land, in which 2 HA has been operated for pond culture. Water sources is originated from mountain. An outdoor hatchery is used to breed and to provide seed of common crap (Majalaya strain) and frequently of *Puntius javanicus* to meet the demand. It was reported that the demand for fingerling of common carp was about 500,000 per-year

Other species like *Tilapia mosambica* and *Tilapia nilotica* were also reared in the ponds.

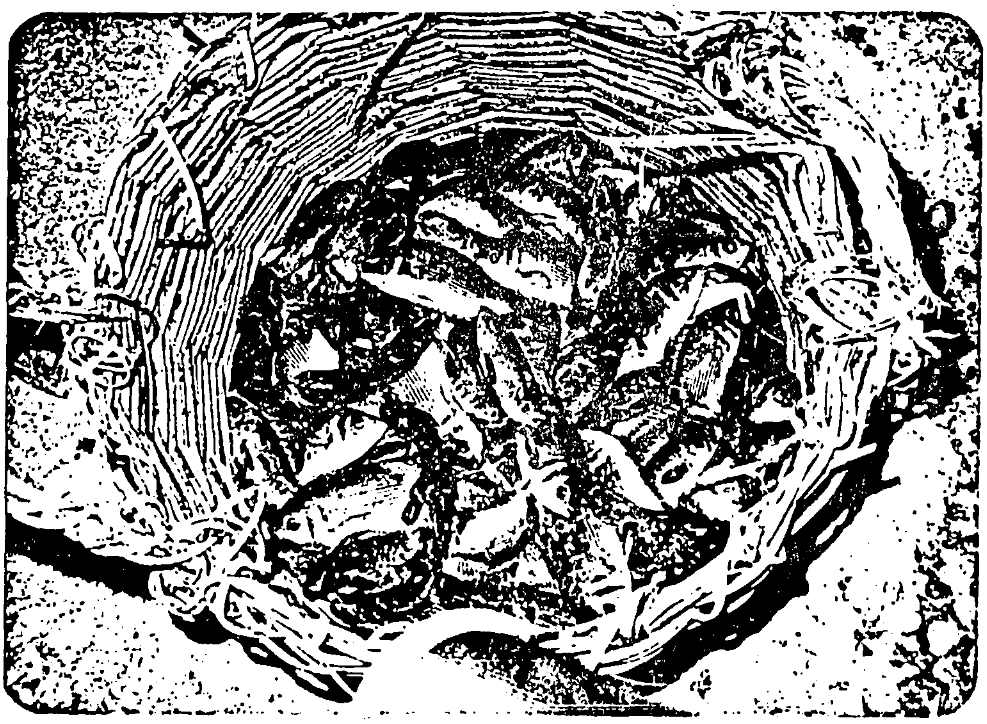
Recommendation was made that the hatchery should attempt to breed *Leptobarbus hoevenii*, considering that the catch of such a species is decreasing and that by providing seed it will not only encourage fishfarmers in practicing pond culture but also restock the open water (lake Riam Kanan) with such a species.

2.2. East Kalimantan.

During the discussion with Mr. Mursid, Chief of Provincial Fisheries Service, it was reported that the annual production of freshwater in East Kalimantan was over 14,000 tons, 75% of which production from Mahakam delta of East Kalimantan.

Part of the production of 7000/kg was transported to Java island. Technical assistant provided by the USAID to the Provincial Authority was procured for development of cage culture which was initiated with only 20 cages and presently about 2000 cages have been practiced in Central Mahakam delta, a swampy region of 3,000,000 Ha, of which 100,000 HA consists of lakes.

During flooding season the depth of water reaches about 5 m and during dry season the water is only 20 cm deep.The water in the swamp usually retains for 6 month, and the species predominantly produced from the areas are : Puntius thynictys, Puntius javanicus, Helostoma temmincki and Trichogaster pectoralis.



Picture 7. Production of swamp.

The cages are specially operated to rear Ophiocephalus striatus.

Other species of economical importance that produced from other resources are as follows :

Species	Market price/kg (Rp)
- Ophiocephalus striatus	2,000 - 3,000.-
- Leptobarbus hoevenii	1,500 - 2,500.-
- Anabas sp	3,000 - 4,000.-
- Pangasius pangasius	3,000 - 4,000.-
- Notopterus chitala	3,000 - 4,000.-
- Macrobrachium rosenbergii	2,500 - 3,500.-

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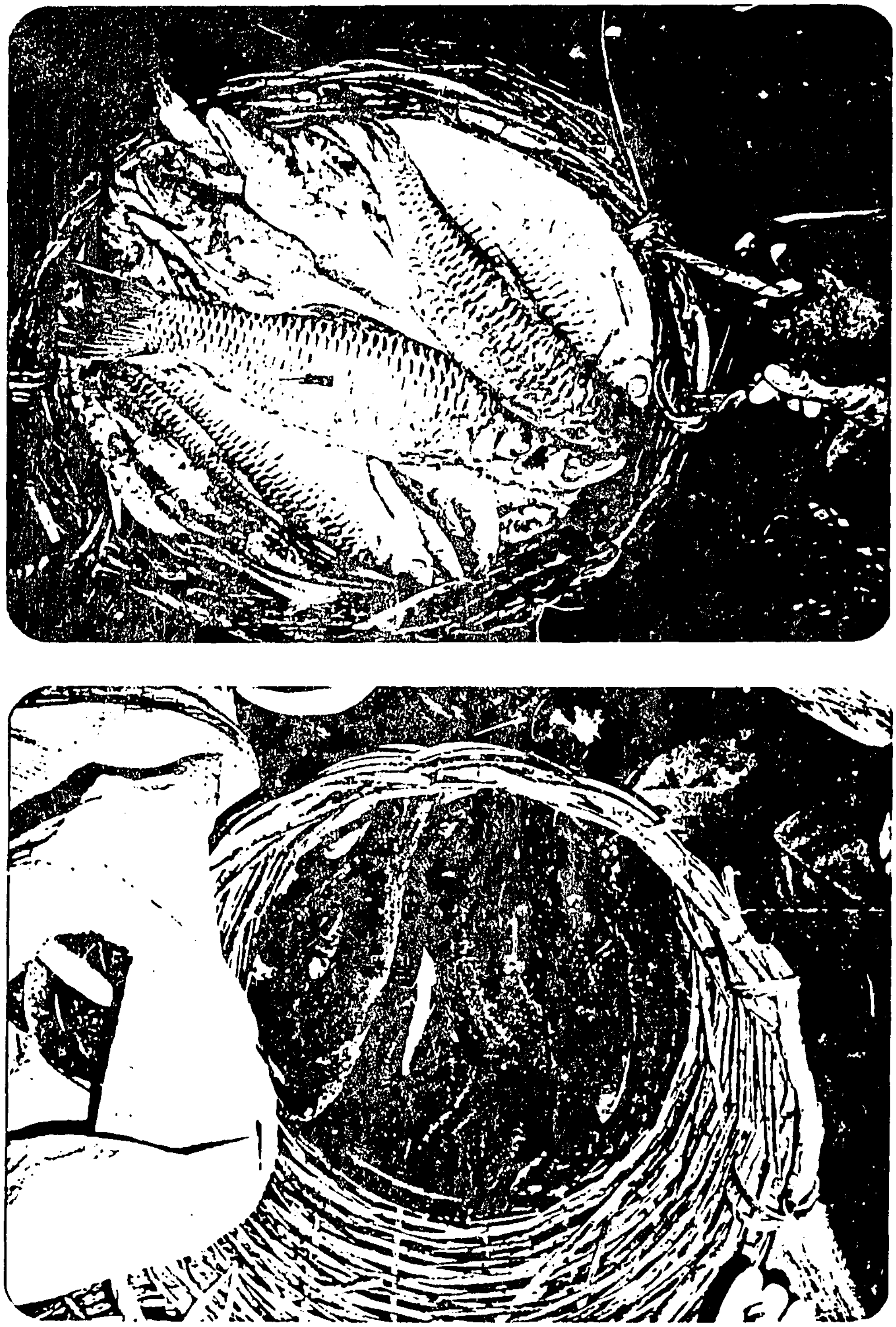
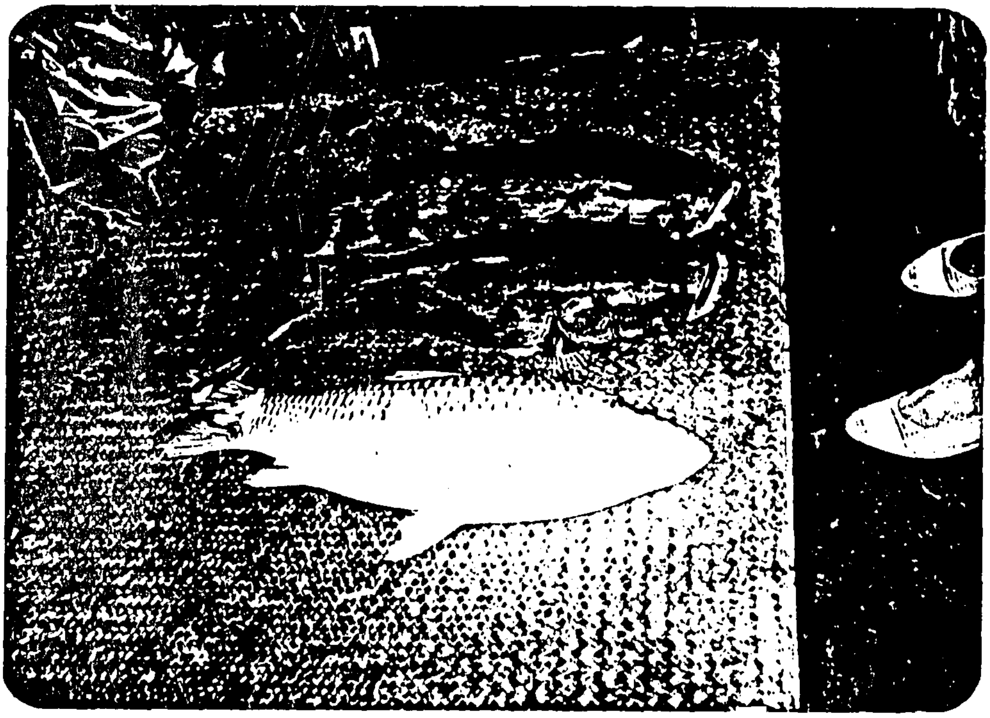


Pictures 8.a & b. Species of commercial value i.e. Leptobarbus hoevenii, and Ophiocephalus striatus

<u>Oxyeleotris marmorata</u> is very cheap, the production is about 10 tons per-year and from the producers the price is only Rp.750/kg. However, frozen fish has been exported to Malaysia, Singapore and Hongkong.



Picture 9. <u>Oxyeleotris marmorata</u>, and <u>Leptobarbus hoevenii</u>.

Technical Cooperation has also been eatablished between the Provincial Authority and T.A.D. (Transmigration Area Development) supported by the West German Goverment.

The activities include implementation of :

1. stock assessment of lakes in East Kalimantan;
2. establishment and development of Central Hatchery in Sibulu, Kutai district;
3. development of cage culture technique in continuing implementation of the USAID program.

The Sibulu hatchery is situated in a-5 HA of land, where a-2 HA reservoir has been established (5 x 6 x 2 depth). A water-pump was installed and has been able to provide water of 60 m^3 per-hour from the Mahakam river. During rainy season the water is run from the reservoir which situated outside the hatchery,but when the dry season comes the water will be pumped out from the river to the reservoir.

Infrashuctures have been established in the Sibulu Hatchery i.e. :

1 Workshop measuring 6 x 10 m^2;

1 Guesthouse;

2 Personnel houses;

1 Office;

20 Earthern ponds measuring 20 x 40 m^2;

6 Pairs concrete tanks of 2 x 2 x 4 m^3 that are operated for indoor (6 x 10 m^2) and outdoor hatchery;

1 Electricity Genset of 15 pH.

The establishment of hatchery is aimed to provide seed of suitable species to be partly restocked in lakes or up-stream rivers, and also distributed to fishfarmer.

Experiment on induced breeding of Leptobarbus hoevenii, Grass crap and Melor carp was attempted. However the activities were hampered due to unsuccessful attempts of larva rearing. It seems that the establishment of the hatchery is well accomplished, the only thing that need to be improved is the management of hatchery technique in which hatchery personnel or technician should be well trained to operate the hatchery.

Additionally, more facilities and equipments are also required to further equip the hatchery.

The species that have mostly been cultured are *Cyprinus carpio*, and *Ophiocephalus striatus*. Both species are usually given food consist of kitchen waste and by-catch product respectively while *Leptobarbus hoevenii* is fed with melon squash, vegetables or cassave leave. The average growth rate was reported about 1 kg per-year.

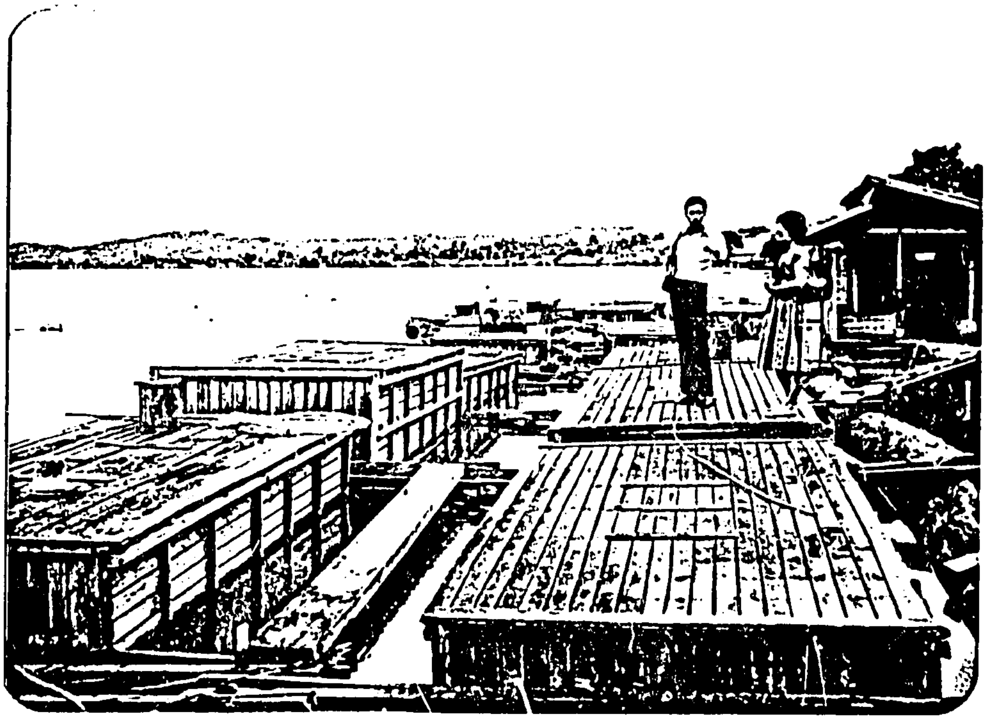
Cage Culture in Tenggarong.

Tenggarong, the capital city of Kutai district, an area about 1.5 times x Java and Bali island, with the population of only 1,500,000 people, is the most potential sites for freshwater productivity in East Kalimantan.

Ophiocephalus striatus is reared in cages measuring 2 x 2 x 4 m^3 and stocked with 1000 fingerling of 50 - 70 gram. After 6 months the production is usually harvested for about 750 kg/per-cage at Rp.1,000.- per-kg, or Rp.750,000.- per-crop. The species was fed with by-product of catch.

Realizing that the price of *Ophiocephalus striatus* is lower than that of *Anabas* sp and also the food given to both species will be the same composition, it is advisable that rearing *Anabas* sp should be more profitable than that of *Ophiocephalus striatus*.

The species that mostly, demanded for breeding and culture are *Oxyeleotris marmorata*, *Notopterus chitala*, *Leptobarbus hoevenii*, *Pangasius pangasius* and *Clarias bathracus*.



Picture 10. Cage culture in Tenggarong.

Picture 11. By-catch product for carnivorous feeding.

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Conclusively, the fish culture has extensively been well practiced. The fishfarmers have been able to utilize by-product of catch and kitchen or market waste to feed appropriate species like Ophiocephalus striatus, Pangasius pangasius or Anabas sp while Leptobarbus hoevenii can be casily fed with ingredients locally available (cassava leaves only Rp.10/kg).

The open water production is quite high because the condition of water resources is naturally potential.This condition should be conserved by way of restocking suitable species in the appropriate water resources. In these respects hatchery technique management should be developed in providing fingerling for such purposes.

2.3. Central Kalimantan.

The area covers over 2,000,000 HA of open water that consists of lake, swamp and river. The province is devided into 6 districts and 10 subdistricts. The population is about 1,200,000 among those settle in transmigration area which covers over 1,000,000 Ha.

Fisheries productivity is naturally potential, however there is no support from other sources, so far, to contribute development of fisheries programme, particularly in the transmigration settlement. There has no technical assistance from other foreign sources to support the fisheries development of the province. Non of hatchery, not even a local establishment has existed in this province. During the rainy season when water is quite high the catch is becoming scarce. Dry season is only for a short period so that the production of catch is not optimally utilized for domestic requirement.

There are a great number of exploiters from outside of province who exploit only the productivity of Kapuas river and transported the production through Banjarmasin.

The species that of most commercial importance is Leptobarbus hoevenii, the market price can reach Rp.6,000 - Rp.8,000/kg.

Other species that have comercial value are as follows.

Picture 12. Leptobarbus hoevenii.

Species	Market price (Rp/kg)
- Leptobarbus hoevenii	6,000 - 8,000.-
- Cyprinus carpio	3,500 - 5,000.-
- Anabas sp	3,000 - 4,000.-
- Helostoma temmincki	2,000 - 3,000.-
- Pangasius pangasius	2,000 - 3,000.-
- Trichogaster pectoralis	2,000 - 2,500.-
- Ophiocephalus striatus	2,000 - 2,500.-
- Macrobrachium rosenbergii	2,000 - 2,500.-
- Clarias bathracus	800 - 1,000.-
- Osphronemus gouramy	500 - 700.-

Picture 13. Fish sold in market.

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The production of Leptobarbus hoevenii and Pangasius pangasius have been decreasing from year to year. Efforts have been made to extensify pond and cage culture and there have already been more than 2000 ponds most of those exist in transmigration area.

The transmigration site is not usually suitable for cropping, and that is the reason why majority of transmigrated settlers diversify their activities towards operating pond and cage cultures.

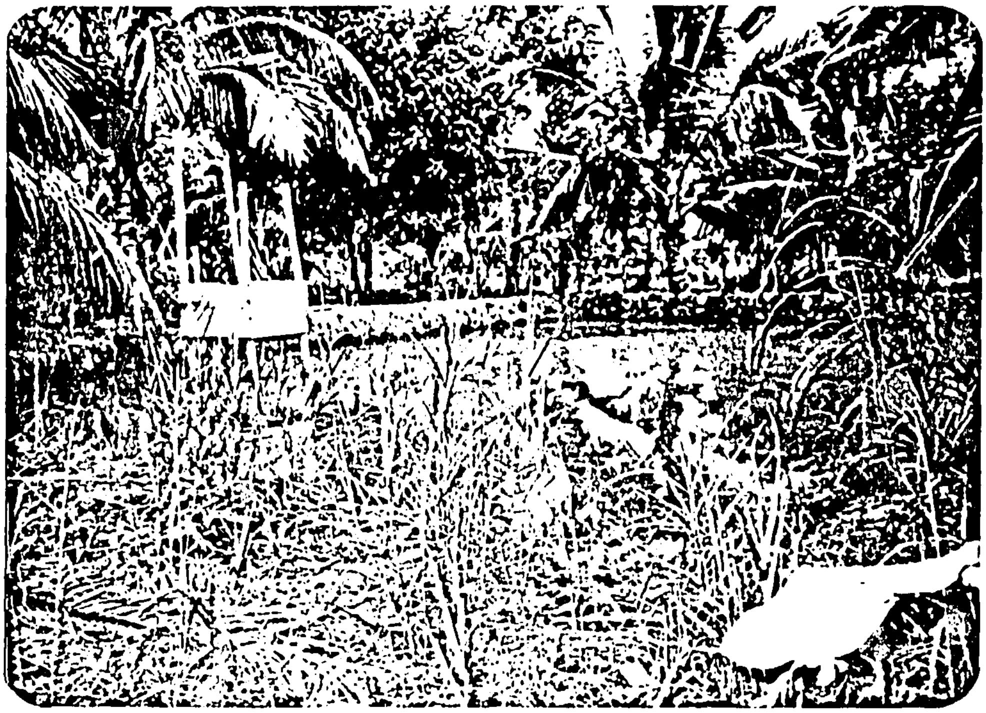
However, the main problem in developing the aquaculture is in obtaining seed especially those of Puntius javanicus, Anabas sp which are of high commercial value.

The requirement of seed of different species for pond culture was estimated at least 6 - 8,000,000 fingerling per-year, for which the fishfarmers usually pay at Rp.200 to Rp.300.- each.

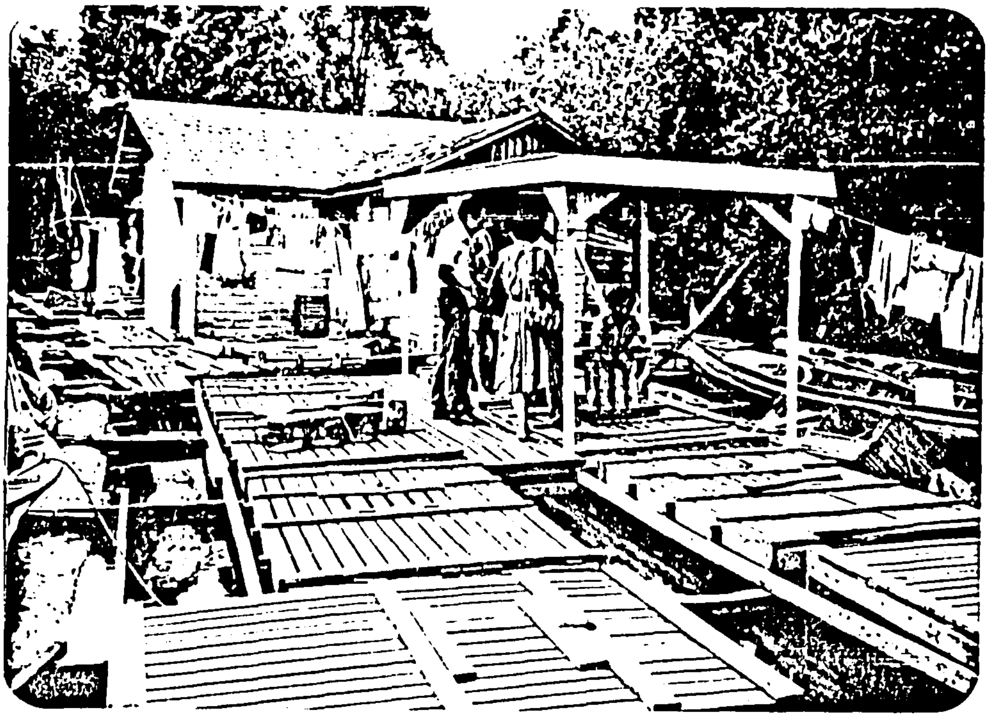
Presently, in the transmigration areas, Tilapia mosambica is commonly reared, although the seed available do not sufficiently meet the the demand. Local food ingredients for herbivorous species are available and can be easily obtained, (rice bran, broken rice and vegetable) but small fish is difficult to find.

Therefore, it seems appropiate that culture of herbivorous rather than carnivorous species is highly recommended because of the feeding management.

Integrated farm with livestock (poultry) would be more productively operated, for this system will mutually provide advantages to all sectors i.e. in increasing production of fish culture, in encouraging development of livestock in this area and reducing the price of livestock.



Picture 14. Pond culture in transmigration area.



Picture 15. Cage culture.

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Hatchery should be established to provide seed for fishfarmer and also for restocking the open waters. Demonstration plot should be programmed for integrated farm particularly in the transmigrated areas like Kapuas and South Barito districts.

There are about 15,000 cages and more than 2,000 ponds presently operated in the subdistricts.

Technical input being requested from the consultant for establishment of a hatchery and a demplot, will be located in Kuala Kapuas and Sei Tatas subdistricts. Those establishments will be under provincial support.

Additionally, central and local hatcheries proposed to be established under national and provincial budget will be located in North Barito and Hulu Kapuas districts respectively.

Establishment of Kuala Kapuas Hatchery.

The Provincial Fisheries Service has proposed the establishment of a hatchery on their 5 HA land, 3 HA of which has been operated for 13 ponds. The establishment is aimed not only for providing seed of different commercially important species but also for restocking the open waters.

The following species will be suitable for different purposes.

Species	Purpose
Leptobarbus hoevenii	Pond and cage culture
Cyprinus carpio	Pond and cage culture
Helostoma temmincki	Culture in swampy area
Puntius javanicus	Restocking lake/river
Grass carp	Restocking lake/river

Leptobarbus hoevenii and grass carp can also be cultured in swampy areas. The existing ponds in the 3 HA land need to be improved and slightly modified, the lay-out of outlets and inlets which are not appropriately built up, should be cemented and widened up to one metre. The lay-out of hatchery planned to be constructed appears as Annex 2 and 3, and the estimated cost for procurement of equipments and fasilities,that required to equip the hatchery appears as Annex 4.

Demonstration ponds at Sei Tatas, Kapuas Ilir subdistrict.

The Dem Plot is situated in a 10 HA of land procured by the Agricultural Regional Services as part of the Agricultural Extension Unit.

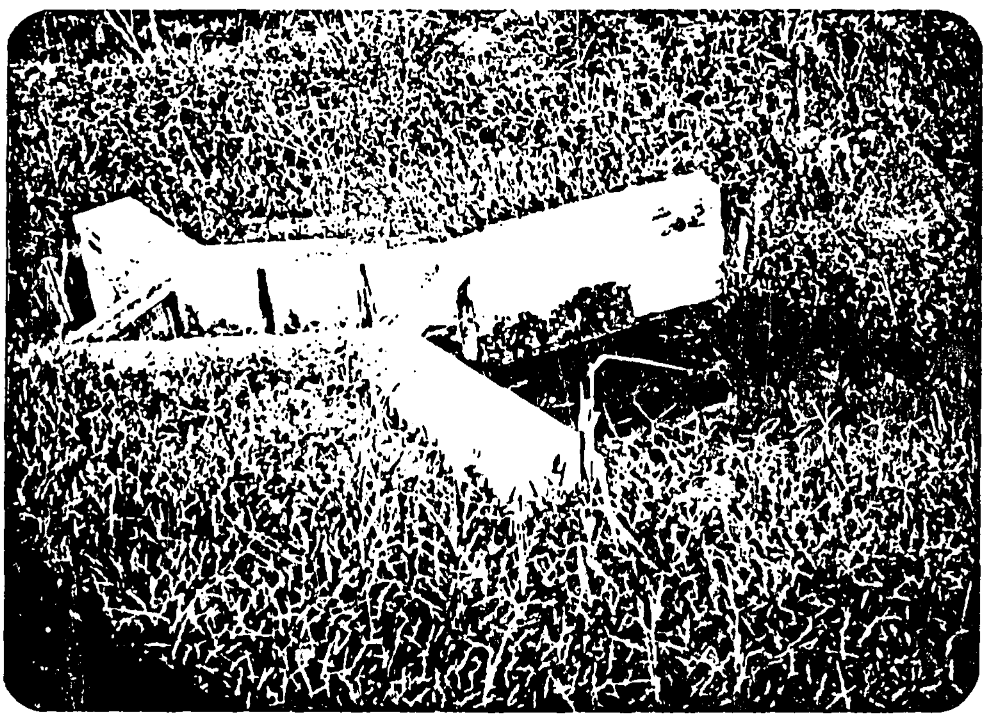
A number of ponds with average measurement of 300 - 400 m², have been under construction in the 5 HA of land and the outlets and inlets are well constructed. The site is situated in between Tatas canal and swampy area.

Picture 16. Pond constructed in Dem Plot of Sei Tatas.

The water quality of the Tatas canal is very good, unpolluted, clear and clean, pH 6 - 7 while the other side of land being more swampy. It is, recommended that nursery ponds should be constructed in the site, next to the canal. Waterpump needs to be constructed.

The lay-out of the Dem Plot appears as Annex 4 and the nursery ponds is given in Annex 5.

Any kind of species will be suitably reared in the Dem Plot and integrated polyculture farm will be suitably applied as this site is part of other agricultural demplots i.e. livestocks, croppings, etc. The species like Leptobarbus hoevenii, Cyprinus carpio, Pangasius pangasius, Tilapia nilotica should be reared in the water of better quality while Helostoma temmincki and Trichogaster pectoralis will be productively reared in the swampy ponds. By development of this demplot, it may be able to anticipate that the production of 1.5 ton per-pond per 6 month could be obtained.



Picture 17. Inlet of pond.

Private integrated farms.

We also visited 2 private integrated farms in Kuala Kapuas. One operates in integrated monoculture of different species like Macrobrachium rosenbergii, Leptobarbus hoevenii, Helostoma temmincki, and Cyprinus carpio with poultry (duck and chicken) in the respective pond measuring 5 x 120 m^2.

The other farm operates in integrated polyculture with chicken. There are 19 ponds in 2 HA of land measuring 100-150 m^2, with average depth of 1 m.

The species reared comprise Leptobarbus hoevenii, Helostoma temmincki, Anabas sp etc. The seed were collected from nature and each of pond was stocked with 50 fingerlings of different species.

Picture 18. Integrated farm.

Pond culture transmigration settlement.

Transmigration Settlement Unit (UPT) of Terusan Tengah, Blok-B Kanan at Selat subdistrict of Kapuas district was visited.

The unit is devided into 3 sub-units :
Sub unit II Blok-B was visited, where there were 16,000 householders of transmigrants (about 8,000 people) and more then 1,000 ponds with average measurement of 100 m², and 120 cm deep were operated in the area. It was also reported that there existed more than 300 ponds in Blok-C.
Presently the settlers are only able to rear Tilapia mosambica, despite of their preference to rear species like Leptobarbus hoevenii, Puntius javanicus, Cyprinus carpio. Fingerling is not available, and if there is any the price will be Rp.200 - Rp.300.- per-fingerling. It was estimated that at least 10,000 seed will be required to meet the demand of those ponds in the sub-unit II of the Blok-B only. There was a desperate request made by fishfarmers of obtaining seed, especially that of Leptobarbus hoevenii.

Pictures 19.a & b. Ponds in transmigration area.

2.4. West Kalimantan.

West Kalimantan province covers an area of 146,807 km^2 and is populated by 2,700,000 people with the density is about 18,6 per-km^2. The province consists of 6 districts where 1 central and 6 local hatcheries exist. The open water comprice river, lake, natural reservoir, and swamp spread over 6 districts, of which Kapuas Hulu is the most productive site, about 71,97% of the open water production is contributed from this district. In any case, the production of open water increases every year, however there are problems that hinder the management of fisheries development i.e.

1. the use of fish traps along rivers and lakes that disturbes migration of fish;
2. the use of natural chemicals by native fishermen in fishing method;
3. short dry season (June to August) and long wet season (September to May) that restrict optimal utilization of production.

Species of high commercial value are :

Species	Market price (Rp/kg)
Macrobrachium rosenbergii	6,000 - 8,000.-
Leptobarbus hoevenii	5,000 - 6,000.-
Cyprinus carpio	3,000 - 4,000.-
Puntius javanicus	3,000 - 4,000.-
Oxyeleotris marmorata	3,000 - 4,000.-
Puntius schwanifeldi	2,500 - 3,500.-
Notopterus chitala	2,000 - 2,500.-
Ophiocephalus micropeltes	2,000 - 2,500.-
Cryptopterus sp	1,500 - 2,000.-
Ophiocephalus striatus	1,500 - 2,000.-

In the effort to extensify and develop fish culture there are difficulties in distributing and transporting seed to other regions because those seed have to be transported as for as 400 km.

Presently the seed of Leptobarbus hoevenii, Cyprinus carpio, Tilapia mosambica, Puntius javanicus are collected from nature.

Food ingredients for both herbivorous and carnivorous species are easy to find. Grains (soy bean, nuts) and seeds (rubber seed and others), cassava etc, are locally available while small fish is easy to collect.

However, extension programme is not well responded, for many of the natives prefer to do catching rather than rearing fish.

In natural reservoir (usually 1-2 HA large) the species like Leptobarbus hoevenii, Ophiocephalus striatus, etc are not intensively reared. In this culture, supplemental food is not always given, and the food is only depend on the natural organic substance available in the reservoir. This is one of the reasons that the production is only harvested every 2 - 3 years.

Cage culture is only operated as part-time activity. Ophiocephalus striatus and Ophiocephalus micropeltes are usually stocked only in cages before sale.

There some constraints in providing seeds i.e.

1. In local hatcheries, fingerling are produced by natural breeding and the production do not sufficiently meet the demand.
2. Anjungan Central hatchery would have been able to supply seed by induced breeding (common carp) however the demand is only restricted from the areas around the central hatchery.

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It is recommended that extension programme should be intensified to encourage fishfarmers rearing species of commercial value i.e Leptobarbus hoevenii and Oxyeleotris marmorata (for export market).

Leptobarbus hoevenii is being reared in Sintang district (400 km from Anjungan) and fingerling captured from nature will cost Rp.150 - Rp.200.- each. In this respect the central hatchery should apply induced breeding of Leptobarbus hoevenii and other variety of species in an effort to provide fingerling. It was estimated that the demand of fingerling will be about 1,000,000 per-year.

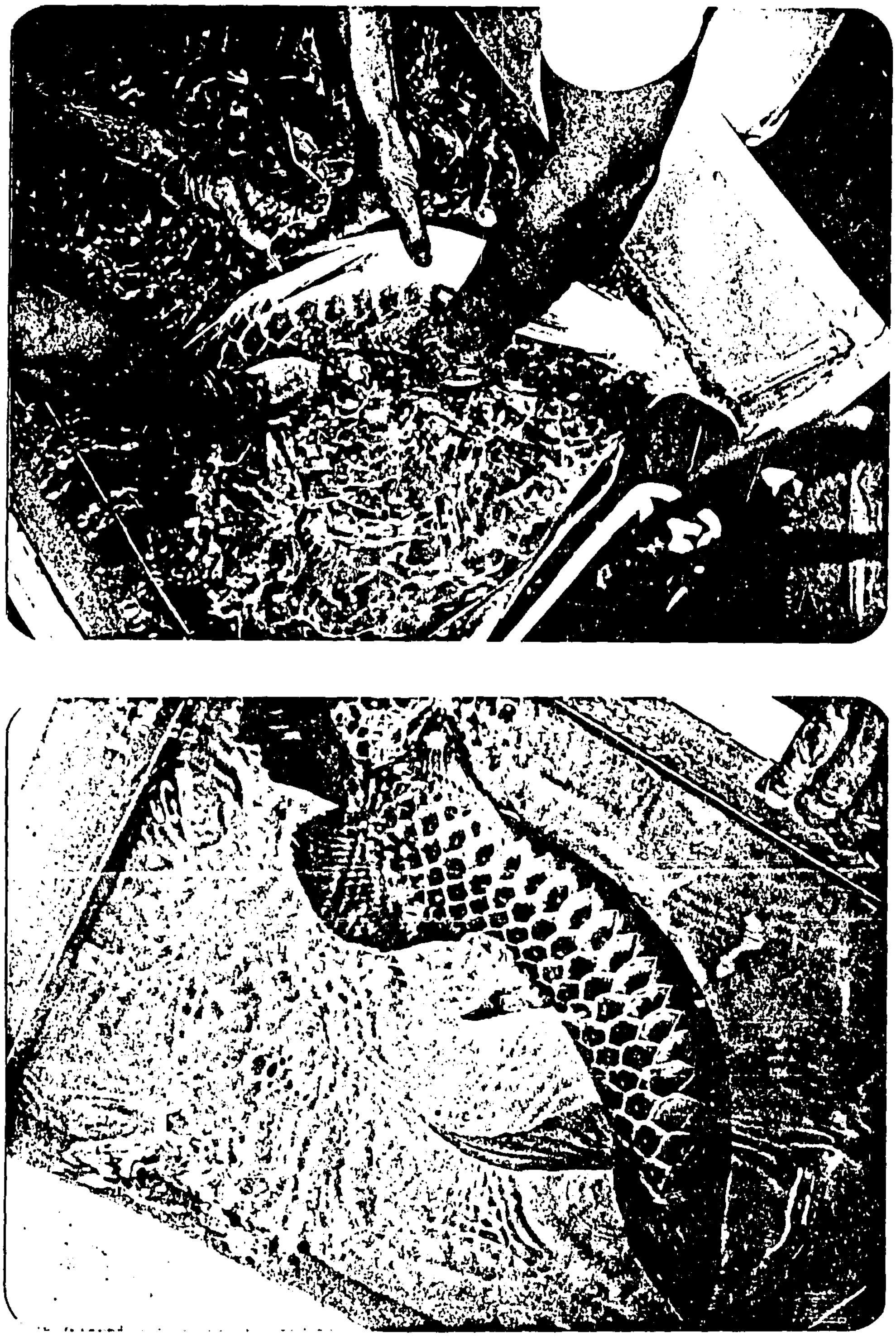
It was indicated therefore, that supervision on breeding technique for this species should be given to the hatchery personnel.

Considering, that the operation of rearing Leptobarbus hoevenii is less costly compared to that of rearing common crap, and also that the market price of Leptobarbus hoevenii is much better than that of common crap, which is Rp.3,000 to Rp.5,000/kg respectively, it is recommended that the culture of Leptobarbus hoevenii should be more extensively practiced.

Other visits.

Visits were also made to collect information regarding biology, life habit, with particular attention to reproductive system of Scleropages formosus (local name : Silud, Arowana, Tangkalasa and Kalakasa), a unique ornamental fish which is of very high commercial value.

No literature has presently provided detailed information regarding this species. Since the existence of this species in danger, the species is presently under conservation.



Pictures 20.a & b. Scleropages formosus

Visit were made to the National Resources Concervation Service and to a couple of Scleropages Collectors. Little is known about the habitation of this species in terms of spawning ground, spawning season, nursery ground, and breeding habit. During dry season when the water is low (from January to August) the fish can be easily captured from lakes or upstream, In January to February, fingerling of 10 - 15 cm is usually captured, it may be assumed that the spawning season should normally take place at the begining of rainy season from September to November, when the water is high. The species live in areas that contain lime (CaO_2) and where a particular pandanous plant grow.

Fecundity of brooder was reported to be 40 - 90 eggs.

Realizing that the existence of this species is in danger, it is of interest to further investigate the biology, habitation with particular attention to breeding process of this species.

The effort is hoped to throw a light to applying breeding technique and that the existence of such a species can be conserved.

Picture 21 : Egg *Scleropages formosus.*

3. SUMMARY AND RECOMMENDATION.

Realizing that there were problems in the management of freshwater aquaculture abound distinctly from one province to another, appropriate solutions, therefore should be applied for respective regions.
The following recommendations were made and listed in order of priority.

I. Central Kalimantan.

1. First priority should be given to establishment and development of a hatchery at Kuala Kapuas.Financial support for the establishment and operational requirement of the hatchery has been requested under Provincial budget.
   Technical supervision and guidance were also requested from the consultant in the hatchery management technique.

2. Indoor and outdoor hatchery at Kuala Kapuas should be constructed for breeding some suitable species. It was anticipated that the hatchery should be able to provide 4 - 6,000,000 fingerling per-year of different species i.e. Leptobarbus hoevenii, Cyprinus carpio, Puntius javanicus, Helostoma temmincki and other species of commercial value.

3. Demonstration plot at Sei Tatas, where nursery pounds being astablished, should be programmed also for an integrated farm system, for, this activity is part of Agriculture Extension Unit. The nursery ponds should be operated for rearing different kind of species.

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4. Technology transfer on approppriate culture technique should be disseminated to transmigrants. Assistance should be provided to enable them rear *Leptobarbus hoevenii*, *Puntius javanicus*, *Helostoma temmincki*, *Cyprinus carpio* and other species of economical importance.

5. It was indicated that requests were frequently made by transmigrants to the Provincial Fisheries Service, to assist with procurement of seed. Since the breeding trial of *Leptobarbus hoevenii* carried out in Jambi takes place during November 1985 to March 1986, the production will be anticipated over 200,000 fingerling, it is therefore, recommended that such demand could be met by initially transferring at least 15,000 fingerling from Jambi to Central Kalimantan by end of January, 1986.

6. Additionally, collection of potential ornamental fish lake *Bothia macracantha* need to be further encouraged.

II. South Kalimantan.

7. Management of hatchery technique should be improved by way of transferring skill and knowledge to hatchery personnel.
   Breeding of other species than *Cyprinus carpio* or *Puntius javanicus* i.e *Leptobarbus hoevenii*, *Helostoma temmincki*, *Pangasius pangasius*, etc should also be applied.

8. Technology transfer should also be applied to fisheries/ fishfarmers in aquaculture technique, with special reference to breeding technique of *Notopterus chitala* which has currently been successfully under breeding trial in Palembang.

9. Exporting live Oxyeleotris marmorata should be encouraged, since this species is of great potential in this province but not being properly utilized.

10. Collection of Bothia macracantha and other ornamental fish should be encouraged.

III. East Kalimantan.

11. Hatchery technique management should be improved by way of transferring technology to the hatchery personnel in operational activities. Induced breeding of species like Leptobarbus hoevenii and particularly in larva rearing should be well supervised.

IV. West Kalimantan.

12. Extension programme should be intensified to fishermen/fishfarmers in applying proper fishing technique and encouraging in fish culture.

13. Central hatchery at Anjungan should be improved in providing seed especially that of Leptobarbus hoevenii and Puntius javanicus and Cyprinus carpio for restocking open water and for distributing to fishfarmer.

14. Induced breeding technique should be applied in local hatcheries, to meet demand of seed, for this,supervision on breeding technique should be provided to hatchery personnel.

15. Transportation system of seed should also be efficiently improved.

16. Further study on life habit with particular reference to reproductive system and breeding technique of Scleropages formosus need to be pursued in an effort to conserve the existence of this species.

Tabel 1 : Produksi Perairan Umum Menurut Jenis Ikan dan Daerah Tingkat II
Propinsi Kalimantan Selatan

Satuan : Ton

Jenis Ikan / Daerah Tingkat II	Jumlah	Jelawat	Lampam	Tawes	Jambal	Gabus	Lais	Toman	Sepat Siam
J u m l a h	43.076,1	1.443,1	3.083,1	331,3	5.084,1	8.871,8	3.396,6	2.787,6	2.140,8
K a p u a s	3.310,1	118,1	17,7	-	64,4	1.592,6	71,6	85,0	206,9
K a t i n g a n	2.113,6	27,3	486,2	-	604,4	301,6	98,8	-	-
Kotawaringin Timur	8.907,9	291,2	603,7	230,6	1.375,8	1.443,1	534,5	850,3	-
S e r u y a n	2.277,1	90,8	155,9	100,7	407,1	220,0	222,0	181,7	-
Kotawaringin Barat	3.484,1	-	247,7	-	258,2	977,2	312,0	316,1	-
Gunung Mas	857,7	-	-	-	144,2	224,4	161,9	123,4	-
Barito Utara	1.117,6	38,4	39,8	-	98,0	-	113,6	-	-
Barito Selatan	12.417,5	836,0	1.348,8	-	1.184,8	1.434,3	1.647,7	960,0	505,2
Palangka Raya	7.421,0	41,3	183,2	-	775,6	2.593,4	31,7	115,0	1.428,7
Barito Timur	1.169,5	-	-	-	171,9	176,2	202,8	145,8	-

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Lanjutan Tabel 1.

Satuan : Ton

Jenis Ikan / Daerah Tingkat I	Tambakan	Belida	Betutu	Ikan Lainnya	Udang Galah	Udang Lainnya
J u m l a h	2.263,1	2.392,8	-	10.859,6	417,2	-
K a p u a s	77,6	-	-	1.028,5	47,7	-
K a t i n g a n	78,1	57,3	-	460,3	-	-
Kotawaringin Timur	199,8	783,0	-	2.419,7	176,2	-
S e r u y a n	102,9	184,7	-	487,3	124,0	-
Kotawaringin Barat	289,5	298,6	-	758,8	26,0	-
Gunung Mas	111,4	-	-	92,4	-	-
Barito Utara	-	90,6	-	737,2	-	-
Barito Selatan	1.082,2	892,4	-	2.573,7	43,3	-
Palangka Raya	153,9	-	-	2.098,2	-	-
Barito Timur	172,7	86,2	-	213,9	-	-

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Tabel 2 : Nilai Produksi Perairan Umum Menurut Jenis Ikan dan Daerah Tingkat II, Propinsi Kalimantan Tangah.

Nilai : Rp.1.000,-

Jenis Ikan / Daerah Tingkat II	Jumlah	Jelawat	Lampan	Tawes	Jambal	Gabus	Lais	Toman	Sepat Siam
J u m l a h	46.831.909	2.379.025	3.744.420	319.845	5.720.060	10.226.697	4.348.150	3.171.880	1.855.755
K a p u a s	1.624.579	88.450	13.115	-	46.445	919.687	41.650	46.525	60;465
K a t i n g a n	2.005.225	34.000	486.200	-	604.000	301.600	98.800	-	-
Kotawaringin Timur	9.171.005	493.695	774.710	278.320	1.442.470	1.404.025	960.060	822.635	-
S e r u y a n	1.038.720	69.990	66.185	41.525	179.275	103.260	96.315	83.935	-
Kotawaringin Barat	2.851.805	-	195.985	-	196.310	809.525	275.415	272.570	-
Gunung Mas	845.275	-	-	-	154.900	234.500	161.900	130.625	-
Barito Utara	1.564.825	96.000	69.65[illegible]	-	171.500	-	170.400	-	-
Barito Selatan	16.871.945	1. 52.340	1.863.775	-	1.600.720	2.074.550	2.288.990	1.505.730	366.590
Palangka Raya	9.791250	144.550	274.800	-	1.163.400	4.214.850	63.400	172.500	1.428.700
Barito Timur	1.067.280	-	-	-	161.040	164,700	191.220	137.360	-

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Lanjutan Tabel 2

Nilai : Rp.1.000,-

Jenis Ikan / Daerah Tingkat II	Tambakan	Belida	Ikan lainnya	Udang Galah	Udang lainnya
J u m l a h	2.395.996	2.813.765	9.317.536	538.780	-
K a p u a s	26.511	-	306.546	75.185	-
K a t i n g a n	78.100	57.300	345,225	-	-
Kotawaring Timur	186.185	831.935	1.730.285	246.685	-
S e ru y a n	45.995	84.240	174.300	93.700	-
Kotawaringin Barat	257.790	261.975	548.185	34.050	-
Gunung Mas	94.050	-	69.300	-	-
Barito Utara	-	135.900	921.375	-	-
Barito Selatan	1.312.655	1.362.065	2.955.370	89.160	-
Palangka Raya	230.850	-	2.098.200	-	-
Barito Timur	163.860	80.350	168.750	-	-

Tabel 3 : Nilai produksi perairan umum menurut jenis ikan dan kwartal, Propinsi Kalimantan Tengah.

Nilai : Rp.1.000,-

Kwartal / Jenis ikan	Jumlah	Kwartal I	Kwartal II	Kwartal III	Kwartal IV
Jumlah	46.831.909	9.760.110	11.272.859	13.035.072	12.763.868
Jelawat	2.379.025	442.825	563.060	630.875	742.265
Lampan	3.744.420	848.885	898.285	997.560	999.090
Tawes	319.845	70.300	91.220	42.080	116.245
Jambal	5.720.060	1.251.350	1.391.390	1.536.205	1.541.115
Gabus	10.226.697	1.938.207	2.533.170	2.869.635	2.885.685
Lais	4.348.150	980.685	1.031.685	1.125.675	1.210.105
Toman	3.171.880	608.220	708.545	878.535	976.580
Sepat siam	1.855.755	341.130	521.665	543.597	449.363
Tambakan	2.395.996	504.150	595.596	668.040	628.210
Belida	2.813.765	687.550	618.085	756.820	751.310
Betutu	-	-	-	-	-
Ikan lainnya	9.317536	1.946.458	2.172.568	2.858.800	2.339.710
Udang Galah	538.780	140.350	147.590	127.250	123.590

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Tabel 4 : Produksi Sungai Menurut Jenis Ikan dan Daerah Tingkat II, Propinsi Kalimantan Tengah.

Jenis Ikan / Daerah Tingkat II	Jumlah	Jelawat	Lampan	Tawes	Jambal	Gabus	Lais	Toman	Sepat Siam
Jumlah	17.106,3	711,1	1.389,6	315,9	2.679,9	2.515,6	1.651,2	1.134,0	671,5
Kapuas	609,8	118,1	17,7	-	64,4	81,5	71,6	31,7	13,9
Katingan	950,9	12,3	218,7	-	271,8	135,6	44,4	-	-
Ktw.Timur	4.462,3	136,7	327,5	230,6	754,1	471,2	400,5	334,2	-
Seruyan	1.214,6	90,8	144,9	85,3	334,3	32,1	130,9	49,9	-
Ktw. Barat	1.321,6	-	92,3	-	180,0	294,4	136,1	115,4	-
Gunung Mas	517,7	-	-	-	99,1	112,9	123,0	97,2	-
Barito Utara	362,9	17,0	37,8	-	33,2	-	34,8	-	-
Barito Selatan	3.972,5	294,9	420,2	-	492,3	282,0	524,2	231,1	135,7
Palangka Raya	2.802,5	41,3	130,5	-	319,8	975,0	31,7	115,0	521,9
Barito Timur	891,5	-	-	-	130,9	130,9	154,0	109,5	-

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Lanjutan Tabel 4

Daerah Tingkat II \ Jenis Ikan	Tambakan	Balida	Betutu	Ikan Lain-lain	Udang Galah	Udang Lainnya
J u m l a h	708,1	1.153,2	-	3.956,7	219,5	-
K a p u a s	9,7	-	-	153,5	47,7	-
K a t i n g a n	35,1	25,8	-	207,2	-	-
Ktw. T i m u r	93,5	400,4	-	1.216,6	47,0	-
S e r u y a n	44,8	154,3	-	70,8	76,5	-
Ktw. B a r a t	20,0	140,7	-	316,7	26,0	-
Gunung M a s	54,2	-	-	31,3	-	-
Barito Utara	-	20,6	-	219,5	-	-
Barito Selatan	313,4	346,2	-	910,2	22,3	-
Palangka Raya	-	-	-	667,3	-	-
Barito Timur	137,4	65,2	-	163,6	-	-

Tabel 5 : Produksi Sungai Menurut Jenis Ikan dan Kwartal
Propinsi Kalimantan Tengah.

Kwartal / Jenis Ikan	Jumlah	Kwartal I	Kwartal II	Kwartal III	Kwartal IV
J u m l a h	17.106,3	4.021,7	4.228,7	4.683,5	4.172,4
Jelawat	711,1	159,9	163,3	177,4	210,5
Lampam	1.389,6	335,0	347,2	350,5	356,9
Tawes	315,9	72,8	92,6	44,8	105,7
Jembal	2.680,0	674,4	666,6	689,4	649,6
Gabus	2.515,6	536,1	609,8	782,2	587,5
L a i a	1.651,2	424,8	406,2	424,6	395,6
T o m a n	1.144,9	245,9	276,1	330,9	292,0
Sepat Siam	671,5	147,7	205,3	198,7	319,8
Tambakan	708,1	169,2	176,3	178,0	184,6
B e l i d a	1.153,2	294,4	266,7	288,6	303,5
Ikan Lainnya	3.945,7	918,3	962,2	1.148,2	917,0
Udang Galah	219,5	43,2	56,4	70,2	49,7

Tabel 6 : Produksi Menurut Kwartal dan Jenis Ikan Perairan Umum
Propinsi Kalimantan Barat Tahun 1984.

Satuan : Ton

JENIS IKAN	JUMLAH	KWARTAL I	KWARTAL II	KWARTAL III	KWARTAL IV
JUMLAH	21.223,7	3.637,2	5.107,6	6.898,2	5.480,1
SUB TOTAL	21.140,7	3.629,0	5.066,8	6.870,0	5.553,9
Jelawat	102,9	14,1	36,6	24,0	28,2
Lempan	5,1	1,5	1,6	2,0	-
Tawes	202,6	40,9	50,1	60,1	15,5
Jombol	1.065,7	181,9	286,8	297,7	299,3
Gobus	1.194,9	189,4	254,0	315,7	435,8
Lois	4.240,1	725,1	1.118,5	1.376,0	1.420,5
Tomon	2.208,6	365,1	439,5	566,6	837,4
Tombakon	1.728,7	267,3	438,9	529,1	493,4
Belido	440,2	82,9	106,4	120,6	130,3
Betutu	26,5	2,8	3,3	3,1	17,3
Ikan Jenis Lain	9.925,4	1.957,0	2.451,1	3.575,1	2.140,2
Sub Total	82,4	8,2	20,8	28,2	26,2
Udang Galah	46,2	7,1	6,5	21,0	11,6
Udang Tawar	-	-	-	-	-
Udang Lainnya	36,2	0,1	14,3	7,2	14,6

Tabel 7 : Produksi Perairan Umum Menurut Jenis Ikan dan Kabupaten Tahun 1984
Propinsi Kalimantan Barat.

Satuan : Ton

KABUPATEN	JUMLAH	I K A N												Binatang kulit keras		
		Sub Jumlah	Jelawat	Lampan	Tawes	Jambal	Gabus	Lais	Toman	Tambakan	Belida	Betutu	Ikan Lainnya	Sub Jumlah	Udang Galah	Udang Lain
JUMLAH	21.223,1	21.140,7	102,9	5,1	202,6	1.065,7	1.194,9	4.240,1	2.208,6	1.728,7	440,2	26,5	9.925,4	82,4	46,2	36,2
KETAPANG	1.711,3	1.711,3	-	-	-	-	167,0	338,8	238,9	150,5	155,2	-	660,9	-	-	-
PONTIANAK	196,4	163,2	-	-	-	-	5,6	26,6	24,3	-	33,7	10,3	62,7	35,2	17,2	18,0
SAMBAS	181,6	171,4	-	5,1	-	42,8	16,6	4,2	4,0	-	11,8	6,2	80,7	10,2	10,3	-
SANGGAU	525,2	513,8	11,2	-	-	-	11,2	95,7	1,4	-	38,0	-	356,3	11,4	11,0	-
SINTANG	3.595,6	3.570,0	71,6	-	202,6	1.022,9	93,4	405,7	167,7	59,8	49,0	-	1.497,3	25,6	7,4	18,2
KAPUAS HULU	15.011,0	15.011,0	20,1	-	-	-	901,1	3.369,1	1.772,3	1.516,4	152,5	10,0	7.267,5	-	-	-

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Tabel 8 : Nilai Produksi perairan umum menurut jenis ikan dan Kabupaten, Propinsi Kalimantan Barat, 1984.

(Satuan : Rp.1.000,-)

KABUPATEN	JUMLAH	JENIS IKAN							
		Sub Jumlah	Jelawat	Lampan	Tawes	Jambal	Gabus	Lais	Toman
JUMLAH	8.542.054	8.478.044	232.410	2.185	235.555	874.255	33.713	2.052.416	1.005.726
KETAPANG	493.834	494.834	-	-	-	-	55.075	115.786	78.911
PONTIANAK	184.370	122.370	-	-	-	-	2.800	32.150	15.780
S A M B A S	122.405	105.335	-	3.185	-	27.055	10.240	2.520	2.600
SANGGAU	831.515	792.375	33.600	-	-	-	10.540	202.975	1.750
SINTANG	3.343.240	3.297.440	166.810	-	235.555	847.190	75.630	505.880	135.325
KAPUAS HULU	3.566.590	3.566.690	32.000	-	-		177.328	1.192.105	750.360

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Tabel 9 : Jumlah benih ikan yang ditanam menurut jenis ikan dan Kabupaten, Propinsi Kalimantan Barat, 1984.

(Satuan : Rp.1.000,-)

KABUPATEN	JUMLAH	JENIS IKAN YANG DITANAM						
		MAS		Nila	Tawes	Gurami	Tambakan	Ikan Lainnya
		0 - 5	5					
JUMLAH	3.386	1.195	512	524	70	46	228	811
PONTIANAK	1.783	683	228	202	-	46	-	624
SAMBAS	560	458	68	5	-	-	-	29
SANGGAU	212	-	-	91	70	-	-	51
SINTANG	831	54	216	226	-	-	228	107

Tabel 10 : Produksi Menurut Jenis Ikan yang dibudidayakan dan Kabupaten, Propinsi Kalimantan Barat, 1984

Satuan : Ton

KABUPATEN	JUMLAH	JENIS IKAN							
		Mas	Tawes	Mujair	Nila	Gurami	Sepat Siam	Tambakan	Ikan Lainnya
JUMLAH	431,0	248,5	10,1	25,4	41,5	7,1	21,3	8,6	32,4
PONTIANAK	130,1	71,9	-	25,4	13,8	3,5	15,5	-	-
SAMBAS	211,0	211,0	-	-	-	-	-	-	-
SANGGAU	37,2		10,1	-	15,2	3,6	5,8	-	2,5
SINTANG	52,7	1,7	-	-	12,5	-	-	8,6	29,9

Tabel 11 : Produksi Ikan yang dibudidayakan menurut Kwartal dan Kabupaten, Propinsi Kalimantan Barat, 1984

KABUPATEN	JUMLAH	KWARTAL I	KWARTAL II	KWARTAL III	KWARTAL IV.
JUMLAH	431,0	41,8	50,4	228,3	110,5
PONTIANAK	130,1	20,1	25,7	32,7	51,6
S A M B A S	211,0	18,3	19,5	157,3	15,9
SANGGAU	37,2	-	-	29,6	7,6
S I N T A N G	52,7	3,4	5,2	8,7	35,4

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Tabel 13 : Nilai Produksi Ikan yang dibudidayakan menurut kwartal dan Kabupaten Tahun 1984, Propinsi Kalimantan Barat.

KABUPATEN	JUMLAH	KWARTAL I	KWARTAL II	KWARTAL III	KWARTAL IV
J U M L A H	933.420	91.470	131.975	507.950	202.025
PONTIANAK	284.545	43.170	77.675	59.200	104.500
S A M B A S	523.525	45.750	48.750	393.250	35.775
SANGGAU	53.550	-	-	41.900	11.650
S I N T A N G	71.800	2.550	5.550	13.600	50.100

Tabel 14 : Jumlah Produksi Benih Ikan Menurut Sumbernya dan Jenis Ikan Tahun 1984, Propinsi Daerah Tingkat I Kalimantan Barat.

Satuan : 1.000 ekor

JENIS IKAN	J U M L A H	S U M B E R B E N I H			
		K H U S U S		C A M P U R A N	
		BBI	RAKYAT	DIJUAL	DITANAM SENDIRI
J U M L A H	3.727	2.037	1.690	2.449	1.278
M a s	2.251	1.561	690	1.766	485
M u j a i r	389	156	233	291	98
N I L A	806	320	486	387	419
Sepat Siam	235	-	235	-	235
Tambakan	-	-	-	-	-
G u r a m i	46	-	46	5	41

Tabel 15 : Produksi Benih Ikan Menurut Jenisnya dan Kabupaten Tahun 1984, Kalimantan Barat.

Satuan : 1.000 ekor

KABUPATEN	JUMLAH	Jenis Benih Ikan				
		M a s	N i l a	Sepat Siam	Mujair	Gurami
JUMLAH	3.727	2.251	806	235	45	389
PONTIANAK	1.783	911	202	235	45	389
SAMBAS	438	438	-	-	-	-
SANGGAU	-	-	-	-	-	-
S I N T A N G	1.506	902	604	-	-	-

Tabel 16 : Nilai Produksi Benih Menurut Jenis Ikan
dan Kabupaten Tahun 1984, Prop. Kalimantan Barat

(astuan : Rp.1.000,-)

KABUPATEN	JUMLAH	J E N I S B E N I H				
		M a s	Nila	Sepat Siam	Mujair	Gurami
JUMLAH	78.263	67.645	5.800	1.175	920	2.723
PONTIANAK	54.408	45.550	4.040	1.175	920	2.723
S A M B A S	15.330	15.330	-	-	-	-
SANGGAU		-	-	-	-	-
S I N T A N G	8.525	6.765	1.760	-	-	-

Annex 1

SCHEDULE OF VISIT

Friday	15 November, 1985	Jakarta - Banjarmasin
Saturday	16 November, 1985	Visit aroun South Kalimantan
Sunday	17 November, 1985	Banjarmasin - Balikpapan Balikpapan - Samarinda (Taxi)
Monday Tuesday	18 November, 1985 19 November, 1985	Site visit around East Kalimantan
Wednesday	20 November, 1985	Samarinda - Balikpapan Balikpapan - Palangkaraya
Thursday Friday Saturday	21 November, 1985 22 November, 1985 23 November, 1985	Site visit around Central Kalimantan
Sunday	24 November, 1985	Palangkaraya - Jakarta
Monday	25 November, 1985	Jakarta - Pontianak
Tuesday Wednesday	26 November, 1985 27 November, 1985	Site visit around West Kalimantan
Thursday	28 November, 1985	Pontianak - Jakarta

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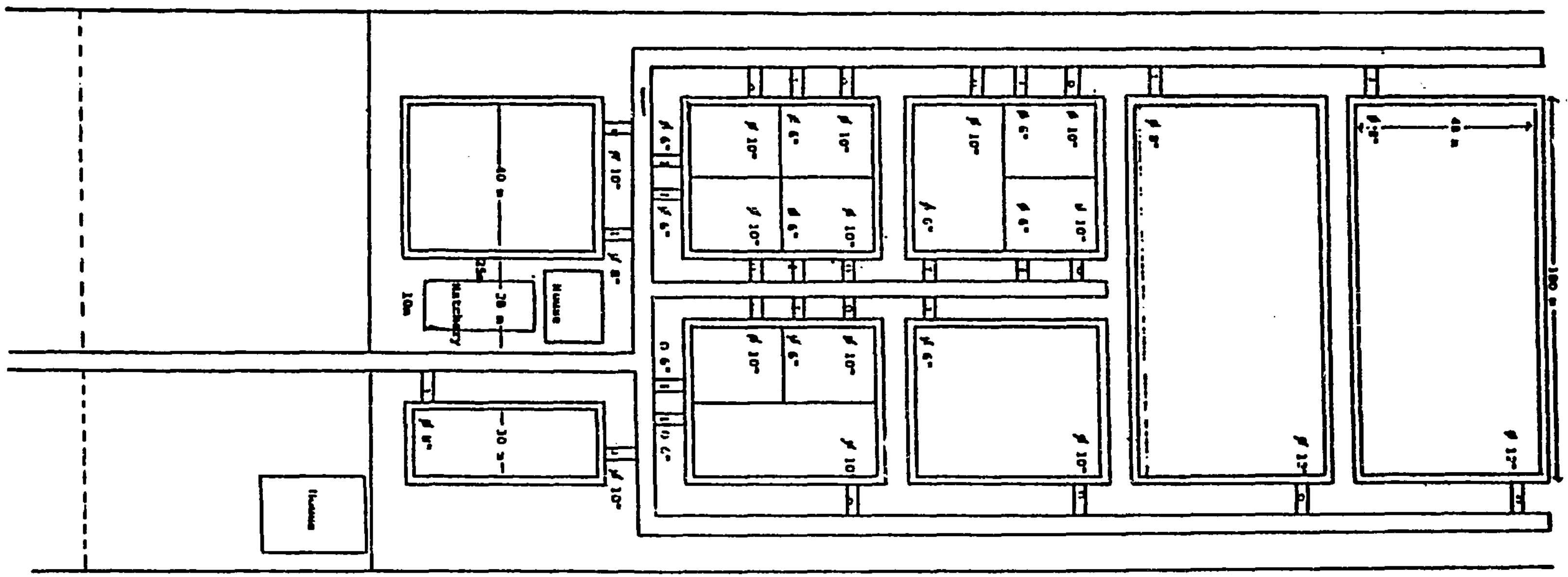
Annex 2

LAY-OUT OF KUALA KAPUAS HATCHERY



Inlet (canal) 0,50x0,75x long m^3

Outlet (canal) (1,5-2)x(1,5-1,75)x long m^3

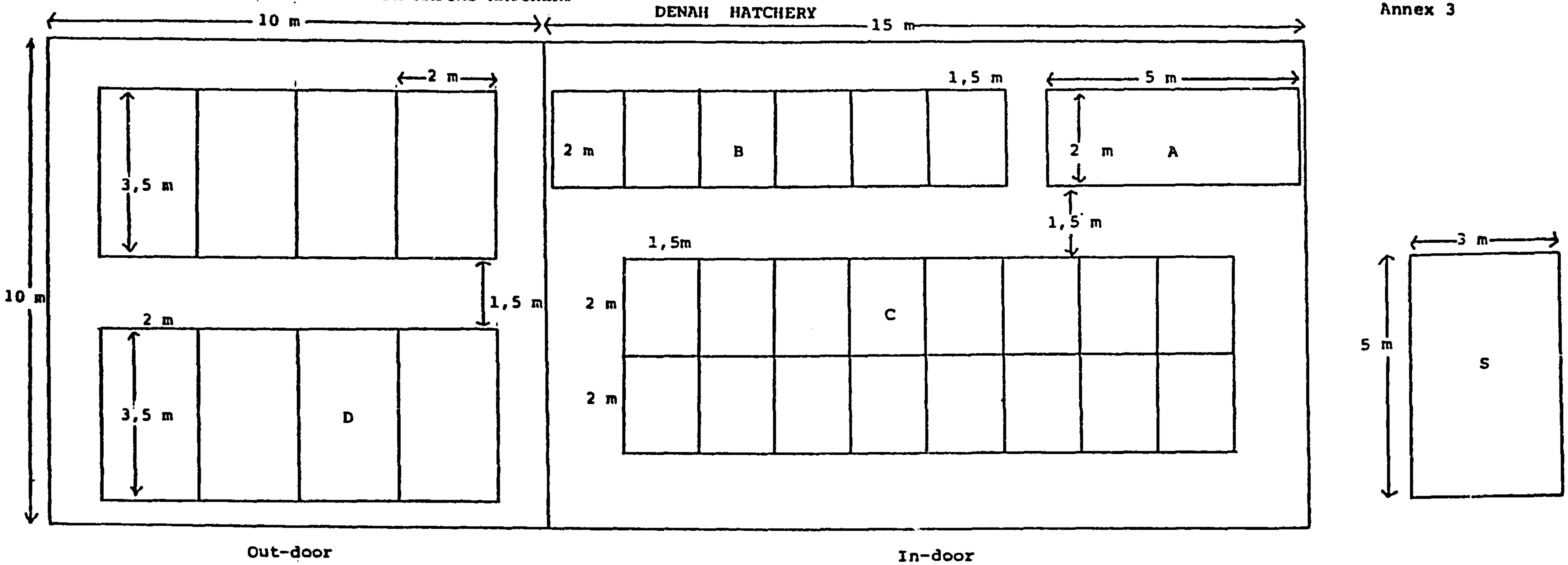
I = Inlet

O = Outlet

Skala : 1 : 1000

Annex 3

DESIGN OF KUALA KAPUAS HATCHERY



A = Hatching Tank (Cement) (2x5x0,60 m³)

B-C = Larval rearing Tank (cement) (1.5x2x0.60 m³)

D = Stocking Tank, Breeding Tank, out door (2x3.5x0.80 m³)

S = Storage water Tank (3x5x2 m³)

Skala : 1 : 100

LEMBARAN KERJA (L.K)

Departemen/Lembaga/
Instansi/Dinas : Paraf

Propinsi Daerah Tk.I : Kalimantan Tengah
Dinas/Lembaga/Satuan Kerja : Dinas Perikanan Prop.Dati.I Kalteng
Nama Proyek : Peningkatan Produksi Perikanan (Perubahan APBN 1986/1987).
Nomor/Kode Proyek : 2P.01.01.001

Pejabat BAPPEDA :
Pejabat Biro Keuangan :
Pejabat Biro Bina Pembangunan Daerah :
Pejabat Dinas/Lembaga/Satuan Kerja ybs :

URAIAN PERHITUNGAN PENGELUARAN

Bagian Proyek/Tolok Ukur/Uraian Pengeluaran	Volume	Harga Satuan	Jumlah Biaya(Rp)
1	2	3	4
PROYEK PENINGKATAN PRODUKSI PERIKANAN			
I. Pembinaan Perikanan Rakyat.Peningkatan Kolam Ikan Sei Batang menjadi Pra-Balai Benih Ikan (BBI).			
Gaji dan Upah (01).			
- Honorarium Pelaksana Proyek	1 org,12 bl	15.000,-	180.000,-
- Honorarium Pembantu Pelaksana	2 org,12 bl	10.000,-	240.000,-
- Honorarium tenaga lepas	2 org,12 bl	40.000,-	950.000,-
		Jumlah (01)	1.380.000,-
Bahan (03).			
1). Pengadaan induk ikan			
- Ikan Mas	100 kg	10.000,-	1.000.000,-
- Ikan Nila	100 kg	7.000,-	700.000,-
- Ikan Tambakan	100 kg	5.000,-	500.000,-
- Ikan Jelawat	100 kg	10.000,-	1.000.000,-
- Ikan Tawes	100 kg	5.000,-	500.000,-
			3.700.000,-
2). Pengadaan makanan tambahan			
- Pellet	5.000 kg	500,-	2.500.000,-
- Dedak/bekatul/menir	1.500 kg	200,-	300.000,-
			2.800.000,-
3). Pengadaan pupuk			
- Pupuk kandang	1.400 kg	300,-	420.000,-
- Pupuk TSP, Urea	600 kg	400,-	240.000,-
- Kapur	2.000 kg	250,-	500.000,-
			1.160.000,-
4). Pengadaan obat-obatan			
- Fumandol, Sumithion	10 ltr	10.000,-	100.000,-
- Diazinon	10 ltr	10.000,-	100.000,-
- Antiseptik/Antibiotika	1 unit	100.000,-	100.000,-
			300.000,-
		Jumlah (03)	7.960.000,-

1	2	3	4
Peralatan dan Mesin (04).			
1). Peralatan pertanian kecil			
- Cangkul	6 bh	5.000,-	30.000,-
- Sekop	6 bh	5.000,-	30.000,-
- Garpu	6 bh	5.000,-	30.000,-
- Golok/parang	6 bh	5.000,-	30.000,-
- Sprayer kapasitas 19 lt.	2 bh	100.000,-	200.000,-
			320.000,-
2). Peralatan untuk pemilihan induk			
- Timbangan kapasitas 1 kg	1 bh	25.000,-	25.000,-
- Timbangan kapasitas 10 kg	1 bh	50.000,-	50.000,-
- Ember plastik	6 bh	2.500,-	15.000,-
- Bakul dan pikulan	4 set	10.000,-	40.000,-
- Fish bus dan kreneng	2 set	15.000,-	30.000,-
- Seser dari waring	4 bh	5.000,-	20.000,-
			180.000,-
3). Peralatan Induced Spawning/ Breeding.			
- Happa	30 m²	10.000,-	300.000,-
- Alat suntik dan pinset	3 set	25.000,-	75.000,-
- Alat centripugal	3 set	75.000,-	225.000,-
- Gelas ukuran 500 ml	3 bh	15.000,-	45.000,-
- Gelas ukuran 1000ml	3 bh	25.000,-	75.000,-
- Waskom	6 bh	2.500,-	15.000,-
- Homogenizer	6 bh	40.000,-	240.000,-
- Hormon-hormon	100 ample	20.000,-	2.000.000,-
			2.975.000,-
4). Genset dan pompa air.			
- Genset 5 KVA,lengkap dengan instalasi	1 unit	5.000.000,-	5.000.000,-
- Pompa air Hitachi & pipa (bensin/solar dengan Ø 3")	2 bh	300.000,-	600.000,-
- Blower & pipa-pipa instalasi	1 unit	2.500.000,-	2.500.000,-
- Pompa air untuk hatchery (listrik)	1 buah	750.000,-	750.000,-
			8.850.000,-
5). Peralatan untuk pengukuran air			
- Aerator	4 bh	20.000,-	80.000,-
- Tabung oksigen (O_2) kapasitas 2 m² lengkap dengan oksigen	1 bh	250.000,-	250.000,-
- Kantong plastik tebal dan besar	1 pak	100.000,-	100.000,-
- Kotak karton	100 bh	2.500,-	250.000,-
			680.000,-
		Jumlah (04)	13.005.000,-

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1	2	3	4
Biaya Perjalanan (05).			
- Pengawasan/supervisi team dari unsur Bappeda dan Dinas Perikanan Tingkat I	4 org, 2 kali	150.000,-	1.200.000,-
- Pengawasan/supervisi dari Tk.II ke lokasi	2 org, 8 kali	20,000,-	320.000,-
- Konsultasi petugas dari Tk.II ke propinsi	1 org, 3 kali	75.000,-	225.000,-
		Jumlah (05)	1.745.000,-
Konstruksi (06).			
- Perbaikan monik(pintu pengeluaran).	5 bh	250.000,-	1.250.000,-
- Perbaikan pematang kolam	400 m	2.500,-	5.000.000,-
- Pembuatan genset	1 unit	1.500.000,-	1.500.000,-
		Jumlah (06)	7.750.000,-
Lain-lain pengeluaran (07).			
- Biaya perawatan/pemeliharaan kolam	Disediakan	250.000,-	250.000,-
- Biaya operasional genset	Disediakan	500.000,-	500.000,-
		Jumlah (07)	750.000,-
		Jumlah I	32.590.000,-

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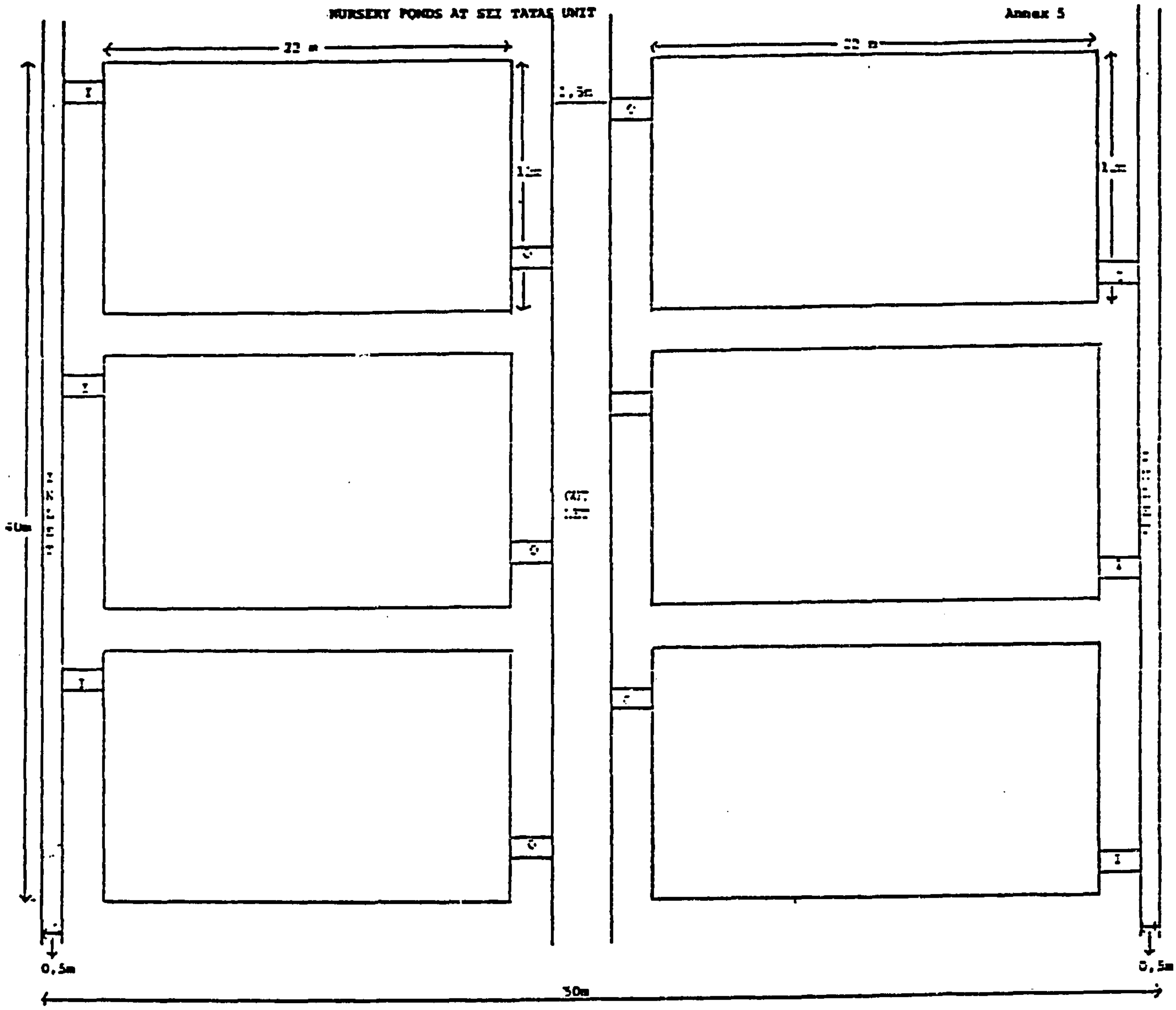
NURSERY PONDS AT SEI TATAS UNIT

Annex 5



Dem Plots Sei Tatas

O = Out Let

I = Inlet

Skala : 1 : 1000

ANNEX C

PEMIJAHAN IKAN JELAWAT DAN IKAN PATIN
DENGAN CARA HIPOFISASI

ANNEX D

PENGELOLAAN PERIKANAN PERAIRAN UMUM

PENGELOLAAN
PERIKANAN PERAIRAN UMUM

KERJASAMA ANTARA :
DIREKTORAT JENDERAL PERIKANAN
DENGAN UNITED STATES OF AMERICA,
AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)
1985

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KATA PENGANTAR

Maksud dari penerbitan buku ini ialah untuk memberikan petunjuk tehnis tentang pengelolaan perikanan perairan umum. Diharapkan hal ini dapat membantu kegiatan pengelolaan perikanan perairan umum didaerah.

Buku ini disusun berdasarkan hasil latihan kerja Budidaya Perikanan Air Tawar yang diselenggarakan di Jambi dan Palembang dari tanggal 2-15 Maret 1985 dengan instruktur Mr.Samruay Meenakarn, sebagai konsultan USAID dalam bidang Budidaya Perikanan Air Tawar. Semoga buku ini dapat menjadi pegangan bagi para petugas yang menangani pengelolaan perikanan perairan umum.

Kepada semua pihak yang telah membantu terbitnya buku ini kami ucapkan terima kasih.

Jakarta, Oktober 1985

A.n. Direktur Jenderal Perikanan

Direktur Bina Produksi

Burhanuddin Lubis, MSc

NIP.080006263

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I. PENDAHULUAN

Perairan umum merupakan sumber-sumber perikanan yang perlu mendapat perhatian dalam pengelolaannya. Perikanan perairan umum yang potensial seperti danau, sungai dan muara banyak terdapat di Sumatera dan Kalimantan. Jenis-jenis ikan yang hidup diperairan umum seperti ikan Jelawat (*Leptobarbus hoveni*) Patin (*Pangasius pangasius*), Belida (*Notopterus borneensis*) Betutu (*Oxyeleotris marmorata*) dsb, mempunyai nilai ekonomis penting.

Jenis-jenis ikan perairan umum tersebut sudah mulai banyak dipelihara para petani, namun masih ada faktor utama yang menghambat perkembangan yaitu kesulitan memperoleh benih dalam jumlah banyak. Hal ini disebabkan karena lingkungan hidupnya sudah banyak mengalami pencemaran baik berasal dari limbah pasar maupun limbah industri dan disamping itu juga akibat dari penangkapan yang berlebihan sehingga menjadi langka.

Dalam rangka meningkatkan produksi dan mengatasi kepunahan jenis-jenis ikan tersebut serta merangsang petani ikan untuk membudidayakan baik dikaramba atau dikolam-kolam maka Direktorat Jenderal Perikanan dalam kerja sama dengan USAID telah menempatkan tenaga ahli dari Thailand untuk memberi penyuluhan kepada tenaga-tenaga tehnis dan petani-petani ikan dalam pengelolaan sumber-sumber perikanan perairan umum.

II. PENGELOLAAN PERAIRAN UMUM

Dalam pengelolaan perairan umum, hal yang harus di perhatikan dan diketahui dahulu yaitu : Carring Capacity dari perairan umum tersebut dan bagaimana cara untuk meningkatkan produksi dari perairan tersebut, untuk mencapai hasil produksi yang maksimum.

Pengelolaan perairan umum dibagi 2(dua) yaitu :

A. Perairan umum yang sudah ada ikannya, dan

B. Perairan umum yang masih kosong/belum ada ikan, (waduk buatan).

Untuk mengelola perairan yang sudah ada ikannya perlu diperhatikan hal-hal sebagai berikut :

(1). Jenis ikan yang ada, baik potensinya, rata-rata ukuran besar ikan dan jumlah produksi yang dihasilkan tiap tahun. Hal ini dimaksud agar dapat diketahui populasi ikan yang ada guna menjaga keseimbangan perairan umum tersebut. Untuk mengontrol keseimbangan populasi dapat dilakukan setiap 6 - 12 bulan sekali secara sampling pada areal seluas 1.000 m^2 dengan perkiraan hasil tangkapan 30 kg tiap 1 m^2.

(2). Melakukan konservasi yaitu :

a. Pengaturan daerah penangkapan, termasuk menetapkan daerah tertentu yang tidak boleh dilakukan penangkapan misalnya didaerah pemijahan (spawning ground). Hal ini dimaksud untuk mencegah agar supaya induk-induk ikan yang memijah tidak sampai tertangkap.

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b. Menentukan waktu musim penangkapan dihubungkan dengan larangan menangkap pada musim pemijahan.

c. Menentukan jenis-jenis alat yang boleh dipakai dan ukuran mata jaringnya untuk menyeleksi supaya hanya ikan konsumsi saja yang tertangkap.

(3). Mencegah populasi dan kerusakan akibat erosi.

a. Polusi diperairan umum dapat disebabkan :

- limbah pabrik;
- limbah rumah tangga yang berlebihan;
- dsb.

Untuk mengatasi hal tersebut diatas perlu dilakukan kerjasama dengan instansi yang berwenang serta perlu adanya peran aktif masyarakat yang ada dilingkungan perairan tersebut.

b. Kerusakan akibat adanya erosi.

Erosi dapat mengakibatkan pendangkalan di perairan umum, hal tersebut dapat merubah/mempengaruhi kehidupan organisme yang ada diperairan tersebut. Untuk mengatasi hal tersebut perlu adanya kerjasama dengan instansi yang berwenang (Departemen Kehutanan dan PPLH).

(4). Mempelajari biologi perairan dan kwalitas air.

a. Biologi perairan yang harus diketahui :

- Sifat-sifat dari pada ikan yang ada diperairan itu hubungannya dengan kebiasaan makan (herbivora, karnivora, omnivora) dan cara makan (permukaan, pertengahan dan dasar).

- Organisme perairan lainnya yang mendukung kehidupan ikan sebagai sumber makanan,ditinjau dari jenis dan kelimbahannya (phytoplankton, zooplankton, tanaman air dan organisme lainnya).

b. Kualitas air.

Kualitas air yang perlu diketahui dan dipelajari yaitu :

- sifat fisika (tempelatur, pH).
- sifat kimia (oksigen, CO_2 , NH_3 , BOD, alkanitas, kesadahan).

(5). Restocking.

Tujuannya adalah untuk mempertahankan keseimbangan populasi ikan disuatu perairan yang produktivitasnya telah menurun.

Benih untuk restocking bisa diperoleh dari :

- Balai Benih Ikan
- Dari hasil pemijahan sendiri oleh induk-induk ikan diperairan tersebut.

Untuk melaksanakan restocking hal yang perlu diperhatikan yaitu jenis, ukuran serta jumlah ikan yang akan ditebarkan haruslah disesuaikan dengan kondisi perairan tersebut.

Untuk perairan yang masih kosong (belum ada ikan) yang perlu diperhatikan ialah keadaan perairan tersebut melalui suatu penelitian. Berdasarkan hasil penelitian kemudian dilakukan restocking.

\\\\{V

III. KONSTRUKSI KARAMBA

Untuk memelihara ikan secara terkontrol diperlukan tempat/wadah yang mudah dalam pengelolaannya. Wadah pemeliharaan tersebut dapat berbeda-beda bentuknya, tergantung pada jenis ikan maupun perairan tempat budidaya.

Untuk pemeliharaan ikan di perairan umum diperlukan wadah yang tahan terhadap pengaruh ombak, angin, panas, predator dsb, serta dapat memberikan tempat yang layak bagi kehidupan ikan yang dipelihara. Selain itu wadah tersebut sangat ditentukan oleh besar kecilnya modal yang tersedia.

Wadah pemeliharaan ikan diperairan umum dapat dibedakan menjadi 2(dua) macam yaitu : Karamba (cages) dan Pagar (pens).
Karamba (cages) adalah wadah budidaya yang dibuat dari bilah kayu bulian, bambu dan jaring yang diapungkan dipermukaan air (Gambar 3). Karamba tersebut dipasang diperairan seperti danau, sungai dsb.
Sedangkan pagar adalah wadah budidaya yang terbuat dari bambu atau jenis bahan lainnya (Gambar 4).Pagar ini umumnya terdapat di perairan umum yang dangkal dan airnya tenang.

Bila ditinjau dari tujuan pemeliharaannya maka umumnya ukuran karamba ada 3 (tiga) macam :

(a). Untuk pembesaran ikan konsumsi maka ukuran karambanya adalah 3 x 2 x 1,5 m^3.

(b). Untuk pemeliharaan induk, maka karamba yang digunakan berukuran 8 x 4 x 1,5 m^3.

\\(?)

(c). Sedangkan untuk pembesaran benih maka karamba yang digunakan berukuran 1 x 1,5 x 0,9 m^3.

Untuk menentukan karamba pembesaran ikan konsumsi yang dikaitkan dengan pola usaha harus dipertimbangkan segi ekonoisnya. Sebaiknya karamba yang digunakan berukuran kecil, tetapi dalam jumlah yang banyak agar panen ikan lebih kontinyu.

Untuk menentukan pembuatan karamba faktor-faktor yang perlu diperhatikan adalah : lama pemeliharaan, harga dan predator serta kemudahan untuk memperoleh bahan tersebut. Apabila waktu pemeliharaan ikan itu dalam jangka waktu yang lama terutama untuk karamba pemeliharaan induk, maka bahan yang digunakan harus tahan terhadap kondisi lingkungan dan karamba yang digunakan harus berukuran besar serta jarak antara bilah memungkinkan untuk terjadi sirkulasi air, akan tetapi ikan tidak bisa lolos. Sedangkan bahan-bahan untuk karamba pembesaran ikan konsumsi sebaiknya ditentukan oleh : lama pemeliharaan sampai waktu panen dan digunakan bahan karamba yang harganya relatip lebih murah agar hasil yang dicapai lebih menguntungkan. Bahan karamba yang umum digunakan ialah bilah kayu bulian, bilah bambu, jaring nilon, dan kawat kasa, sedangkan pengapung karamba dapat digunakan balok kayu, drum dsb.

Karamba untuk pemeliharaan benih (larva) digunakan nilon yang mempunyai mesh size yang relatif kecil, dimana ikan tidak dapat lolos dan predator tidak dapat masuk.

Sebaiknya sangkar tersebut harus dibuat rangkap, dimana net bagian luar, mesh size lebih besar dari pada net bagian dalam untuk mencegah kerusakan net bagian dalam, yang disebabkan oleh predator dan benda-benda lainnya.

IV. PEMELIHARAAN IKAN

Usaha pemeliharaan ikan adalah suatu usaha untuk memproduksi ikan mencapai ukuran komsumsi dana pemeliharaan kolam, karamba dan kurungan terapung (pen). Tehnik pemeliharaan ikan dalam karamba dan pen dilakukan diperairan umum.

Pola usaha pemeliharaan ikan di kolam dapat dilakukan secara tradisional dan intensif, dan kegiatan budidaya ikan tradisional sudah banyak dilakukan oleh masyarakat sebagai usaha pokok maupun sebagai usaha sampingan. Sedangkan usaha budidaya intensif sudah merupakan usaha komersiil yang dalam waktu singkat harus sudah dapat memproduksi ikan.

Hal-hal yang perlu mendapat perhatian dalam budidaya ikan adalah sebagai berikut :

(a). Kualitas air

Dalam budidaya ikan faktor utama yang perlu mendapat perhatian adalah air, karena air merupakan media bagi kehidupan ikan, oleh karena itu agar supaya terjadi pertumbuhan dan reproduksi mutlak diperlukan lingkungan yang cocok.

Sumber air yang dapat dipergunakan untuk budidaya yaitu air sungai, air tergenang (stagnant water) dan air rawa. Adapun parameter kualitas air yang dipergunakan untuk pemeliharaan ikan Jelawat dan Patin dapat dilihat pada Tabel 1.

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Tabel : Parameter kualitas air untuk pemeliharaan ikan.

Kualitas air	Kandungan
Oksigen	3 - 6 ppm
CO_2	9 - 20 ppm
pH	5 - 9
Alkalinitas	80 - 250
Suhu	29 - 30°C

(b). Makanan

Energi yang berasal dari makanan diperlukan dalam proses metabolisme ikan dan kelebihan energi ini disimpan dalam bentuk lemak. Untuk pertumbuhan ikan diperlukan protein dan kelebihan protein yang berasal dari makanan ikan disimpan dalam bentuk daging ikan tersebut.

Makanan ikan tersebut dapat berupa makanan alami misalnya plankton, zooplankton, serangga dsb, dan pakan tambahan dapat berupa makanan lengkap (pellet) serta makanan tidak lengkap (limbah pasar, limbah restoran).Pemberian makanan tambahan yang lengkap ditujukan pada usaha ikan yang intensif. Untuk menentukan pemberian pakan tersebut harus diperhatikan juga sifat masing-masing jenis ikan.

(c). Kepadatan penebaran

Pengertian padat penebaran adalah jumlah/berat ikan yang dipelihara pada satuan luas tertentu. Untuk menentukan padat penebaran ini memerlukan penelitian setempat dan sebagai standarnya dapat digunakan daya dukung suatu kolam.

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Untuk menentukan padat penebaran secara awam, dapat digunakan metoda produksi ikan dalam jumlah (ekor) kemudian dikaitkan dengan mortalitasnya selama pemeliharaan. Sebagai contoh dapat dikemukakan yaitu jumlah survival ikan ditambah mortalitas.

Misalnya produksi ikan 500 kg/1.600 m^2/6 bulan dengan berat rata-rata 500 gr, dan mortalitas 50% :

$$\text{Padat penebaran} = \left(\frac{500.000\ \text{gr}}{500\ \text{gr}}\right) \times \left(\frac{500.000}{500} \times 50\%\right)$$

$$= 1.500\ \text{ekor}/1.600\ \text{m}^2/6\ \text{bulan}$$

V. TEHNIK PEMELIHARAAN.

Sebelum larva dipelihara di karamba pembesaran, maka perlu dipelihara dulu dikolam pendederan sampai larva tersebut kuat antara ± 2-3 bulan, dengan ukuran 12-15 cm (seperti pemeliharaan larva pada pemijahan).

Alat yang biasa digunakan untuk memindahkan larva dari bak penetasan ke pendederan adalah waskom, ember dan kain happa. Sedangkan alat yang digunakan untuk memindahkan larva dari pendederan ke pembesaran dapat menggunakan serok atau kantong plastik.

(1). Pemberian makanan.

Faktor makanan mempunyai peranan yang sangat penting dalam pertumbuhan individu. Untuk meransang pertumbuhan yang optimal, diperlukan jumlah dan mutu makanan yang tersedia dalam keadaan cukup serta sesuai dengan kondisi perairan. Pemberian makanan yang bergizi adalah untuk memperoleh pertambahan daging yang sebanyak-banyaknya dalam waktu sesingkat mungkin.

Kecepatan pertumbuhan tergantung kepada jumlah makanan yang diberikan, ruang, suhu, dalamnya air dan faktor faktor lainnya. Makanan yang dimanfaatkan oleh ikan, pertama-tama digunakan untuk memelihara tubuh dan menggantikan alat-alat tubuh yang rusak. Setelah itu baru kelebihan makanan yang masih tersisa dipergunakan untuk pertumbuhan. Suatu makanan minimal harus mengandung protein,karbohidrat dan lemak.Ketiga zat ini masing-masing akan diubah menjadi energi yang sangat diperlukan agar dapat melakukan aktivitas-aktivitas.

Pemberian makanan dapat meningkatkan produksi ikan peliharaan sampai 3(tiga) kali lipat kalau dibandingkan dengan yang tidak diberi makanan tambahan. Yang di maksudkan dengan makanan tambahan adalah segala macam bahan makanan yang sengaja diberikan kepada ikan-ikan peliharaan yang dapat segera dimakan oleh ikan secara langsung.

Jumlah makanan tambahan yang diberikan setiap hari untuk yang besar sebanyak 3(tiga) kali sehari yaitu pagi, siang dan sore hari. Sedangkan untuk ikan kecil biasanya setiap hari 6(enam) kali dengan selang waktu 2 jam. Jumlah makanan yang diberikan biasanya sekitar 3-5% dari berat total badan ikan untuk tiap hari.

(2). Cara memberikan makanan tambahan.

Dalam pemberian makanan tambahan terhadap ikan yang dipelihara dalam karamba, yang sangat penting untuk diperhatikan adalah kemampuan ikan untuk mencaplok makanan yang diberikan. Makin cepat ikan mencaplok makanan yang diberikan makin baik jadinya. Untuk meningkatkan kemampuan tersebut dapat dilakukan dengan melatih ikan-ikan, sehingga terbiasa untuk langsung mencaplok makanan yang jatuh kedalam karamba. Disamping itu juga kita harus sudah mengetahui kapan ikan tersebut memerlukan makanan.
Pemberian makanan kepada ikan yang dipelihara dalam karamba dapat dilakukan dengan 2(dua) cara yaitu :

a. Makanan langsung ditebarkan.

Dalam penebaran makanan yang perlu diperhatikan adalah arah dan kekuatan arus. Kalau air sedang surut dan arusnya cukup deras, makanan hendaknya ditebarkan dari sisi karamba yang menghadap kehulu, begitu juga sebaliknya kalu arus datang dari hilir.
Dengan demikian makanan akan berada dalam karamba dalam waktu yang cukup lama, sehingga kesempatan bagi ikan untuk mencaplok makanan yang diberikan bertambah besar. Berarti jumlah makanan yang hanyut akan berkurang atau bahkan tidak ada. Tetapi kalau arus air tidak begitu deras (tenang),maka makanan dapat diberikan dari bagian tengah karamba.

Makanan yang diberikan dengan cara tersebut diatas ditujukan untuk makanan yang berukuran cukup besar seperti ikan-ikan kecil, potongan-potongan daun-daunan, dan sebagainya.

Penebaran makanan sebaiknya dilakukan sedikit demi sedikit, jadi kalau tebaran pertama sudah habis di makan ikan, baru ditebarkan lagi, dengan demikian diharapkan jumlah makanan yang terbuang percuma dapat ditekan sedikit mungkin.

b. Makanan diberikan melalui alat.

Pada cara ini, makanan diberikan kepada ikan-ikan dengan menggunakan suatu alat atau tempat tertentu. Cara yang ke 2(dua) ini ditujukan pada makanan-makanan lainnya yang cukup kering seperti biji-bijian, bungkil-bungkilan, serta makanan-makanan berupa tepung seperti dedak baik yang kasar maupun halus.

Cara pemberiannya adalah sebagai berikut

b.1. Cara memberikan makanan yang berbentuk tepung.

Makanan yang berbentuk tepung seperti dedak tidak begitu baik kalau langsung ditebarkan sewaktu memberikannya pada ikan karena akan menyebar kesana kemari. Guna mengatasi keadaan ini, maka makanan yang berbentuk tepung hendaknya diberikan pada ikan dengan menggunakan suatu tempat khusus yakni berupa keranjang atau kantong plastik yang telah ditusuk-tusuk dengan benda tajam sehingga berlubang-lubang. Kalau makanan tersebut (misalnya dedak) telah dimasukkan kedalam keranjang, maka mulut keranjang harus diikat dengan tali sehingga tertutup dengan rapat. Setelah itu, keranjang kemudian digantung didalam karamba sehingga terendam dalam air (Gambar 5).

Kalau makanan tersebut sudah agak basah karena terkena air, akhirnya makanan tersebut akan merembes keluar. Dengan demikian pemberian makanan dapat dilakukan setiap saat tanpa banyak mengeluarkan tenaga. Cara ini cenderung ditujukan bagi ikan-ikan yang masih berukuran kecil atau benih, karena dengan cara ini frekuensi pemberian makanan akan lebih besar, berarti sesuai dengan apa yang telah diuraikan sebelumnya.

b.2. Cara memberikan makanan kering dan berbutir.

Makanan yang kering dan berbutir seperti pellet dimasukkan kedalam tempat tertentu yang bentuknya menyerupai corong. Pada lubang corong dimasukkan tali yang diberi pemberat, corong kemudian digantungkan diatas karamba, dimana ujung dari salurannya berada lebih kurang 5 cm diatas permukaan air, pemberat di usahakan agar tergantung dengan bebas didalam karamba (Gambar 6) Jika ikan-ikan yang berada didalam karamba menyentuh tali atau pemberatnya, maka makanan yang terdapat didalam corong akan jatuh kedalam karamba.Untuk ini perlu adanya latihan bagi ikan-ikan,sehingga mereka akan baru menyentuh tali atau pemberatnya kalau sudah merasa lapar. Tetapi kalau sudah merasa cukup kenyang mereka akan berhenti menyentuh tali atau pemberatnya, dengan demikian tidak ada atau sedikit sekali makanan yang jatuh tanpa dimanfaatkan oleh ikan.

Cara ini cukup menghemat tenaga, tetapi yang perlu diperhatikan adalah keamanan daripada alat tersebut dan isinya sendiri. Disamping itu, harus diperhatikan juga berapa berat beban dan kekuatan arus,sehingga tali atau pemberatnya tidak sampai tergerak oleh arus, yang berarti makanan jatuh tanpa diingini oleh ikan atau jatuh pada saat ikan tidak lapar.

Cara yang ke 2(dua) ini dapat juga dipergunakan pada karamba terendam keseluruhan. Kalau pada karamba terendam sebagian ujung saluran corong berada kurang lebih 5 cm diatas permukaan air, maka pada karamba terendam keseluruhan ujung saluran tersebut terendam sejauh ± 5 cm didalam air, untuk itu saluran harus cukup panjang.

Kita semua tentu sudah tahu bahwa setiap benda yang masuk kedalam air akan mendapat tekanan keatas oleh air sehingga ada beberapa macam benda yang tidak dapat langsung tenggelam. Misalnya pellet, pellet yang baik akan terapung dipermukaan air minimal selama 5 menit, dengan demikian ikan-ikan akan terlambat memperoleh makanan apa lagi kalau tekanan air berpengaruh terhadap kelangsungan tenggelamnya makanan tersebut.

Untuk meniadakan tekanan daripada air terhadap makanan yang dimasukkan kedalam corong, maka para pengusaha karamba didaerah Cianjur memasang sebuah atau dua buah pipa dikiri-kanan alat yang berbentuk corong tersebut. Dengan demikian tekanan air akan berkurang atau bahkan tidak ada sama sekali.

Panjang pipa, baik yang terbuat dari besi ataupun berupa bambu bulat disesuaikan dengan ketinggian permukaan air. Kalau karamba berada 20 cm dibawah permukaan air, maka panjang pipa yang dipasang minimal 30 cm, dengan demikian ujung pipa yang berada disebelah atas adalah sepanjang 5 cm dan ujung yang berada dalam karamba sepanjang 5 cm juga (Gambar 7).

(3). Lama pemeliharaan.

Lama pemeliharaan untuk ikan Jelawat ukuran konsumsi 4-6 bulan dengan ukuran awal 12-13 cm,untuk ikan Patin 6-15 bulan dengan ukuran awal 12-15 cm. Sedangkan lama pemeliharaan utuk induk ikan Jelawat selama ± 2 tahun, untuk induk ikan Patin selama 2-3 tahun.

(4). Pemungutan hasil.

Pemungutan hasil atau panen ikan, ialah mengambil ikan-ikan yang dipelihara sesudah 1(satu) periode pemeliharaan berakhir.

Pemungutan hasil untuk setiap jenis ikan berbeda-beda, ini tergantung pada besar benih yang ditebarkan dan kecepatan pertumbuhannya. Ikan Jelawat dan Patin dapat dipanen sesudah dipelihara selama 4-6 bulan (ikan Jelawat) dan 6-12 bulan (ikan Patin).
Pada prinsifnya panen dilakukan kalau ikan sudah mencapaiukuran yang cukup menguntungkan jika dipasarkan. Panen dilakukan terhadap ikan-ikan yang sudah berukuran besar saja, sedangkan ikan-ikan yang masih kecil di tinggal untuk dipelihara lebih lanjut.

Pemungutan hasil ikan-ikan yang dipelihara dalam karamba dapat dilakukan dengan beberapa cara, hal ini tergantung kepada jenis dan ukuran karamba.

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a. Pemungutan hasil pada karamba terendam keseluruhan.

Karamba terendam keseluruhan merupakan karamba yang tertanam pada dasar perairan dan sisi atasnya (pntunya) berada di bawah permukaan air, terutama pada musim kemarau, dimana permukaan air lebih rendah daripada pintu karamba. Dengan demikian pemungutan hasil ikan dapat dilakukan dengan mudah dan kemungkinan hilangnya ikan yang lepas sewaktu ditangkap semakin kecil, karena air sudah agak dangkal.

Karena keadaannya demikian, maka penebaran hedaknya dilakukan pada awal atau pertengahan musim penghujan, sehingga panen dapat dilakukan bersamaan dengan datangnya musim kemarau atau menjelang berakhirnya musim kemarau.

Ikan-ikan diambil dengan mempergunakan serok atau seser (Gambar 8), yakni dengan cara di ciduk. Kemudian ikan-ikan tersebut dimasukkan kedalam keranjang untuk dibawa ketempat-tempat pemasaran.

Jika air saluran masih cukup dalam dan ikan dapat hidup, maka ikan-ikan yang belum mencapai ukuran yang diinginkan hendaknya dilepas kembali untuk dipelihara lebih lanjut sampai mencapai ukuran yang di inginkan.

Pemungutan harus dilakukan dengan hati-hati agar ikan yang masih kecil tidak terganggu atau bahkan mendapat luka-luka yang dapat mengakibatkan ikan-ikan tersebut mati.

b. Pemungutan hasil pada karamba terendam sebagian.

Pada karamba terendam sebagian,panen dapat dilakukan dengan mengangkat karamba atau dengan menciduk ikan yang terdapat di dalamnya.

Jika karamba berukuran relatif kecil serta di-diserta dipasang secara seri pada pelampung atau dikaitkan pada tonggak, panen dapat dilakukan dengan mengangkat karamba.

Panen dengan cara ini dapat dilakukan sbb :

(i) Mengangkat karamba sedemikian rupa sehingga ikan terkumpul pada salah satu sudut yang masih digenangi air, kemudian ikan-ikan di ciduk dengan serok atau seser.

(ii) Karamba diangkat atau dikeluarkan dari air serta dibawa ketepi, kemudian ikan-ikan di pungut dengan tangan.

Cara yang kedua ini baru dapat digunakan kalau kita tahu secara pasti bahwa ikan yang dipelihara sudah mencapai ukuran yang kita inginkan.Jika tidak tahu atau terdapat ikan-ikan yang belum mencapai ukuran yang diinginkan, maka panen jangan dilakukan dengan cara ini.

Pemungutan ikan pada karamba yang berukuran besar dan yang dibangun dibawah jamban atau rumah diatas rakit (lanting) dilakukan dengan mempergunakan serok yang agak besar. Selain itu dapat juga dilakukan dengan jalan memasang jaring (gill net) di dalam karamba. Ukuran mata jaring hendaknya disesuaikan dengan ukuran ikan yang di inginkan, dengan demikian ikan-ikan yang masih kecil tidak akan tersangkut pada jaring.

Kalau jaring telah terpasang, air pada salah satu sisi karamba dikacau-kacaukan sehingga ikan-ikan akan berenang secara membabi buta menuju kesisi lainnya dan akhirnya terjerat pada jaring. Karena ukuran mata jaring hanya ditujukan untuk ikan-ikan yang berukuran besar saja, ikan-ikan yang berukuran kecil akan lolos, dengan demikian dapat dipelihara lebih lanjut guna mencapai ukuran yang telah ditentukan.

c. Pemungutan hasil pada karamba pagar.

Untuk karamba pagar, panen sebaiknya dilakukan pada saat air surut, dengan demikian luas perairan didalam pagar akan berkurang, yang berarti penangkapan akan lebih mudah.

Peralatan yang diperlukan untuk menangkap ikan adalah hampang dan serok.Pertama-tama ikan digiring dengan hampang ke salah satu sudut karamba pagar yang airnya dangkal.Kalau ikan-ikan sudah terkumpul ruangan yang dibentuk dengan hampang di persempit dengan menggeser hampang ke arah dalam. Pekerjaan ini dilakukan sampai ruangan tersebut cukup sempit, kemudian ikan-ikan diciduk dengan serok. Kalau ikan ikan sudah banyak yang tertangkap atau hanya yang kecil-kecil saja, secepatnya hampang dibuka kembali dan diangkat sehingga ikan-ikan yang tertinggal dapat membebaskan diri agar dapat dipelihara kembali hingga tiba saatnya untuk dipanen.

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VI. KOMPOSISI DAN BAHAN MAKANAN

1. Bahan makanan

Dalam proses metabolisme ikan memerlukan energi. Energi tersebut diperoleh dari makanan yang diterima, sedangkan sumber makanan dapat berasal dari alami(Natural Food) dan dapat pula berasal dari makanan yang diberikan oleh manusia (Supplementary Food).

Makanan alami yang terdapat dalam wadah pemeliharaan ikan sangat terbatas jumlahnya. Agar produktivitas makanan alami dalam suatu wadah pemeliharaan meningkat maka perlu dilakukan pemupukan dengan dosis tertentu secara berkala, sebagai contoh pupuk kandang 160-200 kg/1.500 m^2.

Apabila persediaan makanan alami tidak mencukupi untuk proses pertumbuhan, maka harus diberikan makanan tambahan dari luar.

Salah satu faktor penentu keberhasilan budidaya ikan adalah tersedianya makanan yang sesuai dengan ukuran dan sifat ikan. Pada umumnya makanan ikan dapat digolongkan menurut bentuknya ada 3(tiga) macam yaitu :

(a). Mixture powder

Makanan ini diberikan untuk ikan kecil dan larva. Biasanya makanan ini tersusun lebih dari satu bahan makanan dimana komposisinya ditentukan oleh kebiasaan makan (food habit). bahan-bahan makanan tersebut diaduk sehingga tercampur sampai homogen dan siap diberikan pada ikan.

\\(\\).

(b). Gumpalan

Makanan ini cocok diberikan kepada ikan yang berenang didasar perairan, misalnya ikan Patin (*Pangasius pangasius*) atau untuk usaha budidaya yang tidak bersifat komersil dan terbatas fasilitasnya serta yang mempunyai sedikit tenaga kerja. Bahan-bahan makanan yang telah ditentukan dan mempunyai kualitas yang baik dicampur hingga merata, lalu dimasak sampai berbentuk gumpalan dan siap untuk diberikan pada ikan. Keuntungan bentuk makanan ini yaitu dapat tahan lama didalam air dan tidak cepat hanyut oleh arus.

(c). Pellet

Makanan ini baik digunakan untuk usaha budidaya ikan secara komersil, dimana diperlukan makanan dalam jumlah banyak dan umumnya diberikan pada ikan pelagis. Bahan-bahan makanan yang telah ditentukan dicampur merata lalu ditambahkan secukupnya suatu zat yang dapat berfungsi sebagai perekat. Adonan bahan tersebut lalu dicetak menjadi bentuk tablet (pellet) kemudian dikeringkan dan siap diberikan pada ikan.

2. Makanan tambahan

Oleh karena stock makanan alami tidak mencukupi kebutuhan proses untuk pertumbuhan, maka harus diberikan makanan tambahan dari luar.

Makanan tambahan dapat dibagi menjadi 2(dua) bagian :

(a). Makanan lengkap

Makanan lengkap ialah makanan yang mengandung zat protein, harbohidrat, lemak, vitamin dan mineral. Pemberaian makanan lengkap ini cocok untuk diterapkan pada usaha pemeliharaan ikan secara komersil dan intensif yang memproduksi ikan ukuran konsumsi dalam waktu singkat. Pada makanan lengkap kandungan protein dalam bahan makanan untuk setiap jenis ikan berlainan, misalnya untuk ikan herbivora 18-20%.

(b). Makanan tidak lengkap

Makanan tidak lengkap umumnya berupa limbah pasar, limbah rumah tangga, sayur-sayuran dsb. Makanan tidak lengkap sangat cocok digunakan pada pola pengusahaan ikan secara ekstensif, karena pengusahaan ikan secara ekstensif memerlukan waktu yang cukup lama bila dibandingkan dengan pengusahaan ikan secara intensif.

Komposisi bahan makanan yang akan disusun, sebelumnya harus disesuaikan dengan sifat ikan. Sebagai contoh, untuk ikan herbivora komposisi makanan ditekankan pada bahan makanan yang banyak mengandung protein nabati, sebaliknya untuk ikan carnivora dalam bahan makanan perlu banyak mengandung protein hewani.

Untuk menentukan bahan-bahan makanan yang akan diberikan pada ikan tersebut harus diperhitungkan faktor ekonomis dan kemudahan untuk memperoleh bahan tersebut dalam jumlah yang banyak.

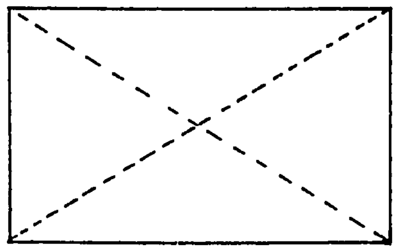
Untuk menentukan kandungan protein dalam makanan ikan dapat digunakan methoda square. Langkah-langkah yang perlu diperhatikan dalam methoda square adalah sebagai berikut :

1. Tentukan kandungan protein dalam makanan yang diinginkan.
2. Tentukan bahan makanan yang akan digunakan dan berapa kandungan proteinnya.
3. Buat empat persegi panjang, simpan kandungan protein makanan dibagian tengah dan bahan makanan pada pojok kanan atas dan bawah.
4. Kurangkan kandungan protein dalam makanan dengan kandungan protein bahan makanan, simpan pada pojok kiri atas dan bawah.
5. Jumlahkan hasil pengurangan tersebut dan buat persentasenya.
6. Komposisi bahan makanan siap digunakan.

Contoh :

Akan membuat pellet dengan kandungan protein 27% yang tersusun dari 2(dua) macam bahan yaitu dedak dan kacang kedelai. Berapa persen (%) dedak dan kedelai harus digunakan.........?.

<u>Cara menghitung sebagai berikut</u> :



Dedak mengandung protein 8,2 dan kedelai 44.

Komposisi dari pellet tersebut :

- dedak = 27 - 8,2 = 18,8 (pojok kanan bawah).
- kedelai = 44 = 27 = 17 (pojok kanan atas).

Jumlah = 35,8

Persentase dedak = $\frac{17}{35,8}$ x 100% = 47,5%

Persentase tepung kedelai = $\frac{18,8}{35,8}$ x 100% = 52,5%

Untuk memeriksa persentase yang akan digunakan betul sebesar angka tersebut diatas yaitu :

- dedak = 47,5% $\frac{8,2 \times 47,5}{100}$ = 3,895%
- tepung kedele = 52,5% $\frac{44 \times 52,5}{100}$ ≒ 23,1 %

Jumlah = 26,995%

= <u>27%</u>

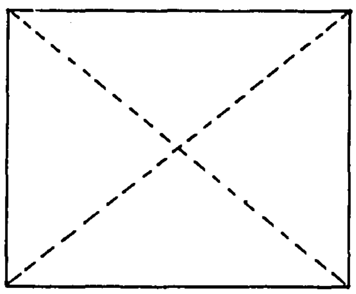
<u>Contoh 2</u> :

Akan dibuat pellet dengan kandungan protein 22% yang komposisinya terdiri dari : fish meal 1 bagian, shrimp meal 1 bagian, rice bran 2 bagian dan broken rice 1 bagian. Berapa persen (%) bahan-bahan tersebut harus digunakan ?.

- rice bran = 2 bagian) = I
- broken rice = 1 bagian)

fish meal) = II
shrimp meal)

Bahan-bahan tersebut dikelompokan kedalam 2(dua) kelompok yaitu : Protein hewani dan protein nabati.



- rice bran kandungan crude proteinnya = 12,7%
- broken rice, crude protein = 9,6%
- rice bran = 2 x 12,7 = 25,4

  broken rice = 1 x 9,6 = 9,6

  35

Kandungan crude protein dari campuran broken rice dan rice bran, = 35 : 3 = 11,6

Kandungan crude protein fish meal = 61,5

Kandungan crude protein shrimp meal = 44,8

- Fish meal = 1 x 61,5 = 61,5
- Shrimp meal = 1 x 44,8 = 44,8 +

  106,3

- Kandungan crude protein dari campuran fish meal dan shrimp meal = 106,3 : 2 = 53,15

Komposisi crude protein dari campuran I

(rice bran + broken rice) = 22 - 11,6 = 10,34

(pojok kanan bawah).

Komposisi crude protein dari campuran II

(fish meal + shrimp meal) = 53,15 - 22 = 31,15

(pojok kanan atas).

$$\begin{array}{lrl} \text{I.} & 22 - 11{,}6 & = 10{,}34 \\ \text{II.} & 53{,}15 - 22 & = \underline{31{,}15\ +} \\ & & = 41{,}49 \end{array}$$

Prosentase dari protein nabati (I) = $\frac{31,15}{41,49}$x100% =74,97%

Prosentase dari protein hewani (II) = $\frac{10,34}{41,49}$x100% =25,03%

- Prosentase dari rice bran = 1/3 x 74,97% = 24,99%
- Prosentase dari broken rice = 2/3 x 74,97% = 49,98%
- Prosentase dari fish meal = 1/2 x 25,03% = 12,515%
- Prosentase dari shrimp meal = 1/2 x 25,03% = 12,515%

\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\

3. Proses pembuatan makanan tambahan.

3.1. Cara pembuatan pellet.

(a). Persiapan.

- Tentukan komposisi dan beratnya pellet yang akan di buat.
- Siapkan bahan dan alat yang diperlukan.

(b). Bahan.
- dedak halus
- tepung ikan
- tepung kacang kedele
- bungkil kelapa halus
- consentrat*)
- vitamin/mineral

*)makanan ayam yang merupakan campuran protein, lemak, karbohidrat, dan mineral.

Alat
- tampah
- tikar
- waskom
- timbangan
- mesin pencetak

(c). Proses kerja.

- Bahan-bahan yang telah ditentukan sesuai dengan komposisinya di timbang satu persatu.
- Aduklah bahan tersebut dimulai dari jumlah bahan yang kecil (yang paling sedikit kemudian dilanjutkan dengan bahan yang lebih banyak agar bahan bahan tersebut tercampur merata.
- Bahan-bahan tersebut disimpan dalam waskom dan ditambah air sedikit demi sedikit hingga berbentuk adonan.
- Adonan siap dicetak dengan menggunakan mesin pencetak berupa gilingan daging No.32 yang digerakan oleh mesin 3 PK kemudian adonan dimasukan sedikit demi sedikit dan hasil cetakan ditampung dalam tampah.

- Pellet yang masih basah dikeringkan dengan panas matahari.
- Pellet kering disimpan dalam ember yang kering dan pada suhu kamar.

3.2. Cara pembuatan makanan gumpalan (Boiled Food) untuk induk ikan Patin.

Bahan-bahan dan alat yang diperlukan.

(a). Bahan-bahan

- dedak
- menir (beras hancur)
- ampas tahu
- tepung ikan
- sayuran

(b). Alat-alat

- kuali besar
- pengaduk
- baskom
- air
- kayu bakar

Cara pembuatan

- bahan-bahan makanan tersebut ditimbang dahulu disesuaikan dengan komposisi yang diperlukan :

dedak diambil.............	20%
menir diambil.............	25%
ampas tahu................	20%
vegetable.................	15%

- Menir dimasukan kedalam kuali yang berisi air lalu dipanaskan;
- Terus diaduk sampai merata (homogen), setelah rata betul maka campuran lain/bahan lain dimasukan kedalam kuali. Setiap kali memasukan bahan-bahan makanan itu kedalam kuali maka bahan-bahan tersebut harus selalu diaduk rata;
- Setelah bahan-bahan makanan tersebut dimasukan semua, maka terus diaduk sampai betul-betul homogen, selanjutnya didinginkan beberapa saat dan sudah siap untuk diberikan pada ikan.

VII. PENANGANAN IKAN.

Pengertian penanganan ikan adalah suatu usaha bagaimana caranya agar ikan tetap hidup melalui perlakukan tertentu. Umumnya penanganan ini dikaitkan dengan pengangkutan ikan hidup dari suatu tempat ketempat yang lain dengan memperhatikan faktor survival dan ekonomisnya.

Langkah-langkah yang perlu dilakukan dalam penanganan ikan adalah sebagai berikut :

(1). Perencanaan

Segi perencanaan mempengaruhi hasil yang akan dicapai. Oleh karena itu perencanaan penanganan ikan harus tepat dan faktor-faktor yang perlu mendapatkan perhatian yaitu :

- species ikan
- ukuran ikan
- wadah tempat mengangkut
- lama pengangkutan
- jumlah dan kepadatannya ikan yang akan diangkut.

Sebagai contoh sebagai berikut :

Bila kita akan mengangkut ikan Patin ukuran 1(satu) inchi dengan menggunakan jerigen plastik tanpa oksigen dapat diisi ikan 200-300 ekor per 4-6 liter air untuk selama 3 - 12 jam perjalanan.

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(2). Persiapan

Sebelum ikan diangkut ketempat yang jauh harus dilakukan pemberokan selama 1 - 7 hari dalam suatu wadah sampai isi perut ikan kosong, tetapi bila jaraknya dekat tidak perlu dilakukan pemberokan lebih dahulu. Pemberokan tersebut dilakukan untuk mencegah cepatnya terjadi populasi pada air karena dapat menyebabkan kematian ikan. Selama masa pemberokan air harus ditukar setiap hari. Untuk mencegah berkembangnya bakteri didalam air tersebut perlu diberi obat anti biotika seperti Methylene Blue, $KMNO_4$,selama tiga hari pada dosis 0,1 ppm.

(3). A i r.

Syarat air yang digunakan harus bersih dan jernih serta mempunyai kwalitas baik. Apabila digunakan air limbah, perlu disaring dahulu, sedangkan bila menggunakan air ledeng harus diendapkan selama 2(dua) hari untuk menetralisir chlorine yang terkandung didalamnya. Air yang berasal dari perairan umum tidak baik digunakan karena banyak mengandung plankton sebab plankton tersebut dalam wadah pengangkut akan mudah mati sehingga dapat mencemarkan air.

(4). Tindakan

Tindakan yang akan dikenakan pada pengangkutan ikan berkaitan langsung dengan faktor ekonomis. Misalnya bila kita akan mengangkut ikan yang mempunyai alat pernapasan tambahan tidak memerlukan banyak air

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bila dibandingkan dengan ikan lainnya.

Umumnya perbandingan air dengan udara yang digunakan adalah 1 : 3, dan bila menggunakan kantong plastik haruslah dibuat rangkap supaya tidak mudah sobek /bocor.

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VIII. TEHNIK PENGANGKUTAN

Pada dasarnya pengangkutan berarti mengangkut benih/ induk dari satu tempat ketempat lain dalam jumlah besar secara tehnis mudah dilaksanakan dan secara ekonomis menguntungkan. Dengan suatu tehnik pengangkutan yang khusus maka benih/induk dapat sempat ketempat tujuan dalam keadaan sehat dengan tanpa banyak kematian.

Besarnya kematian menjadi ukuran keberhasilan dari suatu pengangkutan dimana angka kematian tidak melebihi 10%. Kematian yang terjadi dalam pengangkutan dapat disebabkan oleh faktor fisik dan biologis. Faktor fisik seperti suhu dan oksigen. Sedangkan faktor biologis terutama disebabkan oleh adanya sifat kanibalisme pada ikan Patin.Biasanya kanibalisme tumbuh setelah makanan habis atau terlalu padat.

Pengangkutan benih atau induk ikan dapat dilakukan dengan 2(dua) cara yaitu :

(a). Cara terbuka.

Alat yang digunakan adalah ember, jerigen terbuka, waluhan dsb. Dalam hal ini tidak perlu menambah dengan oksigen murni dan ikan dapat bernafas dengan menggunakan oksigen yang terlarut dalam air.

Karena permukaan air masih berhubungan dengan udara bebas, dan proses diffusi oksigen tidak terganggu maka kelarutan oksigen dalam air relatif besar. Proses diffusi akan lebih sempurna apabila diberikan aerasi sehingga diffusi oksigen tidak hanya terjadi dipermukaan air tetapi semua

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bagian air yang bersinggungan dengan gelombang udara. Cara pengangkutan terbuka dengan menggunakan aerasi ini sangat baik karena tidak hanya memberikan oksigen yang cukup tetapi juga memberikan aliran air. Pada pengangkutan dengan menggunakan ember atau waluhan mempunyai kemungkinan tumbuh, sehingga hanya dipergunakan mengangkut pada jarak dekat.

(b). Cara tertutup.

Pengangkutan cara ini menggunakan kantong plastik atau jerigen tertutup. Kantong plastik dengan tebal 0,02-0,05 mm cukup buat untuk diisi 10-15 liter dan cukup lunak untuk diikat erat. Pada cara tertutup harus ditambahkan oksigen murni, sehingga oksigen yang terlarut dalam air mencukupi untuk kebutuhan pernafasan.

Cara ini lebih mudah, dapat untuk mengangkut yang lebih lama dan tanpa resiko tumpah. Meskipun demikian perlu dihindari terjadinya kebocoran yaitu dengan mempergunakan kantong rangkap atau membungkus kantong plastik dengan karton atau karung goni. Apabila menggunakan jerigen tertutup maka kemungkinan pecah diperkecil tetapi mempunyai kesulitan pada waktu pengisian dan pembongkaran. Disamping itu sering terjadi kebocoran pada bagian tutup jerigen atau pada sambungan pipa pengisi oksigen.

(1). <u>Pengangkutan telur ikan</u>.

Tidak semua telur ikan dapat diangkut dalam jangka waktu lama. Telur-telur ikan yang sifatnya lunak dengan lapisan luar yang lebar dapat dilakukan pengangkutan dengan jangka waktu antara 1 - 1,5 jam.

Sedangkan jenis telur ikan yang keras dengan kulit-kulitnya yang tebal dan lapisan luar yang sempit dapat di-angkut dengan jangka waktu agak lama (± 1 hari). Stadia yang paling tidak cocok pada waktu pengangkutan adalah morula dan blastula. Telur dapat juga diangkut dalam jumlah kecil apa-bila telur tersebut ditempatkan dikantong plastik dengan di-beri oksigen.

(2). Pengangkutan kabul/burayak.

Pengangkutan kabul burayak biasa dilaksanakan dari pem-benihan kekolam pembesaran. Kabul burayak sebelum diangkut di laparkan dulu,dan sebagai wadah pengangkutan biasanya kantong plastik dengan diberi oksigen dengan kepadatan 5.000-8.000 larva/kantong plastik yang berisi air 5-7 liter dan oksigen 15-20 liter. Kebul/burayak yang sehat tidak terpengaruh oleh goncangan suhu dalam wadahsebaiknya/diusahakan sama dengan suhu dimana kabul/burayak itu berasal. Memasukkan kabul /burayak kedalam wadah harus hati-hati, setelah itu wadah di-isi penuh dengan air dan ditutup sepotong karet yang terbuat dari busa stella dipasang sekeliling tepi tutup wadah itu, untuk menjaga agar wadah tetap berisi air. Kemudian sebuah selang sepanjang 10-15 cm dengan diameter 1-2 cm dimasukkan kedalam suatu lubang pada tutup dari wadah itu.
Hal ini dimaksudkan agar kelebihan oksigen yang tertekan bisa keluar.

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Kira-kira 100.000 burayak yang sudah dilaparkan dapat di angkut didalam 100 liter air ini berarti bahwa 2 juta burayak dapat diangkut didalam wadah yang berukuran 2 m^3. Akan lebih baik apabila wadah itu ditutup dengan kesed yang basah/ rumput. Untuk didaerah tropis wadah yang digunakan harus di-isolasi sebagian atau keseluruhannya untuk menjaga agar suhu air didalam wadah tidak mengalami kenaikan.

Benih yang berumur 3-4 minggu dapat diangkut di dalam kantong plastik kira-kira sebanyak 500-2.000 ekor diangkut didalam satu kantong plastik. Jumlah benih yang dimasukkan kedalam kantong plastik tergantung dari ukuran benih dan lamanya pengangkutan.

(3). Pengangkutan induk.

Dalam hal pengangkutan induk ikan ini akan lebih rumit dalam operasinya induk-induk ikan itu harus dibius terlebih dahulu sebelum diangkut hal ini untuk menghindari benturan baik antara induk dengan induk maupun dengan dinding yang mengakibatkan terjadinya luka pada induk ikan tersebut. Suatu metoda yang paling murah untuk membius dengan mempergunakan air dingin (5 - 10°C) sebagai medium selama pengangkutan. Namun metoda ini tidak dapat digunakan untuk semua jenis ikan dan tentunya metoda ini belum tentu bisa diterapkan didaerah subtropis dan tropis.

Apabila air angin itu tidak bisa dipakai maka obat bius harus dipergunakan. Ada beberapa jenis ikan yang tidak tahan obat bius dosis tinggi, dengan daya bius lebih dari 1 jam.

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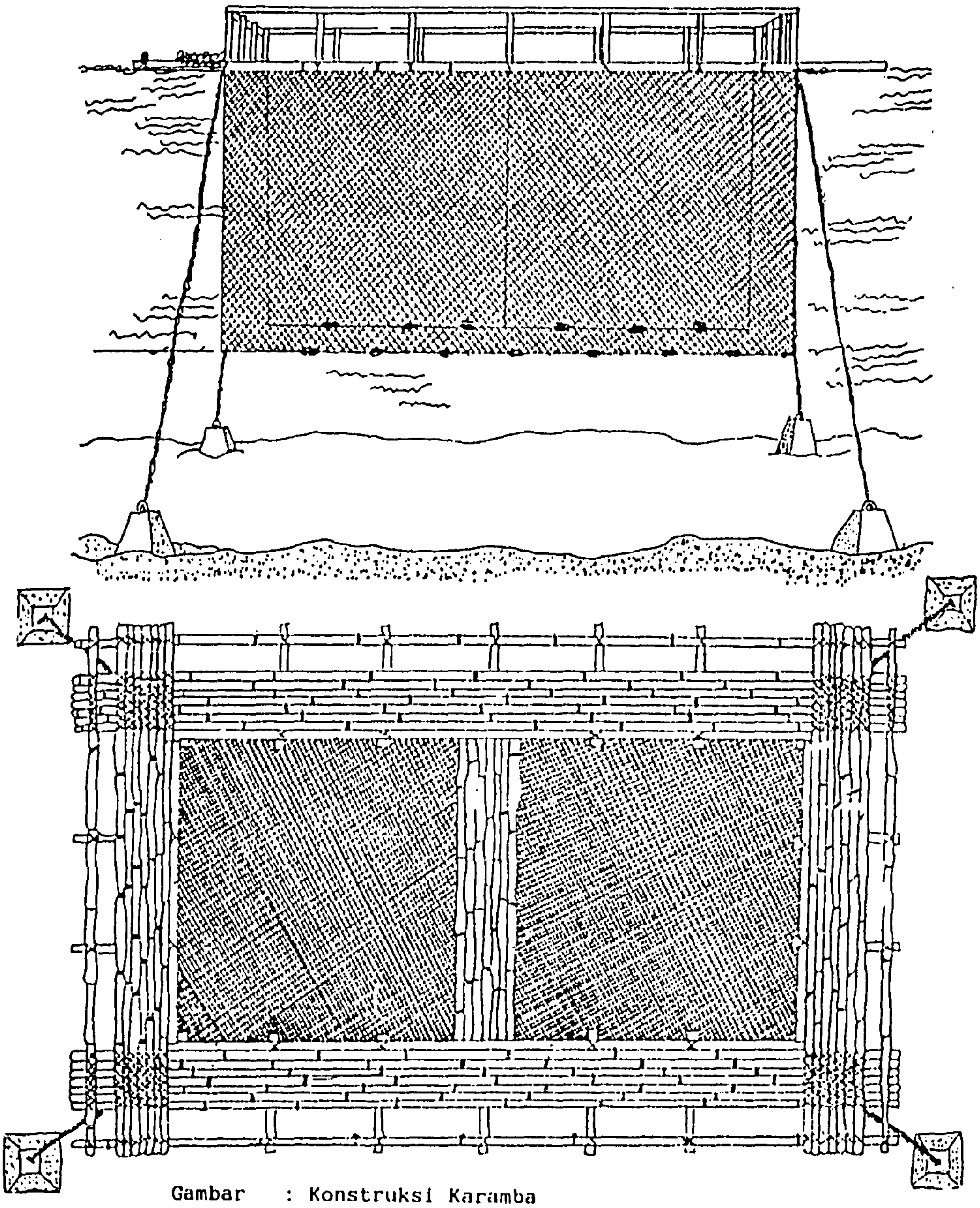
Prosedur pembiusan induk sebelum diangkat adalah sebagai berikut :

Mula-mula induk ikan dimasukkan kedalam larutan MS.222 dengan dosis tinggi (5 gr MS.222 didalam 100 liter air) atau 1 : 20.000 yang akan segera melemaskan induk-induk itu. Setelah 15-20 menit apabila induk ikan tersebut telah betul betul terbius larutan itu dicairkan lagi dengan menambahkan sejumlah air yang bergantung pada daya tahan ikan tersebut.

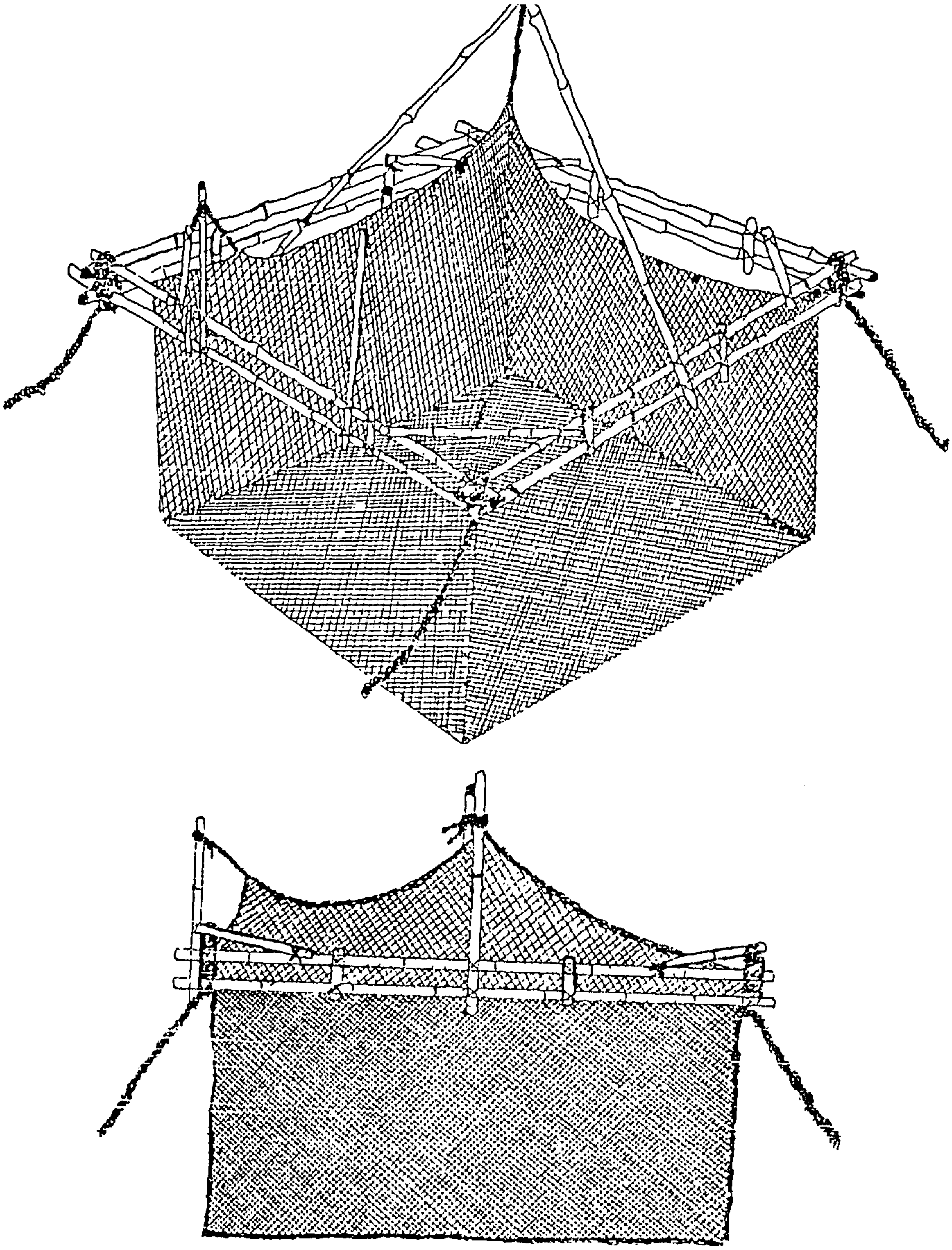
Untuk jenis ikan yang mempunyai daya tahan tinggi seperti common crap dan big head, maka larutan MS.222 yang digunakan harus perbandingannya lebih besar (1 : 40.000).

Dalam hal pengangkutan yang memakan waktu lebih lama maka air didalam wadah tersebut harus diberi oksigen dan suhu harus dengan seksama dijaga jangan sampai naik diatas 20°C. Suhu yang terbaik untuk pengangkutan didaerah tropis antara 20 - 24°C.

Untuk jenis induk yang kecil dapat diangkut dalam keadaan terbius, sejumlah 1 atau 2 ekor yang dimasukan dalam kantong plastik dan diberi oksigen. Untuk jenis ikan yang mempunyai sirip-sirip yang tajam seyogyanya sirip-sirip tersebut dipotong terlebih dahulu untuk menjaga agar sirip tersebut tidak merobek kantong plastik.



Gambar : Konstruksi Karamba



Gambar : Konstruksi Pen

ANNEX E

TRIP REPORT ON COMPARATIVE STUDY
TO THAILAND AND SINGAPORE

Project No.TA.497-0286 Contract No. AID 497-0286-S-00-4062-0

Trip Report

To : Thailand and Singapore

Purpose of Trip : Coordinated a comparative study tour programme to fish farmers on Aquaculture Techniques.

Date of travel : May 3 - 25, 1985

Reported by : Samruay Meenakarn and Dr Josephine Wiryanti

A comparative study tour was conducted during the period of May 3 - 25, 1985 to Thailand and Singapore and was participated by 25 people consisted of fisheries personnel and fishfarmers from different provinces. The list of participants appears as Annex 1.

The participants were scheduled to observe entire course of aquaculture activities comprised induced breeding practices, hatchery, nursery, rearing, marketing technique for commercial operation and economics analyses, of different species. The itinerary of study tour appears as Annex 2.

1. Induced breeding practices.

Practicals on induced breeding were given to the participants of different species such as Pangasius sutchi, Punctius gonionotus and Labeo bicolor. Hormon of HCG (Human Chorio Gonadotropin) was provided and pituitary glands of chinese carp and Pangasius sucthi were used for donor. Practical materials i.e. brooders, chemicals/solutions and donors were purchased, while tools and equipments were also provided.

The participants were able to closely observe each step of breeding procedure i.e. selection of spawners, collection of pituitary glands, dosing practice, injection technique, stripping, spawning/fertilization, hatchery, nursery and larva rearing etc.

2. Hatcheries.

Macrobrachium hatcheries owned by private-venture and government in Ban Ba Kong, located 40 km north west of Bangkok, were visited. We travelled north-ward, stopped at Bangken to observe hatchery of Clarias bathracus which naturally spawned in pond. We then continue travelling up north to Nakornsawan, about 200 km from Bangkok to visit the Khong Krieng Koi private hatchery of Pangasius sutchi, which located along the bank of Nang river.

3. Fish Culture.

Different pond and cage cultures of fish species were observed such as Pangasius sutchi, Clarias bathracus, Punctius gonionotus, Trichogaster pectoralis, Ophiocephalus striatus, Macrobrachium and Ornamental Fish. Different systems of culture were compared :

(a). Monoculture system was applied to Clarias bathracus, Punctius gonionotus, Pangasius sutchi, Ophiocephalus striatus, Sand goby and Clarias macrocephalus

(b). Polyculture system was applied to Trichogaster pactroralis, Ophiocephalus striatus and Anabas tertudineus (Betok).

(c). Integrated fish culture.

A number of species were integrated with poultry or pig. Those species comprised. Tilapia, Pangasius sutchi, Punctius gonionotus, Clarias bathracus, Chinese carp and silver carp. Feeding was originated from the waste and supplemented with market waste and pellet.

(d).. Ornamental Fish.

Hatchery and rearing of ornamental fish in Thailand owned by private-venture were visited. There were 300 species reared and ready for export market, to Srilangka, Germany, Brazil, USA and Indonesia etc.

In Singapore, the participants had an apportunity to visit culture of ornamental fish owned by different fish farmers and also to abserve handling and packaging of fish prior to exportation.

(e). Macrobrachium culture.

Pond culture of macrobrachium was also visited.

Annex 1

LIST OF PARTICIPANTS
COMPARATIVE STUDY TO THAILAND
ON CAGE CULTURE ON THE MAY 2 THROUGH MAY 25, 1985

No.	Name	Occupation
1.	Dr. Josephine Wiryanti	DGF (Team Leader)
2.	Mr. Ubaidillah	GOI Counterpart from Jambi
3.	Mr. Zahrif. N.	GOI Counterpart from Palembang
4.	Ms. Elvita Nezon	DGF
5.	Mr. Sentot Wijaya	DGF
6.	Mr. Yorfatrik Nazda	DGF
7.	Mr. Thoken	CHief, Extension Service, PFS Jambi
8.	Mr. Tongku Karim	Fish farmer from Jambi
9.	Mr. Abdul Malik	Fish farmer from Jambi
10.	Mr. Amir	Fish farmer from Jambi
11.	Ms. Ngatimin	Fish farmer from Jambi
12.	Mrs. Mulyana Maria	Fish farmer from Palembang
13.	Mr. Hipni Saleh	Fish farmer from Palembang
14.	Mr. Ruspi	Fish farmer from Palembang
15.	Mr. Muhammad Daling	Fish farmer from Palembang
16.	Mr. Thoib	Fish farmer from Central Java
17.	Mr. Rabiman	Fish farmer from Yogyakarta
18.	Mr. Aryo Purwandoto	Fish farmer from West Nusa Tenggara
19.	Mr. Ali Amrin Koto	Fish farmer from West Sumatera
20.	Mr. Rifat Salmani	Fish farmer from East Kalimantan
21.	Mr. Junaedi	Fish farmer from Central Kalimantan
22.	Mr. Pepen Effendy	Fish farmer from West Java
23.	Mr. Sutrisno	Fish farmer from DKI
24.	Ms. Rosyida Setyawati *	DGF
25.	Mr. Mohamad Indah Ginting *	DGF

*) Starting 19 May 1985

Annex 2

TENTATIVE SCHEDULE FOR COMPARATIVE STUDY TOUR
FOR FISH FARMERS AND GOI OFFICIALS TO THAILAND

Sponsored by : USAID/Fishery, ARD Jakarta, Indonesia and Directorate General of Fisheries, Ministry of Agriculture Republic of Indonesia.

Duration : o/a May 3 - 25, 1985

DATE	PLACE TO BE VISITED AND ACTIVITIES
May 2	Meeting with Director General of Fisheries in Jakarta and paper work from USAID/Jakarta
May 3	Leave for Bangkok
May 4-6	Courtessy call to The Indonesian Embassy, Courtessy call to National Inland Fisheries Institute, Observed place of interest and observed facilities and orientation, overnight in Bangkok.
May 7	Observed Catfish Culture in pond at Suphanburi, overnight in Bangkok.
May 8	Observed Trichogaster at Samuthpragarn, overnight in Bangkok.
May 9	Polyculture and Integrated fish farm at Prathumtani and surrounding, overnight in Bangkok.
May 10-13	Observed and Practiced Induced Spawning at private fish farm in Bangkok. Among others - Pangasius Sutchi - Puntius Gonionotus - Ornamental Fish
May 14	Cage Culture at Utaitani and Nakornsawan (Pangasius Sutchi Oxyelotris) overnight at Nakornsawan.
May 15-18	Tak and Chiengmai Fisheries Station to observe fish breeding and larvae rearing (Puntius Gonionotus, Common Carp, Chinese Carp, Nilotica, overnight at Chiengmai.
May 19-20	Kwan Phayao Fisheries Station to observe Induced Spawning of Chinese Carp and Giant Catfish (Pangasius Gigas) and open water management.
May 20-23	Back to Bangkok and other NIFI Project, then proceed to Singapore
May 24	Singapore to observe ornamental fish breeding and culture
May 25	Back to Jakarta

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LAPORAN
STUDI PERBANDINGAN KE THAILAND DAN SINGAPURA
DALAM BIDANG AQUACULTURE

OLEH
PESERTA TRAINEES

DIREKTORAT BINA PRODUKSI
DIREKTORAT JENDERAL PERIKANAN
JAKARTA

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KATA PENGANTAR

Laporan ini disusun berdasarkan hasil study perbandingan (Comparative Study) ke Negara Thailand dan Singapura selama ± 23 hari dari tanggal 3 - 25 Mei 1985.

Keterbatasan waktu yang tersedia menyebabkan informasi yang didapat banyak kekurangan-kekurangan, namun kiranya laporan ini dapat merupakan bahan untuk memberi gambaran sejauh mana perkembangan perikanan khususnya budidaya perikanan di Indonesia yang telah dicapai maupun yang akan diterapkan dibandingkan dengan Negara lain.

Demikian laporan ini dibuat untuk dapat dipergunakan seperlunya.

Jakarta, Juli 1985,

Peserta Trainees

I. PENDAHULUAN.

Berdasarkan informasi dan literatur-literatur yang ada di Indonesia, bahwa di Negara Thailand usaha budidaya perikanan dan produksi yang dicapai lebih baik dibandingkan dari beberapa negara di Asia Tenggara.

Untuk itu, dalam rangka program Project Small Scale Fisheries Development Project bantuan USAID.ATA.497-0286 Tahun 1985/1986, dilaksanakan study perbandingan/study tour ke Negara Thailand selama 19 hari dari tanggal 3 - 23 Mei 1985 dan Negara Singapura selama 3 hari dari tanggal 23 - 25 Mei 1985 dengan jumlah peserta sebanyak 25 orang terdiri dari petani dan staff Direktorat Jenderal Perikanan.

Tujuan dari Comparative Study tersebut adalah untuk membandingkan cara-cara tehnik pemeliharaan jenis-jenis ikan yang ada di Negara Thailand dan ikan hias di Singapura dengan tehnologi yang telah diterapkan di Indonesia, selanjutnya untuk mempelajari kemungkinan yang dapat diterapkan di Indonesia dan mendorong minat petani-petani ikan untuk lebih meningkatkan usahanya dibanding perikanan khususnya budidaya perikanan.

Bidang perikanan yang ditinjau adalah pembenihan ikan (alami, hatchery dan induced breeding), budidaya perikanan dan aspek ekonomi secara umum, pada petani-petani ikan, perusahaan-perusahaan perikanan serta lembaga-lembaga perikanan.

Lembaga perikanan yang dikunjungi antara lain adalah NIFI (National Inland Fisheries Institut) diBangkok, Pembenihan Udang Galah di-Ban Pakong, Dinas Perikanan Propinsi Chiang Mai.

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Cabang perikanan budidaya terdiri dari perikanan di perairan umum (cage culture) dan budidaya ikan di kolam secara monoculture, polyculture dan Integrated Farm.

II. PEMBENIHAN.

1. Pembenihan Udang Galah di Ban Pa Kong.

Pembenihan Udang Galah di Ban Pa Kong terletak ± 40 km dari Bangkok kearah Barat Laut. Lokasi yang dikunjungi adalah milik pemerintah dan perorangan/swasta. Kapasitas pembenihan ± 200.000.000 larva/tahun, jumlah bak-bak larva 40 buah ukuran 10 x 5 x 1 m luas tanah keseluruhan 15 ha.

Pemanenan dilakukan sekitar 3 minggu dari bak-bak. Dalam 15 bak setiap tahun dapat dihasilkan ± 20.000.000 ekor benur dengan umur kira kira 1,5 bulan. Survival rate rata-rata ± 50%. Setiap tahun dibutuhkan induk sebanyak ± 1.000 ekor/tahun. Induk-induk berasal dari perairan umum sekitar Ban Pa Kong.

Jenis penyakit yang pernah diketahui disini adalah jamur. Untuk menjaga kwalitas air diperlukan temperatur 27 - 31°C.

Makanan tambahan yang dipakai adalah Artemia,dengan dosis ± 5 naupli /larva/hari, Hatching rate Artemia 38 - 50%.Selain itu juga dikultur Chlorella sp. Pellet dalam bentuk powder juga diberikan dengan dosis 5% dari berat badan.

Air laut diambil dari laut sejauh ± 5 km dari Ban Pa Kong.

Sumber air tawar dipompa dari sungai sekitarnya dan dari dalam tanah (sumur).

Transportasi benih dengan menggunakan plastik yang diberi oksigen. Selama itu tidak ada keluhan dari konsumen sehubungan dengan transportasi.

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Pada peninjauan dihatchery Udang Galah milik swasta, fasilitas yang dimiliki lebih kecil dari pada milik pemerintah. Peninjauan dihatchery milik Mr. Attawan, dapat memproduksi 500.000 ekor/bulan. Panenan dilakukan setelah berumur 1 - 2 bulan. Luas pemilikan tanah 1 ray (1/6 ha). Luas yang dimiliki berukuran 2 x 6 x 1 m sebanyak 15 buah, disamping bak induk dan lainnya berkapasitas total ± 300 m^3 terdiri dari 9 bak.

Pembahasan.

Produksi benur milik pemerintah dalam 1 tahun sebanyak 20 juta benur yang dikultur dalam 15 bak. Bila terdapat 40 bak larva, maka dalam berproduksi penuh dapat menghasilkan ± 55 juta benur/tahun.

Produksi benur milik swasta dapat berproduksi 500.000 ekor/benur/bulan, dengan demikian setiap tahun dapat menghasilkan benur sebanyak ± 6 juta benur/tahun. Pada hatchery swasta bila melihat fasilitas yang ada maka hatchery ini diperkirakan mempunyai kapasitas ± 30 juta benur/tahun. Sedangkan hatchery milik pemerintah bila berproduksi penuh baru mencapai 55 juta benur/tahun. Dengan demikian produksi dari hatchery-hatchery disini belum mencapai target/kapasitas produksi.

Produksi benur (Udang Galah) dapat berjalan dikarenakan Udang Galah sudah banyak dipelihara dalam arti dapat diterima masyarakat umum. Sedangkan di Indonesia belum begitu memasyarakat, walaupun hatchery-hatchery Udang Galah di Indonesia juga telah berproduksi yang relatip sama dengan tehnologi yang dipakai di Thailand.

Kesimpulan.

- Produksi benur di Thailand baik dari pemerintah/swasta masih berada dibawah kapasitas produksi dari masing-masing keadaan hatchery
- Untuk mengetahui sebab-sebab belum tercapainya terget tersebut perlu dicari sebab-sebab yang lebih terperinci dan teliti.
- Tingkat tehnologi pembenihan Udang Galah di Indonesia tidak lebih rendah dari pada Thailand.
- Udang Galah di Thailand sudah dapat diterima masyarakat sehingga banyak yang memelihara dikolam-kolam.

2. Pemijahan Lele di Bangkeu.

Lokasi pemijahan Lele berada ± 25 km dari Bangkok kearah Utara. Usaha pemijahan Lele ini adalah usaha milik swasta. Pemijahan yang dilakukan adalah pemijahan secara alami, dengan menggunakan areal seluas 0,5 ha. Kolam disini menggunakan air secara tergenang (stagnant water).

Induk dipelihara dalam kolam dengan kedalaman air 1 - 1,5 m; kolam tidak dipupuk. Induk diberi makanan trace fish sebanyak 10% dari berat badan. Trace fish dibuat dalam bentuk pellet. Pemberian makanan dilakukan 2 kali dalam sehari. Untuk fingerling diberi makan tepung pellet dengan protein tinggi. Induk yang dipelihara sebanyak 600 kg, campur jantan dan betina, diperkirakan perbandingan jantan dan betina 1 : 1. Induk disini memijah selama 20 hari sekali. Pemijahan tidak serentak. Produksi selama ± 22 hari menghasilkan ± 2.000.000 fry . Setelah memijah diberi makanan trace fish. Pada waktu pengeringan kolam pemijahan, induk masuk saluran kanal, kemudian diberi makan selama 12 hari. Kemudian dimasukan air sehingga menutupi galengan-galengan. Selama 10 - 12 hari, kemudian air diturunkan hingga kelihatan sarang-sarangnya untuk diambil benihnya. Setelah diambil benihnya kemudian kolam dikeringkan untuk menyeragamkan dalam pengeluaran telur.

Pembahasan.

Setiap ± 22 hari menghasilkan ± 2.000.000 fry, diperlukan induk 600 kg. Bila perbandingan jantan dan betina 1 : 1, diperkirakan berat satu induk 250 gram, maka 1 kg berisi 4 ekor. Bila dianggap 1 kg berisi 2 pasang maka dalam kolam ini diisi 1.200 pasang.

Bila yang memijah 50% (600 pasang), berarti setiap ekor menghasilkan $\frac{2.000.000}{600}$ = 3.330 ekor fry. Dengan demikian 1 ekor induk betina menghasilkan telur ± 5.000 - 6.000 ekor,bila diperkirakan mortalitas 50%.

Setelah pemindahan dari penetasan dimasukan dalam pendederan I selama 6 hari, dipindah kekolam pendederan ke II selama 10 - 12 hari dengan mortalitas ± 50%, berarti menghasilkan fingerling 1 juta ekor. Dalam pendederan I seluas 1 ray diisi 750.000 fry.Dalam pendederan II diperkirakan mortalitas 5 - 10%.

Penyediaan benih dapat dipenuhi sesuai dengan permintaan/ keperluan petani karena pemilikan tanah yang luas dan sarana pendukung yang memungkinkan.

Kesimpulan.

- Faktor pemilikan tanah/kolam yang luas dengan sarana pendukung yang cukup akan dapat menghasilkan benih Lele yang sesuai dengan permintaan petani kolam.

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3. Pembenihan Khong Krieng di Nokornsawan.

Lokasi pembenihan di Nakornsawan berjarak ± 200 km dari Bangkok kearah Utara. Luas areal pembenihan ± 1.500 m^3. Usaha pembenihan ini dilaksanakan oleh pengusaha swasta.Usaha pembenihan ini telah didirikan selama 12 tahun (1973), dengan kapasitas produksi 20.000.000 fry Pangasius sutchi/tahun. Pembenihan disini dilaksanakan dengan induced spawning.

Pembenihan menggunakan air langsung dari sungai tanpa difilter, hanya diendapkan saja.Sumber tenaga listrik berasal dari listrik umum /negara. Aktivitas pembenihan dilakukan pada bulan-bulan Maret sampai Oktober. Induk yang dipakai seberat 2 - 3 kg. Induk dapat dipakai maksimum 3 bulan.

Bak-bak yang ada yaitu bak larva berukuran 3 x 4 sebanyak 9 buah, 2 x 6 sebanyak 8 buah, bak-bak tersebut mempunyai tinggi ± 1 m.
Hasil panenan setelah berumur 4 hari dibawa ke Bangkok, berukuran ± 4 cm. Juga dijual benih ikan yang berukuran 7 cm.

Pembenihan Khong Krieng sekarang tidak begitu aktip karena modal sudah kembali. Investasi mula-mula 300.000 bath, sedangkan keuntungan 1 - 3 juta bath/tahun. Harga benih Pangasius 2 ekor/bath ukuran fingerling.Alat transportasi benih dengan menggunakan "kaleng minyak" volume 20 liter diisi dengan 150 ekor setiap kaleng.

Makanan untuk induk yaitu Race brake 50%, katul 25%, trace fish 25%. Pemberian makanan diberikan 5% dari berat badan dan seminggu dua kali diberikan makanan trace fish dengan dosis 10% dari berat badan. Survival rate dari telur ke fry ± 20%; dari fry ke fingerling ± 60%.

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Pembahasan.

Pembenihan Pangasius sutchi dapat dilaksanakan disini karena faktor sarana pendukung yang mudah didapatkan dan juga faktor alam yang memungkinkan untuk itu. Pemijahan Pangasius sutchi bukan merupakan hal yang baru seperti di Indonesia.

Usaha pembenihan Pangasius sutchi merupakan hal yang menguntungkan, terbukti bahwa dari mula berdiri (1973) hanya satu perusahaan (Khong Krieng Kai), tetapi sekarang sudah ada 20 pembenihan disepanjang Sungai Nang.

Kesimpulan.

- Usaha pembenihan Pangasius sutchi merupakan usaha yang menguntungkan;
- Mudah untuk mendapatkan sasaran pendukung pembenihan.

4. Pengenalan Induced Breeding di Bangkok.

Induced breeding mempunyai tujuan utama dalam rangka pengembangan ikan secara intensif/terkontrol dalam jumlah benih yang terkontrol, kwalitas benih, ketetapan waktu yang diperlukan. Disamping itu mortalitas daripada larva ukuran fingerling dapat diperkecil. Hal demikian belum dapat dicapai dengan memijahkan secara alami/tradisional. Disamping hal tersebut diatas induced breeding sangat diperlukan dalam rangka pengembangan budidaya ikan secara alami belum dapat dikuasai pemijahannya oleh manusia antara lain : Ikan Lele Bangkok (*Pangasius sutchi*); Patin (*Pangasius pangasius*); Jelawat (*Leptobarbus haeveni*) dan jenis ikan lainnya.

Dalam rangka study perbandingan di Thailand telah dilaksanakan induced breeding terhadap ikan-ikan, Pangasius, Tawes dan Redtail.

Langkah dan persiapan sebagai berikut :

Persiapan.

1. Persiapan induk ♂ + ♀ yang masak kelamin dengan jumlah yang sesuai (jumlah berat yang dibutuhan).
2. Penyediaan donor sebagai sumber kelenjar hypopisa.
3. Penyediaan hormon untuk jenis-jenis ikan tertentu misalnya, Hormon HCG.
4. Penyediaan air yang cukup dengan kwalitas yang baik.
5. Penyediaan aquades, aquabides, dll.
6. Peralatan antara lain : gelas pengukur, kelenjar hypopisa, pinset, pipet,alat suntik, pisau, parang, happa biasa, happa corong,baskom, seser, timbangan, dsb.

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Tehnik-tehnik Induced Breeding.

1. Ikan Lele Bangkok (*Pangasius sutchi*).

   a. Bahan dan alat.

      - Induk betina 2 ekor ± 5 kg (2 kg + 3 kg).
      - Induk jantan 2 ekor.
      - Donor 20 kg (± 9 ekor) *Pangasius sutchi*.
      - Hormon HCG 1 ampul (1.500 IU).
      - Aquabides, Aquades, air bisa.
      - Peralatan parang, timbangan,pisau, piset, alat suntik, baskom, alat penggerus, happa biasa dan happa corong.

   b. Ikan ditimbang - untuk betina 5 kg, donor 5 kg dan induk jantan. Ikan donor diambil kelenjar hypopisanya dengan cara membelah kepalanya kemudian kelenjar tersebut digerus sampai halus dengan menggunakan aquabides sebanyak 2,5 cc + 200 IU.HCG.

      Hormon diambil 1 cc untuk disuntikkan pada induk ikan mempunyai berat 2 kg (penyuntikan I), dan 1,5 cc lagi untuk penyuntikan II pada induk yang mempunyai berat 3 kg, suntikkan dilakukan pada punggung ± 2 cm dibawah pangkal sirip punggung.

      Untuk sementara penyuntikkan pertama selesai dan ikan dilepas /dibiarkan dalam bak.

      Suntikkan I dilakukan pada jam 11.30 setelah ± 10 - 12 jam dilakukan lagi penyuntikkan yang ke II.

      Pada pelaksanaan penyuntikkan ke II perbandingan antara donor dan recipien 3 : 1 (3 dosis), sedang hormon HCG digunakan 500 - 600 IU.

      Selanjutnya stripping dilakukan setelah 18 - 24 jam setelah suntik I dengan cara mengurut bagian perut untuk ♀ pada posisi bagian ekor sebelah bawah. Telur ditampung dalam baskom dan segera dilaksanakan stripping induk ♂ dengan cara yang sama, kemudian telur dan sperma yang sudah bercampur diaduk dengan menambahkan air beberapa kali sampai diperkirakan bersih dari lendir (± 5 menit) agar pencampurannya sempurna.

Karena sifat daripada telur ikan Pangasius ini melekat maka dilakukan lagi pencucian dengan lumpur untuk memisahkan telur yang selanjutnya ditetaskan dalam happa penetasan.

Stripping dilakukan 3 kali, hal ini dikarenakan telur belum keluar semua setelah 24 - 30 jam telur menetas yaitu ± 60%.

Telur yang telah menetas yaitu ± 5 jam berikutnya larva dipindahkan ke dalam bak atau happa lain yang telah dipersiapkan selama 2 hari. Setelah berumur 2 hari larva dipindahkan dalam aquarium atau bak yang sudah diberi air, makanan adalah kuning telur yang sudah direbus setiap 1 jam sekali dengan volume 1 buah kuning telur untuk 200.000 larva. Umur 10 hari di bak atau aquarium dipindahkan kedalam kolam yang telah dipersiapkan dengan baik. Dengan diberikan makanan secukupnya untuk selanjutnya dilakukan pendederan.

2. Ikan Tawes (*Puntius gonionatus*).

a. Bahan dan alat.

- Induk ♀ 7,2 kg yang terdiri dari 4,2 kg ukuran besar (9 ekor), 3 kg lagi ukuran kecil (6 ekor).

  Induk ♂ beratnya sama, tapi jumlah individu lebih banyak.
- Aguabides, aquades
- Donor 2 dosis yang berarti 14,4 kg
- Aceton.

b. Cara kerja.

Induk ♀ dan ♂ ditimbang, hypopisa diambil dari kelenjar hypopisa awetan dengan aceton yang berbanding sudah tepat kemudian digerus sampai halus dan merata dengan menggunakan 4,5 cc aquabides.

Ikan yang mempunyai berat 4,2 kg disuntik dengan larutan tadi (tanpa HCG) pada setiap ekor ikan masing-masing 0,5 cc.

Penyuntikan dilakukan 1 kali suntikan dilakukan pada bagian punggung atas, 3 sisik dibawah sirip punggung dengan posisi jarum tegak lurus sampai bagian otot. Setelah itu ikan-ikan dilepas kembali kedalam bak yang sudah dipersiapkan termasuk didalamnya disediakan happa dan ikan jantan tadi antara 4 sampai 6 jam ikan-ikan akan memijah sendirinya (tanpa diurut). Setelah ikan-ikan memijah induk jantan + betina dikeluarkan dari happa.

Untuk mengurangi kepadatan, telur dibagi pada bak penetasan lainnya. Dalam waktu 24 - 30 jam telur akan menetas, setelah telur menetas larva-larva dipindahkan kedalam happa lainnya (baru) dan pada beberapa aquarium. Untuk satu buah happa ukuran 2,5 x 1 m diisi ± 300.000 ekor larva ikan, pada umur ± 4 - 5 hari diberikan makanan kuning telur yang sudah direbus dengan frekwensi 2 kali tiap jam. Satu butir kuning telur dapat di berikan pada 300 000 larva, penggantian air dilakukan setiap hari.

Dalam percobaan ini ternyata telah dicapai hasil 90% pada umur 15 hari benih tersebut dapat dipindahkan kekolam.

3. Red Tail Shark.

a. Bahan dan alat.

- Induk ♀ + ♂ yang sudah matang telur, ♀ 300 gr (11 ekor) ukuran ± 8 - 10 cm; ♂ 65 gr (4 ekor).
- Donor yang digunakan ikan Mas dengan berat 410 gram.
- Aquabides, aquades, HCG.
- Obat bius.
- Peralatan parang, timbangan, pisau, piset, alat suntik, baskom, alat penggerus, happa biasa dan happa corong.

b. Cara kerja.

1. Hypopisa ikan Mas diambil dan dilakukan dengan menggunakan campuran 1 cc aquades.
2. Tambahan aquabides 2,2 cc, tambahan HCG 110 IU.
   (Tiap ekor ikan dibutuhkan 10 IU).
3. Dalam penyuntikan ikan-ikan harus dibius dengan menggunakan obat bius Hypno.
4. Kemudian ikan disuntik dengan menggunakan 0,2 cc larutan tadi, penyuntikan dilakukan pada bagian panggal sirip punggung, (± 1 cm dibawah sirip punggung) dengan posisi jarum 450 mengarah kebelakang.

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5. Suntikan ke II dilakukan dengan menggunakan 3 dosis , recipien : donor = 1 : 3 dilaksanakan setelah 6 - 8 jam dari suntikan I dengan menggunakan HCG 50 IU/ekor, cara-cara penyuntikan sama dengan suntikan I.
6. Telur yang sudah dibuahi dicuci dengan air dan dimasukkan dalam corong penetasan (happa corong), telur akan menetas 24-30 jam kemudian.

Kesimpulan.

1. Hasil penetasan Induced Breeding terhadap ikan,
   a. *Pangasius sutchi* mencapai hasil 60%
   b. Tawes 90%
   c. Red Tail Shark 70%
2. Penyuntikan dilakukan terhadap
   a. Pangasius
      - Suntikan dilakukan 2 x dengan dosis,
      - Suntikan I 1 dosis + 200 IU.HCG
        II 3 dosis + 500 - 600 IU.HCG
   b. Tawes
      - Suntikan dilakukan 1 x dengan perbandingan 2 dosis tanpa HCG.
      - Tanpa dilakukan stripping
      - Telur dikeluarkan 4 - 6 jam setelah penyuntikan
      - Sifat telur memisah dan ½ melayang
   c. Red Tail Shark
      - Suntikan dilakukan 2 x dengan suntikan I,
        1 dosis + 10 IU.HCG/ekor
      - Suntikan II, 3 dosis + 50 IU.HCG/ekor

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- Interval waktu penyuntikan I - II = 6 - 8 jam

- Sebelum disuntik ikan dibius dengan obat bius Hypno

III. BUDIDAYA.

A. SYSTEM PEMELIHARAAN.

1. Monocultur.

Jenis ikan yang dipelihara di Thailand, secara monocultur yang telah kami tinjau antara lain adalah jenis ikan :

- Lele;
- Tawes;
- *Pangasius sutchi*;
- Betutu;
- Toman, dan
- Gabus.

a. Ikan Lele.

Konstruksi kolam.

Berdasarkan peninjauan yang dilakukan pada umumnya, kolam-kolam untuk budidaya Lele adalah semi-intensif yang terdiri dari kolam-kolam tanah. Rata-rata ukuran kolam tanah ± 1 Ray = 1.600 m^2, dengan konstruksi pematang lebar ± 2 m; tinggi 1,5 m, penggantian air terus menerus tak perlu dilakukan penggantian air dapat dilakukan dengan pompa, atau dapat pula seperti kolam biasa dengan saluran pembuangan dan saluran pemasukan/seperti "monik".

Methoda pemeliharaan.

Methoda pemeliharaan ikan Lele di Thailand, ukuran benih awal fingerling 3 - 5 cm dengan padat penebaran ± 100.000 ekor /Ray. Masa pemeliharaan antara 6 - 8 bulan dan dapat menghasilkan ± 200 gram/ekor.

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Makanan ikan selama pemeliharaan adalah pellet dengan komposisi 9 bagian ikan rucah dan 1 bagian dedak. Jumlah makanan yang diberikan 5% dari berat badan, dan dapat pula diberikan makanan "boillet food" komposisinya dedak 25%, menir 50% dan ikan rucah 25%.

Perlakukan kolam sebelum ditebari adalah :

- dikeringkan ± selama 3 - 5 hari;
- diberi kapur, dan
- diberi pupuk.

b. <u>Ikan Tawes</u>.

Berdasarkan peninjauan yang dilakukan, pada umumnya kolam-kolam untuk budidaya Tawes digunakan kolam-kolam tanah dengan ukuran ± ½ Ray dengan sirculasi airnya menggunakan pompa.

Metoda pemeliharaan.

Metoda pemeliharaan ikan Tawes, ukuran benih awal fingerling ± 3 cm. Dengan padat penebaran ± 20.000 ekor/Ray, makanan yang diberikan yaitu Boilled food dengan komposisi 25% dedak, 50% menir fish/meal/tepung ikan dan 20% vegetable, diberikan 5% dari berat badan. Masa pemeliharaan yaitu ± 6 bulan.

Perlakuan kolam sebelum ditebari ikan tawes adalah :

- dikeringkan ± 3 - 5 hari;
- diberi kapur, dan
- diberi pupuk.

c. Pangasius sutchi.

Pemeliharaan Pangsius sutchi di Thailand dilakukan dikolam dan karamba (cage). Pemeliharaan dikolam terdiri dari kolam-kolam tanah dengan saluran pemasukan dan pengeluaran, dengan memakai "monik" dan pompa. Ukuran rata-rata kolam ½ Ray.
Untuk karamba dipasang disepanjang perairan sungai, misalnya Sungai Nan di Nakornsawan.

Konstruksi karamba.

Keramba terbuat dari kayu dengan pelampung bambu atau ada juga dari drum, ukuran sangkar yaitu 2 x 1½ x 5 m (lebar, tinggi, dan panjang). Pada umunya setiap unit karamba, dilengkapi dengan sebuah rumah rakit untuk tempat tinggal keluarga pemilik sangkar ikan (cage) tersebut. Perlengkapannya cukup baik, hampir semua rakit mendapat fasilitas penerangan listrik dari pemerintah, sehingga fasilitas dan kegiatan lain dapat dengan mudah (TV, kulkas, dll).

Metoda pemeliharaan.

Pemeliharaan dikolam, padat penebaran ± 30.000 ekor/Ray, dengan ukuran benih awal 3 - 5 cm, masa pemeliharaan selama 6 bulan, sedangkan untuk karamba digunakan padat penebaran 100 ekor/m² dengan ukuran rata-rata 100 gram/ekor.

Masa pemeliharaan ± 1 tahun dan diharapkan berat rata-rata dapat mencapai ± 1 kg/ekor. Makanan yang diberikan untuk pemeliharaan dikolam dan disangkar (cage) yaitu Boilled food dengan komposisi dedak 25%, menir (broken-rice) 50% dan fish meal/tepung ikan 25%. Pemberian makanan dilakukan 2 kali setiap hari,

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yaitu pagi dan petang dengan 5% dari berat badan.

Perlakukan kolam sebelum ditebari ikan yaitu :

- dikeringkan ± 3 - 5 hari;
- diberi kapur, dan
- diberi pupuk.

Sedangkan pada pemeliharaan dikaramba (cage), sebelum dimasukkan ikan kedalamnya dan sesudah panen yaitu selelu diperiksa jangan sampai ada bagian-bagian dinding atau dasar karamba yang rusak/hancur sehingga ikan-ikannya tidak mudah keluar/ hilang.

d. <u>Ikan Toman dan Ikan Betutu.</u>

Pemeliharaan ikan Toman dan ikan Betutu dilakukan/dilaksanakan dikaramba (cage) dengan konstruksi dari kayu, pelampung bambu atau drum dengan ukuran sangkar 2 x 1½ x 5 m.
Pada umumnya sangkar dan rumah petani terletak pada satu unit yang dilengkapi dengan fasilitas penerangan listrik.

Untuk ikan Toman pemeliharaannya diutamakan ukuran fingerling sampai konsumsi. Sedangkan untuk Betutu pemeliharaannya diutamakan ukuran 400 gram/ekor. Padat penebaran ikan Toman ± 100 ekor/m² dengan ukuran benih 3 - 5 cm/fingerling, begitu juga untuk ikan Betutu. Lama pemeliharaan untuk ikan Toman ± 6 bulan dengan berat rata-rata ± 1 kg/ekor. Sedangkan untuk ikan Betutu dilakukan seleksi setiap 2 atau 4 bulan sekali, untuk mendapatkan ikan Betutu yang ukurannya 400 gram keatas sebagai market table size. Makanan yang digunakan untuk ikan Betutu dan ikan Toman yaitu boilled-food dengan komposisi dedak 25%, tepung ikan 25% dan menir (broken-rice) 50%.

Alat untuk mengangkut ikan Betutu untuk dipasarkan yaitu semacam kontainer yang terbuat dari seng atau alumunium yang disamping kiri kanan dibuat lobang-lobang,dibagian atasnya diberi tutup. Kapasitas kontainer tersebut ± 10 kg.

e. Ikan Gabus.

Pemeliharaan ikan Gabus dilakukan dikolam-kolam biasa (kolam tanah), ukuran rata-rata ½ Ray per kolam, dengan padat penebaran 100 ekor/m^2, ukuran fingerling. Masa pemeliharaannya ± 1 tahun, berat yang dicapai waktu panen 250 - 400 gram, (2-4 ekor/kg). Makanan yang diberikan yaitu dedak dan ikan rucah dengan perbandingan 1 bagian dedak dengan 10 bagian ikan-ikan rucah.

2. Polycultur.

Ikan Sepat Siam, Gabus dan Betok.

Pemeliharaan ikan Sepat Siam dapat dilakukan bersama-sama dengan ikan Gabus dan ikan Betok,kolam yang digunakan yaitu kolam biasa/kolam tanah seluas ± 1 ha. Dengan memakai saluran keliling yang berukuran 1½ - 2 m ditengah kolam, digenangi air sedalam ½ m ditengah/bagian pada kolam ditumbuhkan rumput-rumput, yang dibuat petak-petak pembatas 2 - 3 m sebagai saluran.

Persiapan kolam sebelum pemeliharaan dilakukan :

- pengeringan kolam;
- perbaikan pematang;
- pembuatan saluran keliling;
- penumbuhan rumput berjarak setiap 2 m, dan

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- kemiringan kolam ± 5%.

Penebaran sebanyak 600 kg dengan berat rata-rata 125 gr/ekor. Lama pemeliharaan yaitu 10 - 14 bulan. Jenis makanan yang diberikan selama pemeliharaan berupa dedak, untuk panen digunakan alat tradisional yang disebut Lahat. Kapasitas alat penangkap tersebut adalah 500 kg/10 menit.

Panen dilakukan dengan terlebih dahulu pengeringan kolam selama ± ± minggu dengan pompa dan selama 2 hari mulai menangkap ikannya (inipun tergantung pada luas kolam).

3. Integrated-farm.

Pemeliharaan ikan secara integrated-farm yang telah ditinjau antara lain yaitu, antara ikan dengan babi dan antara ikan dengan ayam.

Jenis ikan yang dipelihara :

- Tilapia;
- Pangasius;
- Tawes;
- Lele, dan
- Chines carp/silver carp.

Makanan ikan secara langsung dari kotoran dan sisa makanan ayam dan babi. Lama pemeliharaan ± 10 - 12 bulan dengan hasil 10 ton Pangasius, 5 ton Tilapia dan ikan-ikan lain ± 15 ton.

a. Ayam dan ikan.

Jenis ikan yang dipelihara Chinese carp, Tawes dan Nila. Luas kolam rata-rata 20 ray dengan keadaan air yang stagnant

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dan penambahan air bisa dilakukan dengan menggunakan pompa sewaktu-waktu sesuai dengan kebutuhan.Jumlah ayam setiap kandang ± 1.500 ekor dan ikan dengan padat penebaran antara lain :

- Chinese carp, 150 ekor/ray ukuran fingerling;
- Indian carp, 200 ekor/ray ukuran fingerling;
- Tawes , 500 ekor/ray ukuran fingerling, dan
- Ikan lainnya datang sendiri.

Makanan berasal dari pupuk kotoran ayam, sisa-sisa limpah pasar, pellet dan sebagainya.

Perlakukan kolam sebelum pemeliharaan dilakukan :

- pengeringan, setiap 1 tahun sekali selama 1 minggu;
- pengapuran 150 kg/ray, dan
- pemupukan 2 kg/ray.

Selama enam bulan setelah pemeliharaan, panen dilaksanakan secara selektif.

b. Ikan Hias.

Budidaya ikan Hias dilakukan oleh suatu perusahaan swasta (Jerman). Sistem budidaya dilaksanakan dari pembenihan sampai siap untuk diexport. Jenis ikan hias yang dipelihara ± 300 jenis (300 sp). Jenis-jenis ikan tersebut sebagian dari import beberapa negara antara lain Srilangka, Jerman, Brazil,Amerika, Indonesia dsb.

Tehnik pemeliharaan dilakukan diaquarium/bak semen dengan sistem filter dengan menggunakan pipa U. Makanan yang diberikan pellet. Salah satu jenis ikan hias yang ditinjau pemeliharaannya adalah <u>Labio bicolor</u>. Pemeliharaan <u>Labio bicolor</u>

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dilakukan oleh petani dikolam-kolam tanah ukuran ± 20 x 30 m, sebagian lagi dilakukan diaquarium rata-rata ukuran 30 x 50 m. Makanan yang diberikan selama pemeliharaan terdiri dari moina, setiap dua jam sekali (setelah kuning telur habis) sampai berumur ± 10 hari, selanjutnya sudah dapat diberikan tubifex. Ukuran yang dipelihara rata-rata 3 - 5 cm.

Sistem penggantian air diaquarium dilakukan setiap pagi dan sore hari, juga sewaktu-waktu tergantung keadaan air (kualitas air) dengan sistem siphon, sedangkan dikolam dilakukan dengan pompa apabila air telah mulai kotor. Untuk pencegahan terhadap penyakit air diberi Na, Cl Tetra-cyclin, Terramycin, methylenblue dan lain-lain.

c. Udang Galah.

Pemeliharaan Udang Galah (Macrobrachium) dilakukan dikolam-kolam tanah ukuran rata-rata 1 ray dengan dasar kolam rata dan kedalaman ± 1,5 m.

Padat penebaran 12.000 ekor/ray dengan ukuran fingerling. Selama pemeliharaan makanan yang diberikan terdiri dari pellet dan moina sebanyak 1 kali sehari. Komposisi pellet terdiri dari fish meal : broken rice : rice brand (1.600 : 300 : 240) kg dengan kadar protein ± 35%. Lama pemeliharaan dilakukan selama 6 - 8 bulan. Jumlah makanan yang diberikan 1,2 kg/ray dengan cara melempar kedalam kolam. Rata-rata produksi 100-200kg/ray. Persiapan kolam sebelum pemeliharaan dilakukan :

- pengeringan kolam (dilakukan 1 tahun sekali);
- penebaran kapur 60 kg/ray;

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- sistem penggantian air dilakukan dengan menggunakan pompa axial, setiap kualitas air mulai berobah.

B. HAMA DAN PENYAKIT.

Pada budidaya dari jenis-jenis ikan yang ada hama dan penyakit ikan tidak merupakan suatu masalah yang serius. Informasi dari hasil peninjauan yang dilakukan, ikan pada suatu saat mati disebabkan oleh bakteri jenis aeromonas, larnea dan fungi. Tetapi walaupun demikian tidak pernah menyebabkan kematian secara masal. Sedangkan hama terdiri dari ular, burung dan ikan-ikan liar.

Cara pencegahan yang dilaksanakan untuk pemberantasan hama dan penyakit adalah dengan menggunakan kapur.

C. PEMBINAAN.

Dalam pengembangan perikanan di Thailand dibina oleh dua instansi yaitu Direktorat Jenderal Perikanan dan NIFI (National Inland Fisheries Institut). Pembinaan langsung dilaksanakan oleh Dinas Perikanan Daerah, yang dilakukan oleh PPL. Dalam suatu kelompok petani dan wilayah pembinaan tertentu.

D. PEMBAHASAN.

Dilihat dari keadaan budidaya yang diterapkan atau yang dilakukan oleh petani Negara Thailand, pada umumnya hampir sama dengan keadaan budidaya di Indonesia. Secara tehnis Negara Indonesia sudah mengarah ke usaha yang intensif karena potensi sumberdaya/lahan yang dimiliki petani terbatas. Sedangkan di Thailand tehnologinya masih semi intensif karena areal yang masih memungkinkan untuk ekstensifikasi.

Dilihat dari sarana penunjang untuk keberhasilan budidaya di-Thailand cukup baik seperti halnya air, listrik, makanan ikan, peralatan lainnya serta transportasi yang merata ke daerah-daerah yang memungkinkan petani bisa memanfaatkan untuk usaha perikanan yang lebih baik.

Dilihat dari segi pemasaran, khususnya jenis ikan konsumsi lebih mendorong semangat perusahaan untuk lebih meningkatkan produksi, karena saluran pemasaran yang tidak melalui tengkulak dengan harga cukup tinggi dan bisa diterima oleh petani.

Sedangkan dalam segi peranan pemerintah dalam rangka pengembangan perikanan, petani yang kurang mampu dapat bantuan berupa kredit dari Bank.

Segi lain yang menunjang keberhasilan budidaya perikanan di Thailand adalah mentalitas petani yang cukup tinggi, dapat dilihat dari keuletan dalam berusaha yang lebih baik. Dilihat dari produksi yang dicapai oleh petani umumnya cukup baik misalnya produksi ikan Lele, Pangasius, Udang Galah, dsb, karena makanan yang memenuhi syarat, mudah didapat, air yang belum mengalami pencemaran masih banyak tersedia, kebutuhan benih dapat dicukupi secara kontinyu.

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IV. ANALISA EKONOMI.

A. EKONOMI.

Hasil peninjauan keobyek-obyek perikanan di Thailand, ditinjau dari kultur teknis bisa diterapkan oleh petani di Indonesia dengan kata lain cukup feasible untuk dikembangkan.

Namun meskipun demikian perlu kiranya kita menyimak bahwa kultur teknik tersebut secara ekonomi harus feasible (ekonomicaly feasible). Beberapa kegiatan cabang usaha tani ikan yang telah ditinjau antara lain :

- hatchery Udang Galah dan Lele;
- kultur artemia;
- ikan hias;
- pemeliharaan ikan Lele, Gabus dan Sepat Siam, serta
- usaha perikanan terpadu (Integrated-farm).

Untuk menganalisa tiap cabang usaha tani diperlukan masukan-masukan yang berupa investasi, modal kerja dan hasil, namun kelengkapan dari data yang diperlukan tidak diperoleh, karena sumber data hanya berasal dari para pelaksana/pekerja tiap cabang usaha tersebut, yang tentu saja kurang memahami/menguasai mengenai perputaran modal usaha. Sebenarnya data/informasi diharapkan langsung dari pemilik yang benar mengetahui secara detail mengenai pengelolaan usaha taninya. Beberapa data/informasi yang diperoleh ternyata banyak yang kurang benar, sehingga kalau dianalisa ternyata perusahaan tersebut menderita rugi secara terus menerus, sedangkan sebaliknya perusahaan yang menurut analisa ekonomi menderita rugi dan harus menghentikan usahanya ternyata berjalan cukup lancar. Cabang usaha tani ikan tersebut sudah berjalan antara 5 - 20 tahun. Oleh karena itulah kami tidak dapat mengajukan analisa ekonomi dari tiap cabang usaha tani secara lengkap untuk memperoleh jawaban bahwa cabang usaha tersebut benar-benar dapat dikatakan economicaly feasible. Namun untuk mendapatkan gambaran yang jelas,bersama ini kami coba untuk menyajikan analisa ekonomi beberapa cabang usaha tani ikan yang telah ditinjau antara lain sbb :

1. Udang Galah.

Hatchery Udang Galah milik Pemerintah yang terletak didistrik Ban Pa Kong seluas 15 ha. Produksi yang dicapai rata-rata pertahun 20 juta ekor benih dengan harga jual 7 ekor/Bath.*) Nilai uang yang masuk dalam 1 tahun = $\frac{20.000.000}{7}$ x ฿ 1 = ฿ 2.800.000.
Kalau dibandingan dengan hatchery Udang Galah di Indonesia produksi benih Udang di Thailand sebesar 1.500.000 ekor/ha relatif sama. Dengan demikian baik tehnologi maupun management pengelolaan hatchery Udang Galah antara di Thailand dan Indonesia sama.

Hatchery Udang Galah milik perorangan. Hatchery ini terletak di distrik Ban Pa Kong, seluas 1.500 m².Investasi untuk pembangunan hatchery tersebut sebesar $ 5.000 telah dapat dilunasi kembali ke Bank.
Modal kerja per bulan mencapai ฿ 40.000 yaitu untuk :
- induk/benur;
- makanan udang;
- upah buruh, dsb, termasuk biaya penyusutan alat.

*) 1 Bath = Rp.35.-

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Hasil benih udang/bulan 500.000 ekor dengan harga jual 10 ekor /Bath atau $\frac{500.000}{10}$ x ₿ 1 = ₿ 50.000.

Keuntungan yang diperoleh per bulan	₿ 10.000
Dikurangi biaya hidup	₿ 5.000
Keuntungan bersih	₿ 5.000

Kegiatannya sudah berjalan 5 tahun. Dengan bisa bertahan selama jangka waktu tersebut benar-benar petani tersebut sudah menguasai management usaha taninya, hal tersebut kiranya perlu dicontoh atau diterapkan di Indonesia yang memiliki potensi yang lebih baik. Dalam hal ini diperlukan adanya dukungan dari pihak Pemerintah untuk menjamin kontiniunitas usaha dalam bentuk peraturan ataupun bantuan modal.

Perusahaan Udang.

Objek yang ditinjau merupakan suatu perusahaan yang memiliki lahan seluas 100 Ha dan jumlah tenaga kerja sebanyak 40 orang. Produksi Udang 100 kg/Ray/bulan atau 100 Ha (680 Ray x 100 kg = 68.000 kg). Harga jual Udang Galah ₿ 20/kg. Sehingga pendapatan kotor perusahaan tersebut berkisar ₿ 1.360.000. Sedangkan biaya exploitasi per bulan ₿ 600.000. Dengan demikian keuntungan sebesar ₿ 760.000.

2. <u>Kultur Artemia.</u>

Lokasi kultur artemia milik petani perorangan terletak didistrik Ban Pa Kong seluas 3 Ha.Semula tambak-tambak tersebut digunakan untuk menghasilkan garam. Selanjutnya fungsi berubah setelah permintaan akan artemia meningkat. Dengan hanya menggunakan pupuk kotoran ayam sebanyak 0.8 kg/m² untuk masa 6 bulan diperoleh hasil

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artemia 30 - 50 kg/HA/hari dengan harga jual ฿ 100 kg. Permintaan akan artemia berasal dari petani Udang Galah yang banyak terdapat didaerah tersebut.

3. Kultur Lele dan Gabus.

Objek yang ditinjau merupakan usaha petani perorangan,lokasi yang ditinjau terletak didaerah Bangkung, Supanburi dengan luas areal 3 Ha. Kolam terdiri atas 13 kolam pembesaran antara lain 0,7 HA untuk Lele, dan 2,3 Ha untuk Gabus. Lama pemeliharaan Lele 6 - 8 bulan, dan Gabus 8 - 12 bulan.

Produksi Lele per musim 5.000 kg/ray, sedangkan Gabus per musim 7.000 kg/ray.

Analisa ekonominya.

Oleh karena data yang diberikan oleh petani hanya perkiraan saja, ternyata setelah dianalisa perusahaan tersebut secara ekonomi tidak feasible (rugi). Hal ini bertolak belakang dengan kenyataan dilapangan dimana perusahaan tersebut sudah berjalan 12 tahun kalau rugi tidak mungkin untuk terus berlanjut.

Dibawah ini kami sajikan analisa ekonominya.

Modal kerja.

- Benih Lele	4.000.000 x ฿ 0,08	=	฿	320.000
- Benih Gabus	9.000.000 x ฿ 0,03	=	฿	270.000
- Buruh	5 x 8 x ฿ 5.000	=	฿	200.000
- Listrik untuk 8 bulan	@ ฿ 500	=	฿	4.000
- Bensin	8 x @ ฿ 3.000	=	฿	24.000
- Biaya hidup 8 bulan	8 x ฿15.000	=	฿	120.000
		=	฿	938.000

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Makanan ikan.

- Ikan rucah	6.000 kg/Ray x 240 x ฿ 3,5	= ฿	5.040.000
- Dedak	600 x 240 x ฿ 3	= ฿	432.000
		= ฿	4.472.000

Jadi biaya total (input) ฿ 938.000 + ฿ 4.472.000 = ฿ 6.410.000.

Sedangkan produksi ikannya per musim adalah :

- Ikan Lele	4 x 5.000 x ฿ 30	= ฿	600.000
- Ikan Gabus	9 x 7.000 x ฿ 30	= ฿	1.890.000
	Jumlah(output)	= ฿	2.490.000

4. Pemeliharaan Ikan Sepat Siam di Samuth Pragan.

Luas kolamnya hampir 2 HA, dengan ditebari induk sepat sebanyak 600 kg, ternyata dalam masa pemeliharaan 10-12 bulan dapat dihasilkan :

- Ikan Sepat sebanyak	3 ton dengan harga ฿ 14/kg	= ฿	52.000
- Ikan Gabus	2 ton dengan harga ฿ 40/kg	- ฿	80.000
- Ikan Betok	2 ton dengan harga ฿ 35/kg	= ฿	70.000
	Jumlah	= ฿	202.000
Dikurangi makanan	10 x 30 x 60 x ฿ 3	= ฿	5.400
		= ฿	196.600
Upah untuk 10 bulan 2 orang		= ฿	10.000
	Sisa bersih	= ฿	186.000

Keuntungan terletak pada masuknya ikan-ikan Gabus dan Betok dengan tidak sengaja ditanam.

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5. Ikan Hias.

Peninjauan kelokasi pemeliharaan ikan hias baik di Thailand maupun di Singapura tidak diperoleh data untuk analisa ekonomi. Hal ini bisa dimengerti bahwa keberhasilan perusahaan harus dijamin.

6. Pemeliharaan ikan terpadu (integrated farm).

Ternyata integrated farm ini yang paling menguntungkan, salah satu contoh adalah integrated farm di miburi seluas 100 Ha. Dimulai dari luas 1 Ray (0,2 Ha) berkembang dalam 25 tahun menjadi 100 Ha. Kegiatan yang dilakukan petani tersebut adalah pemeliharaan ikan dan ternak ayam dimana ayam hanya diperlukan kotorannya saja, sedangkan jenis ikan yang dipelihara antara lain, Chinese carp, Tilapia, Tawes, Pangasius, Grass carp dan Toman.

Lama pemeliharaannya 6 bulan sedangkan pungutan dilakukan tiap hari ± sebanyak 1.000 kg. Harga jual per jenis ikan adalah sebagai berikut :

- Chinese carp 15 Bath/kg
- Tilapia 10 Bath/kg
- Tawes 15 Bath/kg
- Pangasius 10 Bath/kg
- Toman 15 Bath/kg
- Gross carp 10 Bath/kg

Sedangkan tenaga pelaksana hanya 3 orang dan kesemuanya merupakan anggauta keluarga.

B. PEMBAHASAN.

Kalau kita perbandingkan dengan usaha perikanan yang dilakukan petani kecil di Indonesia, ternyata ada beberapa hal yang perlu kita contoh dan perbandingan antara lain adalah :

- Supplay air didaerah-daerah peninjauan ternyata hanya berkisar 6-8 bulan per tahun sedangkan di Indonesia adalah daerah yang berpengairan sepanjang tahun.
- Adanya rasa percaya diri yang kuat dari petani dan adanya jaminan dari pembinaan akan keberhasilan usaha. Dengan dibekali rasa percaya diri mereka sanggup membayar konsultan untuk pengembangan usahanya baik secara profit share maupun production share.
- Meskipun di Thailand tidak dapat asosiasi petani ikan namun demasaran sudah lebih lancar. Hal ini disebabkan adanya specialisasi usaha antara pembenihan, pendeder dan pembesaran ikan. Dengan demikian pemasaran sudah lebih terbuka.
- Dilihat dari penerapan tehnologi perikanan, petani kita di-Indonesia hampir sebanding dengan yang dimiliki oleh petani Thailand, malahan usaha pengembangan running water system di-Thailand baru sedang dijajaki kemungkinannya. Pada hal petani di-Indonesia sudah melaksanakan sejak tahun 1980.
- Hal yang mendukung pengembangan perikanan di Thailand adalah tersedianya lahan yang cukup, di Indonesia rata-rata pemilikan tanah hanya : 0.5 ha sedangkan di Thailand, mencapai rata-rata 7 Ha.

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V. KESIMPULAN.

1. Berdasarkan peninjauan dan wawancara yang dilakukan dari segi pembenihan, budidaya, tehnologi yang dipakai di Indonesia tidak jauh berbeda dibandingkan dengan di Negara Thailand.

2. Dilihat dari produksi yang dipakai dan kemampuan bertahannya perusahaan yang bergerak dalam bidang perikanan di Negara Thailand lebih baik dibandingkan dengan Negara Thailand, hal ini disebabkan antara lain :

   - faktor lingkungan yang lebih mendukung;
   - rantai pemasaran yang lebih terbuka;
   - ketekunan/rasa percaya diri dan faktor sosial yang lebih baik, dan
   - sarana penunjang yang cukup baik.

3. Hubungan antara usaha pembenihan,pendederan, pembesaran dan pemasaran merupakan hal yang paling menentukan keberhasilan usaha dibidang perikanan, hal ini di Thailand sudah cukup baik dibandingkan dengan Indonesia.

7U

JADWAL
STUDI PERBANDINGAN KE THAILAND DALAM BIDANG AQUACULTURE
TANGGAL 2 - 25 MEI 1985

Disponsori oleh USAID/Fishery, Jakarta dan
Direktorat Jenderal Perikanan,
Departemen Pertanian.

Instructor Mr. Samruay Meenakarn

Tanggal	Program
2	- Tiba di Jakarta
3	- Wawancara dengan Direktur Jenderal Perikanan di Jakarta dan USAID. - Berangkat ke Bangkok.
4 - 6	- Melapor ke Kedutaan Indonesia, di Bangkok. - Mengunjungi Lembaga Perikanan Darat. - Mengunjungi tempat-tempat obyek perikanan serta orientasi sarana-sarana perikanan di Bangkok. - Menginap di Bangkok.
7	- Mengunjungi Budidaya Lele Bangkok dikolam-kolam Suphanburi. - Menginap di Bangkok.
8	- Mengamati budidaya Trichogaster (Sepat Siam) di Samuthpragarn. - Menginap di Bangkok.
9	- Mengunjungi polikultur (budidaya ikan campuran) dan budidaya terpadu (Integrated Fish Fram) di Prathumtani dan sekitarnya. - Menginap di Bangkok.
10 - 13	- Mengamati dan memperaktekkan pemijahan buatan di peternakan ikan di Bangkok, diantaranya Pangasius sutchi (Lele Bangkok), Puntius gonionotus (tawes) dan ikan hias.
14	- Mengunjungi budidaya karamba di Utaitani dan Nakornsawan (Pangasius sutchi oxyelotris). - Menginap di Nakornsawan.
15 - 18	- Mengamati pemijahan ikan dan pembesaran larvae dari jenis-jenis Puntius gonionotus, Common carp (mas), Chinese carp (kakap, rumput, Mola, Kaper) dan Nilotica (Nila). - Menginap di Chiengmai.
19 - 20	- Mengamati pemijahan buatan dari jenis-jenis Chinese carp dan Pangasianodon gigas (Lele raksasa) dan pengelolaan perairan umum di Kwan Phayao Station.
20 - 23	- Kembali ke Bangkok dan mengunjungi proyek-proyek dari Balai Budidaya Air Tawar. - Berangkat ke Singapore.
24	- Mengunjungi Budidaya Ikan Hias di Singapore.
25	- Kembali ke Jakarta

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LIST OF PARTICIPANTS

COMPARATIVE STUDY TO THAILAND

ON CAGE CULTURE ON THE MEI 2 THROUGH 24 MEI, 1985

No.	Name	Occupation
1.	Dr. Josephine Wiryanti	DGF (Team leader)
2.	Mr. Ubaidillah	USAID Counterpart from Jambi
3.	Mr. Zahri. N	USAID Counterpart from Palembang
4.	Ms. Elvita Nezon	DGF
5.	Mr. Sentot Wijaya	DGF
6.	Mr. Yorfatrik Nazda	DGF
7.	Mr. Thoken	Chief, Extension Service, PFS Jambi
8.	Mr. Tongku Karim	Fish farmer from Jambi
9.	Mr. Abdul Malik	Fish farmer from Jambi
10.	Mr. Amir	Fish farmer from Jambi
11.	Ms. Ngatimin	Fish farmer from Jambi
12.	Mrs. Mulyana Maria	Fish farmer from Palembang
13.	Mr. Hipni Saleh	Fish farmer from Palembang
14.	Mr. Ruspi	Fish farmer from Palembang
15.	Mr. Muhammad Daling	Fish farmer from Palembang
16.	Mr. Thoib	Fish farmer from Central Java
17.	Mr. Rabiman	Fish farmer from Yogyakarta
18.	Mr. Aryo Purwandoto	Fish farmer from West Nusa Tenggara
19.	Mr. Ali Amrin Koto	Fish farmer from West Sumatera
20.	Mr. Rifat Salmani	Fish farmer from East Kalimantan
21.	Mr. Junaedi	Fish farmer from Central Kalimantan
22.	Mr. Pepen Effendy	Fish farmer from West Java
23.	Mr. Sutrisno	Fish farmer from DKI

ANNEX F

TECHNICAL PAPER ON INDUCED BREEDING TECHNIQUE OF *Pangasius sutchi*, *Pangasius pangasius*, and *Leptobarbus hovenii*

Project No. TA 497-0286   Contract No.: AID 497-0286-S-00-4062-0

INDUCED BREEDING TECHNIQUE OF *PANGASIUS SUTCHI*, *PANGASIUS PANGASIUS*, AND *LEPTOBARBUS HOVENII*.

Prepared by

Samruay Meenakarn

USAID - Fish Breeding Advisor

Presented at the DGF Workshop on

Hatchery Management Technique,

held in Yogyakarta

on 5 - 7 August 1985

SM/JW/5.7.85

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INDUCED BREEDING TECHNIQUE
OF PANGASIUS SUTCHI, PANGASIUS PANGASIUS,
AND LEPTOBARBUS HOVENII.

Induced breeding refers to a process of spawning fish species by way of hormon injection. In natural condition, the spawning normally takes place in optimum and favourable oper-water condition. This is the reason why some species are difficult to spawn in captivity though they can be reared, to some extent, to achieve maturation.

In open-water, fertilization and hatching normally take place during the rainy season, and yet such onvironmental stimuli appear to be lacking in captivity and that makes the natural spawning impossible to accur.
The induced spawning method will therefore be the answer to control production of fingerling.

Hormon

Hormon normally administered for induced breeding is made up of biological compounds produced in the pituitary gland of endocrine system. In nature, the hormon is secreted to control reproductive events. In young animals the hormon is not well developed until they reach adult atage in which the pituatiry gland produces sex hormon to facilitate reproduction.

The pituitary gland is located underneath the brain of animals. Environmental stimuli as rainfall, optimum temperature and water quality condition facilitate the spawning of fish. This is one of the reasons that almost riverine species require favourable condition to facilitate the pituitary gland secretes hormon in enhancing maturation of egg and sperm before natural spawning takes place.

There are two hormons considered to be effective for inducing the spawning process, i.e. Luteinizing Hormon (LH) and Follicle Stimulating Hormon (FSH). The pituitary gland of adult fish usually contains both LH and FSH which are important factors for induced breeding.

Source of hormon.

Pituitary gland that required to induce female in releasing eggs, is usually collected from the same species. However, after several experimentations, it has been indicated that the pituitary gland of common carp can be effectively manipulated to induce every other species, for which reason common carp is known to be "universal donor". The pituitary gland of chinese and indian carp (Labeo rohita) have also been successfully manipulated in induced breeding procedures.

In some species, i.e. Pangasius pangasius and Leptobarbus hovenii, extracted hormon is currently used for induce breeding, because it contains pure hormons which consist of 90% LH and only 10% FSH. Therefore, in induced breeding the extracted hormons used should be complemented with homogenized pituitary gland to supplement the FSH content which is lacking in extracted hormon, otherwise without addition of crude pituitary gland the process of spawning will not effectively accur.

Following are different extracted hormons manipulated in induced breeding :

Name	Unit
HCG (Human Chorionic Gonadotropin)	IU
Pregnyl	IU
Physex	IU
Chorion	IU
Synahorin	RU
Pare hormon	RU

Administration of hormon.

In induced breeding procedure, the pituitary glands are collected from donors. The amount of pituitary glands and hormon mixture injected to the spawners should be in optimum ratio otherwise the process of spawning will not successfully take place. High dose of injection will cause egg over-ripen and broken, while low dose will delay ovulation.

There are two methods of calculating the amount of pituitary glands required for induced spawning by using weight (mg) and doses. The first method is considered rather labourious, for the glands should be preserved in acetone or in absolute alcohol before being dried up in dessicator. The dried tissue is then accurately weighed up. In this case the procedure should be carried out in a laboratory.

The dosing method is quite popular recently, particularly in Thailand because it is easior to measure body weight of both recipient and donor in adjusting the optimum dosing requirement.

$$\text{dose} = \frac{\text{Donor}}{\text{Recipient}}$$

$$1 \text{ dose} = \frac{1 \text{ unit donor}}{1 \text{ unit recipient}}$$

$$\text{Example : } \tfrac{1}{2} \text{ dose} = \frac{1 \text{ unit donor}}{2 \text{ unit recipient}}$$

$$2 \text{ dose} = \frac{6 \text{ kg D}}{3 \text{ kg R}}$$

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Preparation of hormon.

The pituitary gland that located underneath the brain is removed using forcep by chopping off and opening up the upper part of donor's head. The gland should then be finely ground in a homogonizer and added with either distilled water (aquabidest) or 0.7% sodium chlorida solution. The whole solution is being used to inject the female spawners using syringe. Care should be taken in choosing size of syringe and needle to inject fish. Small amount of solution should use small needle in small syringe (2 cc solution should use No.22/23 syringe while 5 - 10 cc solution, No.18 - 22 syringe should be used).

Injection technique.

The solution is injection intramascularly to the recipient on any part of area such as pectoral girdles, the site part between dorsal fin and lateral line, on pelvic girdle and dorsal girdle etc, and 1 ml of solution is normally administered to 1 kg body weight of recipient. However, it can be adjusted, e.g. 5 kg spawner is not nesessarily injected with 5 ml solution but depend on the concentration of hormon, 100 kg brooders of *Pangasianodon gigas* will only use 100 gr PG of silver carp.

Spawning and Fertilization.

Most of species are normally injected twice, but some only require one injection to stimulate ovulation of eggs. The ovulation period, however, varies and depending on species. The spawning can take place naturally in concrete or earthern pond or in hapa etc. Fertilized eggs are then collected in incubated hatching container.

Stripping is a convenient way to enhance the fertilization process. Females are usually stripped first during their ovulation period and the egg is then placed in a dry container (plastic bowl). Immediately, males are stripped off and the sperm (milt) is then put into the same container and mixed together very gently using feather for half of a minute before water is added to cover up the eggs and stirred for 1 - 2 minutes to rinse and release mucous. The fertilization will then take place immediately soon after the water is added (dry method).

In wet method, the egg and sperm are mixed together with water in a container as the process accurs in natural breeding where sperm and egg are released in the water by male and female spawners respectively. This method is normally used in the case of the sperm is lacking.

Hatching or Incubation method.

There are several hatching methods involving different equipments used which depend on what type of egg to hatch. Hatching funnel or jar suspended in aerated water is suitable for hatching semi-bouyant type of eggs, while hapa is used for hatching adhesive type of eggs, in which case the eggs should be strewn evenly on every side of hapa. In any case, the adhesive type of eggs can also be hatched out in a hatching funnel provided that the eggs should be individually separated by mixing up with muddy water for 10 minutes.

Water quality is a critical factor during the hatching process. The water should be fresh, clean and clear. Temperature should be maintained between 25 - 28°C for hatching the semi-bouyant eggs, while the adhesive type of eggs should be maintained between 28 - 30°C.

Water temperature can only be maintained for 6 hours. Optimum volume of water in the hatching container should be maintained during the hatching process.

Larval Rearing.

Larval rearing is one of the main activities should be carefully prepared because the production of fingerlings will particularly depend on the way the larvae being treated during their critical period, though every step of breeding process like selection of spawners, injection technique, fertilization and hatching is carried out thoroughly.

There are several crucial points should be taken into account in the process of larval rearing :

(1). Type of container.

Larvae can be reared in hapa, aquarium, concrete or earthern pond which depend upon species and size of fish.
Larvae of Pangasius sutchi, Pangasius pangasius and Leptobarbus hovenii are suitably reared in aquarium or in small concrete pond during their first 15-day of life, that makes the cleaning of the container easier.
After 15-day of age the larvae can then be transferred into earthern pond.

(2). Food and Feeding practice.

Two different types of food are given to fish fry in a form of life-food such as phytoplankton, zooplankton, tubifex, brine shrimp or artemia etc, and supplementary food like egg-yolk, rice bran, fish meal etc.

Live-food is crucially required in feeding fry during 15-day of life, because the food will retain longer in the water and will not pollute the container. Supplementary food is given to fry after 15 days when the fry are reared in the earthern pond. The live-food is still required during the period of life in the nursery and that can be achieved by fertilizing the pond.

The feeding rate can not be calculated from the percentage of the body weight, but the amount of food should be estimated according to the density of fry and size of container. Feeding time should also be taken into account. Over feeding of supplementary food will cause pollution of water and hence mortality of fry. Sedimented food makes fry unable to eat, because the food can only stay floating for 3 hours. Thus food should be given every 3 hours to Pangasius fry whereas Leptobarbus as slow eater, can eat the food longer. Feeding time will take every 6 hours.

(3). Water supply.

The water supplied during the first 15-day of life, for young fry should be clean and should contain no harmful substance. During those period the water in the container should regularly be changed every day for about one third of the volume. After 15 days of their life where the fry are nursed in the earthern pond, fertilizer should be applied to provide live-food.

(4). Hatchery Management.

Hatchery management is the most important aspect to be taken into account. Preparation of food, optimum feeding rate, feeding time, preparation of water, control of temperature, aeration system, prevention of diseases and predators should be carefully carried out.

Diagram of Induced breeding for *Pangasius sutchi*, *Pangasius pangasius* and *Leptobarbus hovenii*.

Activity	*Pangasius sutchi*	*Pangasius pangasius*	*Leptobarbus hovenii*
1. Preparation of brooder	Reared in cage (10 fish/ m^2) Reared in pond (1 fish/5 m^2)	Reared in cage (10 fish/ m^2) Reared in pond (1 fish/5 m^2)	Reared in cage (2 fish/m^2) Reared in pond (1 fish/10 m^2)
Food	Pellets or cooked food	Pellets or cooked food	Pellets or cooked food
Food ingredients	Broken rice (50%) } Fish meal (25%) } cooked food Rice bran (25%) } Trash fish 10% body weight twice a week	Broken rice (50%) } Fish meal (25%) } cooked food Rice bran (25%) } Trash fish 10% body weight twice a week	Fish meal 30%, soy bean meal 20% Fish moal 30%, copra cake 10% Wheat flour 6%, Ipomea 10% Vitamin 1%, mineral 3% (pellets)
Feeding rate	5% body weight per-day (dry weight)	5% body weight per-day (dry weight)	3% body weight per-day including vegetable 10% body weight/twice a week
2. Selection of brooder	♀ big belly, soft and rounded shape vent reddish color and swollen ♂ matured milt and sperm sperm	♀ big belly, soft and rounded shape vent swollen and reddish color ♂ matured milt and sperm	♀ big belly, soft, long shape, scale separated vent swollen ♂ matured milt and sperm
3. Injection technique	1st injection : 1 dose+100-300 IU 2nd injection : 3 doses+300-500 IU	1st injection : 1 dose+100-300 IU 2nd injection : 3 doses+300-500 IU	1st injection 0.5 dose 2nd injection 2.5 doses + 100 IU
Donor	Pangasius Common carp	Pangasius Common carp	Common carp
4. Spawning and fertilization	♀ stripped eggs ♂ stripped milt Dry method fertilization	♀ stripped eggs ♂ stripped milt Dry method fertilization	♀ stripped eggs ♂ stripped milt Dry method fertilization
Eggs and Hatching method	adhesive eggs hapa hatching funnel	adhesive eggs hapa hatching funnel	semi bouyant eggs hapa hatching funnel

Activity	Pangasius sutchi	Pangasius pangasius	Leptobarbus hovenii
Water temperature	28 - 30°C	28 - 30°C	25 - 28°C
5. Larval rearing Container 1 - 15 days	aquarium concrete pond indoor	aquarium concrete pond indoor	aquarium concrete pond indoor
15 day up	earthern pond	earthern pond	hapa (pond or lake) earthern pond.
Food 1 - 15 days	boiled egg-yolk (2 days) moina, brine shrimp	boiled egg-yolk (2 days) moina, brine shrimp	boiled egg-yolk (2 days) moina, supplementary food
Water temperature	28 - 30°C	28 - 30°C	28 - 30 °C

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OPTIMUM DOSES FOR INDUCED BREEDING

Species	1st Injection		2nd Injection		Interval between 1st-2nd Injection (Hours)	Ovulation (Hours) From 1st Injection	Type of eggs
	Donor	HCG	Honor	HCG			
Puntius gonionotus	1.5-2 dose	-	-	-	-	4 - 6 hours	Semi-bouyant
Leptobarbus hovenii	0.5 dose	-	2.5 dose	100 IU	6 - 8	11 - 12 hours	Semi-bouyant
Indian carp	0.5 dose	-	2 dose	-	6 - 8	10 - 12 hours	Semi-bouyant
Silver carp	0.5-1 dose	-	1.5-2 dose	-	6 - 8	11 - 12 hours	Semi-bouyant
Big head carp	0.5-1 dose	-	1.5-2 dose	-	6 - 8	11 - 12 hours	Semi-bouyant
Grass carp	0.5 dose	-	2.5-3 dose	200-500 IU	6 - 8	11 - 12 hours	Semi-bouyant
Labeo bicolor	0.7-1 dose	10 IU	2 -3 dose	50 IU	6 - 8	11 - 12 hours	Semi-bouyant
Pangasius sutchi	1 dose	100-300 IU	3 dose	300-500 IU	10 - 12	18 - 24 hours	Adhesine eggs
Pangasius pangasius	1 dose	100-300 IU	3 dose	300-500 IU	10 - 12	18 - 24 hours	Adhesine eggs
Pangasianodon gigas	0.8-1 dose	1,000 IU	2.5-3 dose	4,000 IU	10 - 12	18 - 24 hours	Adhesine eggs
Clarias macrobcephalus	0.5-1 dose	-	2 -3 dose	100 IU	6 - 8	12 - 15 hours	Adhesine eggs

ANNEX G

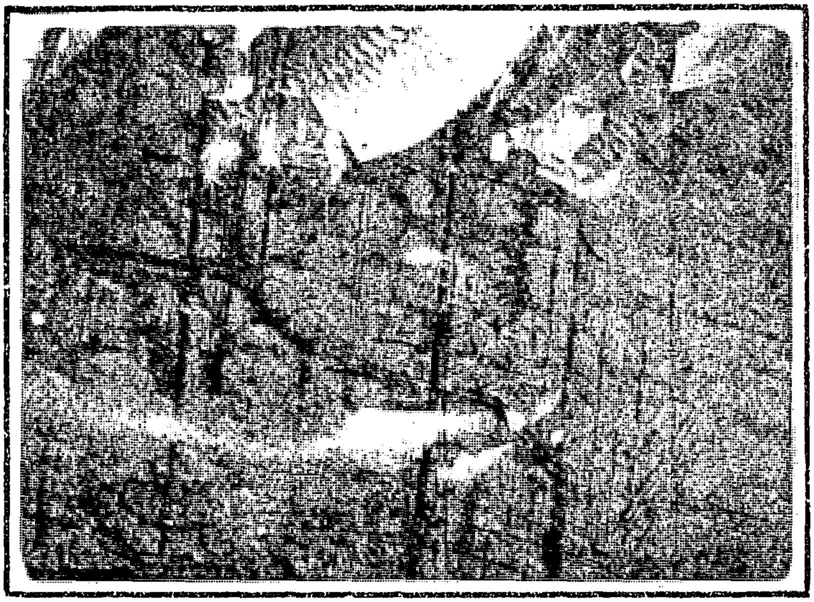
INDUCED SPAWNING ON *Leptobarbus hovenii*

USAID/ARD 497-0286 AID 497-0286-S-00-4062-00

INDUCED SPAWNING ON

Leptobarbus hovenii (Bleeker)

CARRIED OUT IN JAMBI, INDONESIA



by
Samruay Meenakarn
Fish Breeding Advisor

The Directorate General of Fisheries, Indonesia,
in Collaboration with
the United States Agency for International Development,
in the Cage Culture and Seed Production Sub-project
of the Small Scale Fisheries Development Project.
Jakarta, July 1986

CORRECTION

Page	Item	Correction
Contents	illustratione HORMANE	illustrations HORMONE
1	reverine extensivelly. anca popuier bahicat United States Agency of	riverine extensively and popular habitat United States Agency for
5	pererequisite well - rounded jins	prerequisite well-rounded fins
7	environnental messengres hormane	environmental messengers hormone
8	ectraction hormon-extrac hormon-ectracts	extraction hormon-extract hormon-extracts
13	(milk)	(milt)
17	a though	although
19	2-3 inches or	2-3 inches or over
2[illegible]	Wish tanks would have not	wish thanks would not have

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P R E F A C E

This manual has been prepared within the framework of Small Scale Fisheries Development Project, implemented by the Directorate General of Fisheries, Indonesia, in collaboration with the United States Agency for International Development. It is primarily meant to disseminate technical and practical knowledge to extension workers and to other personnel engaged in fish breeding activities.

The contents deal with the induced breeding, specifically of Leptobarbus hovenii (Bleeker) which has successfully been the firstfruit of the author's trials carried out in Jambi province of Indonesia. It highligts the general biological aspects and presents the artificial breeding technique of this species. Preparation of broodstocks, spawning and fertilization, incubation method and subsequently, larval rearing technique are discussed. The preparation of hormone, collection of pituitary glands, injection technique are also dealt with. Finally, to make the manual more comprehensible, steps of activities are also profusely illustrated.

Samruay Meenakarn
Fish Breeding Advisor

Jakarta, July 1986.

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INDUCED SPAWNING ON LEPTOBARBUS HOVENII (BLEEKER) CARRIED OUT IN JAMBI, INDONESIA

1. INTRODUCTION

Leptobarbus havenii, originally is reverine freshwater fish which belongs to a medium size carp. This species is extensivelly distributed over a large areas of open -water in Indonesia, with enormous potential in Jambi Province anda Kalimantan. This species is populer with local name of 'Ikan Jelawat' or 'Ikan Kelemak'.

People of Jambi area have, over fifty years, practised how to collect fingerlings of this species from the natural bahibat before being stocked and reared in the floating cages or earthen ponds.

Leptobarbus hovenii being a herbivore, is characterized by its ability to grow very fast in captivity with feeding regime consists of herbage or vegetables but may also with other available food stuff or wastes disposed from kitchen or market. Additionally, the fish is not anly of good taste and flavour but it also is of good market.

Because of the above reasons, in the areas like Jambi, Palembang and Kalimantan, people are practising **Leptobarbus hovenii** culture with great interest. However, one of the main impediments in developing the effort is the lack of seed supplies. Fingerlings that collected from the nature are insufficient to meet huge demands.
Besides, the production of seeds which very much dependent on natural conditions is not steadily obtained.

To overcome the problem, the Directorate General of Fisheries in collaboration with the United States Agency of International Development have established an applied research dealing with the induced breeding of **Leptobarbus hovenii**, implemented in Jambi province, in their effort to increase the production of fingerlings.

2. BIOLOGY

As mentioned above, **Leptobarbus hovenii** is not only found in Sumatra and Kalimantan but the species is also distributed over Malaysia and Thai-

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land. The fish is recognizable from its board head, four well depeloped barbels (rostral and maxillary), moderate-size mouth with maxillary reaching vertically from the front of the eyes, spoon-shaped pharynged teeth in three rows (5, 3, 2), medium size scales, continuous lateral line running in lower part of caudal peduncle and short dorsal and anal line with seven and five branched rays, respectively.

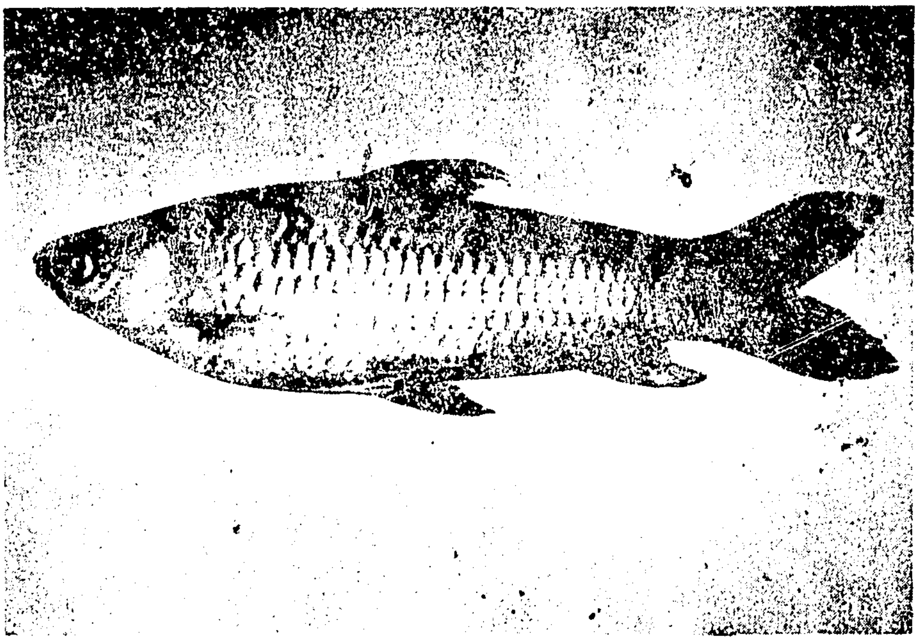

Figure 1. <u>Leptobarbus</u> <u>hovenii</u> (Bleeker)

The largest size can attain 50 cm of length and weighing about 5-6 kg. Every size of fish looks beautiful, in small or medium size for example; there is a sharply defined broad black lateral band from head to base of caudal fin. This band, intensified in the young, becomes obscure or altogether disappears in the large fish. Scales of back and sides light green with dark green centres, belly white, top of head rich grass green with rosy reflections, opercles lustrous golden or blassy yellow, a black blotch

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behind opercles, iris yellow, dorsal fin hyaline green, ventrals and anal blood red, caudal red distally and dull green at base with the interventing part light grey and pectorals hyaline.

Leptobarbus hovenii is herbivorous which subsists on aquatic plants, fruits, leaves, vegetables, etc. They are riverine fishes, spawn in the upstream during rainy season, semi-buoyant type of eggs, fecundity about 120,000 – 150,000 for 1 kg female weight. The incubation period takes about 15–18 hours at water temperature of 25 – 28 °C. Larvae and fingerlings subsist on phytoplankton, zooplankton, water insects and algae.

3. PREPARATION OF BROODSTOCKS

3.1. Collection of broodstocks

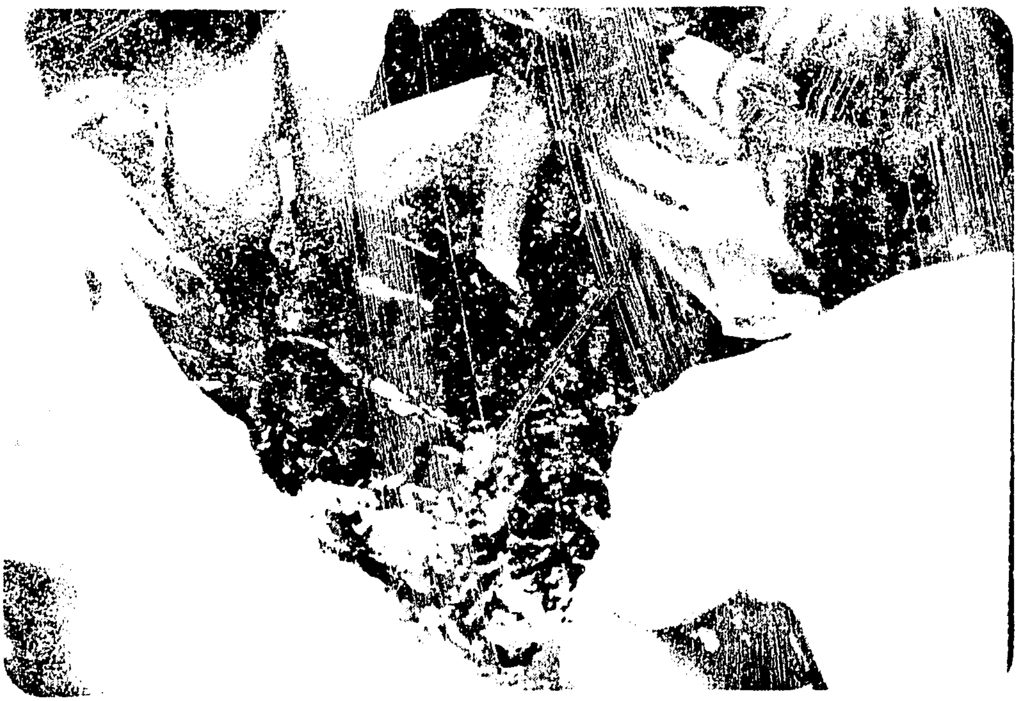

Figure 2. Collection of broodstocks

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Large size of prospective brooders, in which case weight and age should be strictly selected, captured by fish-farmers can be held in captivity either in the floating cages or in the earthen ponds for the eventual broodstocks. These adult fishes will be fully mature after 1 year old and be effectively spawned during their 3 to 7 year of age. The brooders weighing 1 kg or over, which usually over 1 year old, should therefore be readily prepared in order to enable the building-up and selection of healthy brooders. In any case, fingerlings can also be collected, provided that the period of rearing should be extended for another year.

3.2. Rearing of broodstocks

At Mudung lake where the station of trial was located, the mature brooders were reared in the floating cages measuring 4 x 8 x 1,5 m^3 in

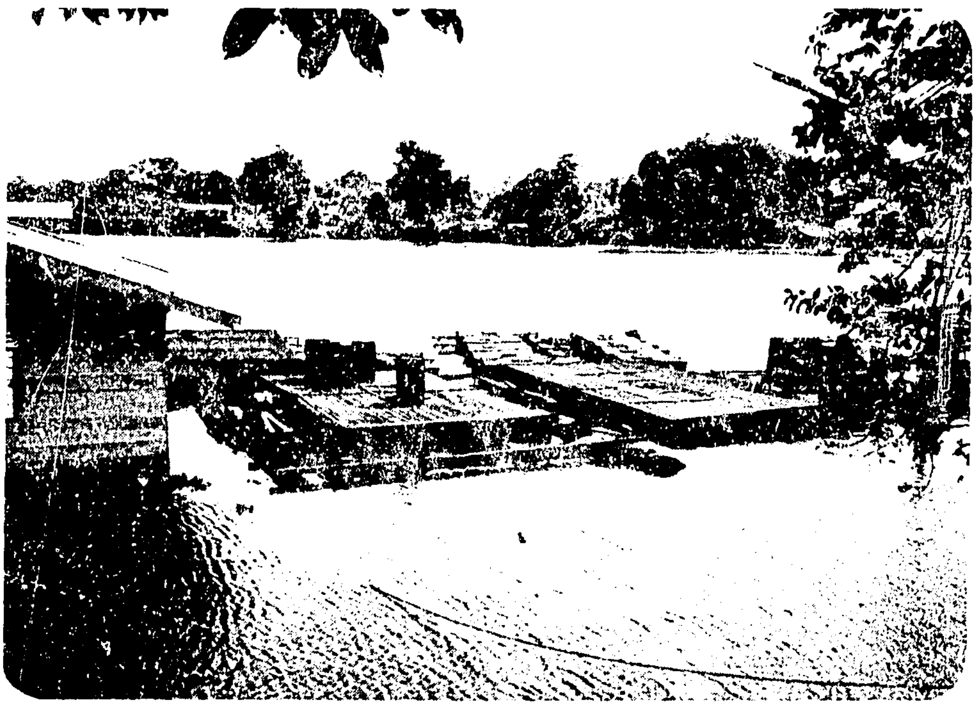

Figure 3. Floating cages for rearing broodstocks

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which males and females were stocked togehter with stocking density for 2 fishes per square metre.

Pellet diet with protein content of about 30% was given at the rate of 3% of body weight per day. Vegetables at about 10% of body weight were supplemented twice a week. The pellet diet was formulated as follows:

Fish meal	35%
Soy bean meal	25%
Rice bran	20%
Copra cake	10%
Wheat flour	6%
Vitamin premixture	1%
Mineral	3%

Additionally, it was reported that in Thailand, **Leptobarbus hovenii** has been successfully reared since 1973. By applying cooked food regime with a formula consisted of 30% fish meal, 20% soy bean meal, 20% rice bran, 20% broken rice and 10% ipomea, it was indicated that the brooders attained their readiness for induced spawning (Varikul and Meenakarn, 1973).

3.3. Selection of mature brooders.

Leptobarbus hovenii will normally be able to ovulate and ready for spawning during the rainy season between October to March. Since sexually mature and healthy brooders are pererequisite for any kind of induced spawning procedure, therefore, mature female and male brooders must be selected with care and exact.

In mature females, the ripe eggs should attain the fourth stage of development process. The eggs will be rounded shape and greenish grey, the ovaries weighing about 15–20% of body weight. There are physical indications of male and female brooders that are in ready--to--spawn condition.

The females have big, well – rounded and soft belly, scales along abdomen separated and swollen vent whereas in males the pectoral jins become rough and the milt will be in oozing condition when the abdomen being stripped.

Figure 4. Selection of mature brooders

Figure 5. Mature female brooder

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4. PREPARATION OF HORMONE

4.1. Hormone

Hormone normally administered for induced breeding is made up of biological compound produced in the pituitary gland of endocrine system. This hormone is secreted to control reproductive events. In nature, the reception of environnental stimuli such as day length (photo period), temperature and the amount of rainfall is mediated by the nervous system and involves the passage of information from sensory receptors to brain. This neural information, upon reaching the hypothalamus, determines the activity of the pituitary gland through chemical messengres termed releasing hormones. These in turn stimulate the pituitary gland to release, into the general circulation, a hormone whose target organ is the gonad. This hormane is termed a gonadotropin. In young animals the hormone is not well developed until they reach adult stage in which pituitary gland produces sex hormone to facilitate reproduction.

Figure 6. Pituitary gland

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The pituitary gland is located underneath the midbrain of animals. Environmental stimuli such as rainfall, optimum temperature and water quality conditions, facilitate the spawning of fish. This is one of the reasons that almost all riverine species require favourable conditions in bringing about the pituitary gland to secrete the hormone in enhancing maturation of eggs and sperm prior to natural spawning takes place.

There are two hormones considered to be effective for the induced spawning process, i.e. Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FHS). The pituitary gland of adult fish usually contains both FH and FSH which are important factors for induced breeding.

4. 2. Source of Hormone

The pituitary gland being employed to induce the female brooder to release eggs, is usually collected from the same species or termed 'homoplastic pituitary extract'. However, after several experimentations, it has been indicated that the pituitary gland of common carp can be effectively manipulated to induce every other species, particularly in induced spawning of **Leptobarbus hovenii**, the pituitary gland of common carp is, in point of fact, more effective than that of **Leptobarbus hovenii** itself. Therefore, common carp is referable to 'universal donor'. In Thailand the induced spawning on **Leptobarbus hovenii** has been successful by manipulating the pituitary gland of Chinese carp (Varikul and Meenakarn, 1973).

In several species, i.e. **Pangasius pangasius**, **Pangasius sutchi**, **Pangasianodon gigas** and **Leptobarbus hovenii**, ready-made hormone-extract is currently being employed, because this pure hormone contains about 90% LH and 10% FHS. Therefore, in induced breeding process the hormone -extract used should be complemented with the ectraction of homogenized pituitary gland to supplement the FHS content which is lacking in the hormone-extrac. Without the addition of crude extract of pituitary gland, the process of spawning will not effectively take place.

There are a number of hormone-ectracts that commonly administered for the induced breeding practices in Thailand. Those are:

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Name	Unit
HCG (Human Chorionic Gonadotropin)	IU [1)]
Pregnyl	IU
Physex	IU
Chorion	IU
Synahorin	RU
Pare hormone	RU [2)]

1) International Unit
2) Rodent Unit

4.3. Administration of Hormone

In induced breeding procedure, the pituitary glands are collected from donors. The dosage of pituitary glands and hormone mixture that injected to the brooders should be in optimum ration, otherwise the process of spawning will not be successful.

There are two methods of calculating the amount of pituitary gland required for induced spawning by applying weight (mg) of gland and dosage. The first method is considered rather laborious, for the glands should be preserved in pure acetone or in absolute alcohol before being dried up in dessicator. The dried tissue is then accurately weighed up.

The dosing method is preferable recently, particularly in Thailand because it is easier to measure body weight of both recipient and donor in adjusting the optimum dosing requirement.

$$\text{dose} = \frac{\text{donor}}{\text{recipient}}$$

$$1 \text{ dose} = \frac{1 \text{ unit donor}}{1 \text{ unit recipient}}$$

4.4. Preparation of hormone solution

The pituitary gland located underneath the brain is removed, using a pair of forceps, by chopping off and opening up the upper part of donor's head. The gland should then be finely ground in a homogenizer and added with either distilled water or 0,7% sodium chloride solution. The whole solution is used to inject the brooders.

The volume of solution is adjusted between 1–2 mls, depending on the size of the brooders. Normally 1 ml of solution is administered to 1 kg body weight of recipient.

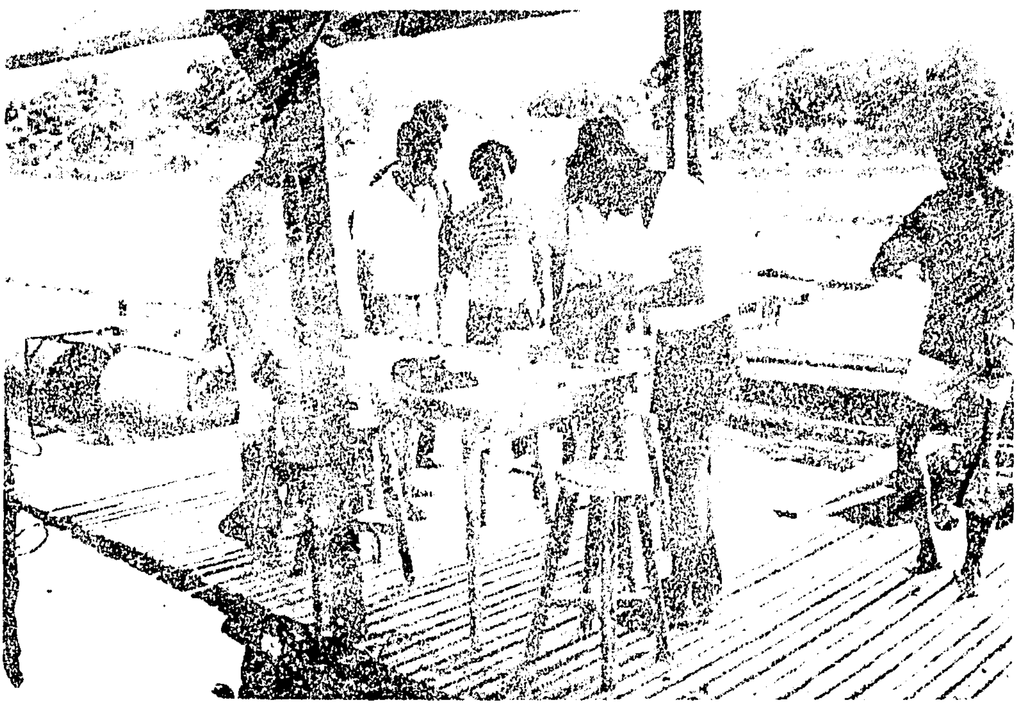

Figure 7. Preparation of hormone solution

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5. INJECTION TECHNIQUE.

The solution is injected intramuscularly to the female recipient on any part of area such as pectoral girdles, the side part between lateral line and dorsal fin, on pelvic girdle and dorsal girdle etc. The **Leptobarbus hovenii** is very conveniently injected at the back part of dorsal fin, because the brooders can be kept in the water while being injected.

Two instalments of injection are given to the **Leptobarbus hovenii** brooders; the introductory or preparatory dose of 0.5 followed by final or decisive dose of 2.5 plus 100 IU hormone-extract. Between the preparatory and decisive dose there is a time - lapse of 6 to 8 hours. The detail of dosage is as follows:

Sample	Weight (kg)	1st instalment of injection		2nd instalment of injection		Time-Lapse between 1st-2nd Instalment (hours)	Ovulation after 1st injection (hours)	Hatched out (%)
		PG (dose)/ donor's*) weight (kg)	HCG (IU)	PG (dose) donor's*) weight (kg)	HCG (IU)			
1	2.2	0.5/ 1.1	–	2.5./ 5.5	100	6	10	50
2	2.0	0.5/ 1.0		2.5/ 5.0	100	6	10	50
3	1.7	0.5/ 0.85		2.5/ 4.8	100	6	10.5	80

Common carp was used for donor.

PG : pituitary gland.

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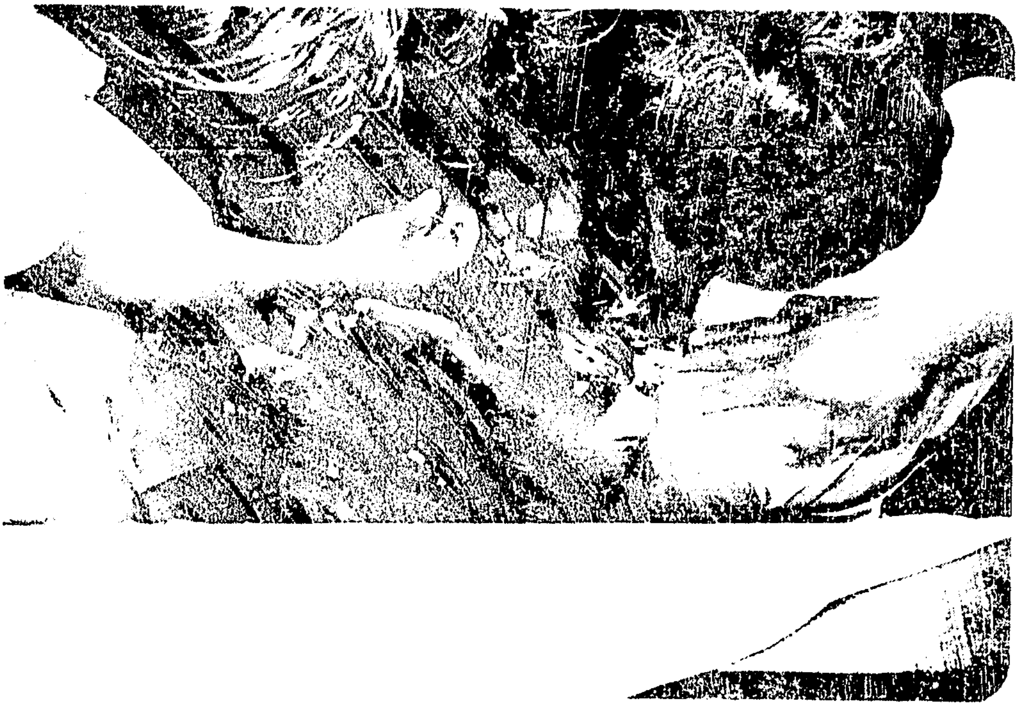

Figure 8. Intramuscular injection

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6. SPAWNING AND FERTILIZATION

Figure 9. Stripping eggs or sperm (Dry method)

Immediately, after the final injection the brooders should be returned to the hapa which has been suspended in the tank or cage. The brooders must be carefully watched for indications that the eggs and sperm are ready to be stripped. In **Leptobarbus hovenii**, stripping is a convenient way to enhance fertilization process.

When the eggs begin to flow freely, in which case the event can occur between 10–12 hours after the first injection, the females to be netted gently for being stripped first during their ovulation period and the eggs are then placed in a dry container (Plastic bowl). Immediately, the males are also stripped off and the sperm (milk) is then put into the same

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Figure 10. Fertilization process takes place while the eggs being rinsed off.

container. The eggs and sperm are mixed together very gently using feather for half of a minute before adding water to cover the eggs and stirred for 1–2 minutes to rinse and release mucous. In this dry method, the fertilization takes place immediately after the water is added. In wet method, the eggs and sperm are mixed together with water in a container. Following this process which completely takes about 1 hour, the eggs will be transfered into an incubator or hatching devices.

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7. INCUBATION METHOD

The eggs of **Leptobarbus hovenii** is semi-bouyant type. Hatching funnel or jar immersed in aerated water and equipped with water installation is suitable for hatching this type of eggs, however, the hapa system suspended in stagnant water can also be operated, provided that number of eggs must be in optimum density.

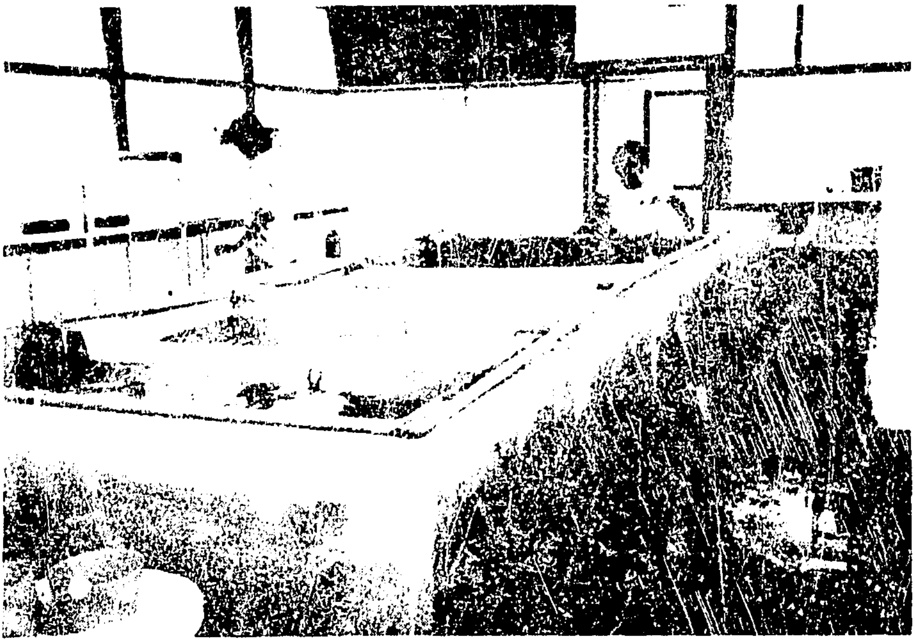

Figure 11. Hatching of eggs (Hapa)

Water quality is a critical factor during the hatching process. The water must be fresh, clean and clear. Temperature should be maintained between 25 – 28°C for hatching this semi-bouyant type of eggs. Higher water temperature (29°C or over) will speed up the development process

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of eggs too early and that will cause high mortality.
Hatching period of the **Leptobarbus hovenii's** eggs takes about 15 - 18 hours at the water temperature of 25 - 28°C.

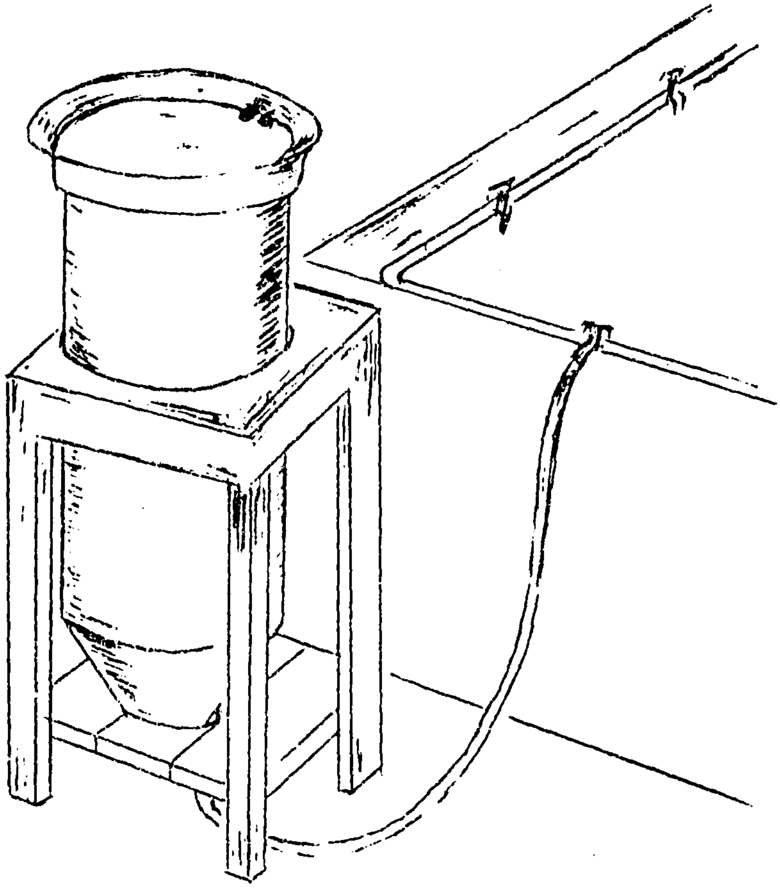

Figure 12. Incubator used for semi-bouyant type of eggs.

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LARVAL REARING

Larval rearing is one of the main activities should be carefully prepared because the production of fingerlings will particularly depend on the way the larvae being treated during their critical period, a though every step of breeding process i.e. selection of brooders, injection technique, fertilization and hatching should be carried out thoroughly.

There are several crucial points should be taken into account in the process of larval rearing:

8.1. Type of container

After the fertilized eggs are hatched out, newly larvae are suitably reared in the aquariums or in the concrete tank during their first 15 - day of life, in order to make the cleaning of container easier. After 15 - day of age the larvae can then be transferred into the nursery earthen pond or floating net with small size meshes.

8.2. Food and Feeding

Two different types of food are given to fish fry in a form of life-food such as phytoplankton, zooplankton, tubifex, brine shrimp or artemia etc. and supplementary food like egg- yolk, rice bran, fish meal etc.

Within 2 3 days after the eggs hatched out when the yolk sac begins to disappear, the **Leptobarbus hovenii** larvae will be able to eat immediately.

Live-food is crucially required for feeding fry during 15–day of life, because the food will retain longer in every part of water and will not pollute the container. Supplementary food is given to the fry after 15–days old when, the fry being reared in the earthen ponds. Live-food is still required during the period of life in the nursery which can be provided by way of fertilizing the pond.

The feeding rate can not be calculated from the percentage of body weight, but the amount of food should be estimated according to the density of fry and the size of container.

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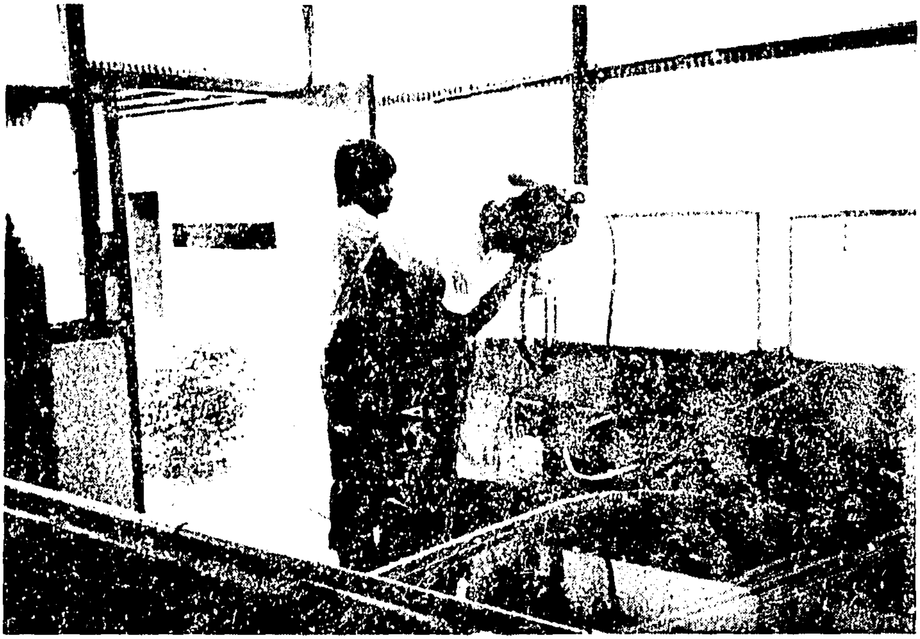

Figure 13. Larval rearing activity.

8.3. Water supply

The water, during the first 15–day of life, supplied for the young fry should be clean and should contain no harmful substances. During this period the container should be cleaned and the water should regularly be changed every day for about one third of the volume. After 15 days of their life when the fry are nursed in the earthen pond, fertilizer should be applied to provide live food.

8.4. Hatchery Management

Hatchery management is the most important aspect to be undertaken

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Preparation of food, optimum feedingrate, feeding time, preparation of water supply, control of temperature, aeration system, prevention of diseases and predators should be carefully performed.

DIAGRAM OF LARVAL REARING FOR **LEPTOBARBUS HOVENII**

Age	Activities
Fertilization	Stripped eggs, sperm, dry method
Hatching out	In hapa, aquarium, during 15 – 18 hours period at water temperature of 26 – 28^{o} C
1 – 2 days	Rearing in the hatching containers.
3 days	Transfer from hatching containers to aquarium, fibreglass tank or concrete pond. Start feeding with boiled egg--yolk every 6 hours interval.
4 days	Adding some water about 2 – 3 inches or.
5 – 15 days	Feeding with live moina twice a day Clean the bottom of containers by syphoning method
15 – 60 days	Feeding with supplementary food with ration for fish meal 5 : soy bean meal 2 ; rice bran 2; wheat flour 1; (by weight).
Remark	Every step of activities should be equipped with aeration system.

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My sincere appreciation goes to Dr. Josephine Wiryanti for her assistance in preparing this manual.

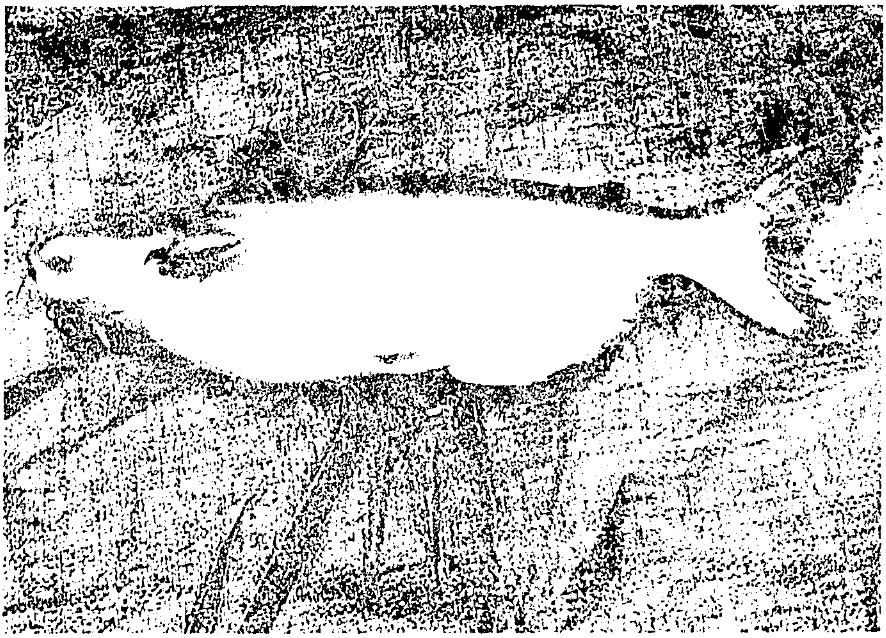
Vw

ANNEX H

INDUCED SPAWNING ON *Pangasius pangasius*

USAID/ARD 497-0286 AID. 497-0286-S-00-4062-00

INDUCED SPAWNING ON *Pangasius pangasius* (Hamilton) CARRIED OUT IN SOUTH SUMATRA, INDONESIA



By :
Samruay Meenakarn
Fish Breeding Advisor

The Directorate General of Fisheries, Indonesia
in collaboration with
The United States Agency for International Development
in the Cage Culture and Seed Production sub-project,
of the Small Scale Fisheries Development Project
Jakarta, July 1986

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1\b

PREFACE

This manual has been prepared within the framework of Small Scale Fisheries Development Project, implemented by the Directorate General of Fisheries in collaboration with the United States Agency for International Development. It is primarily meant to disseminate technical and practical knowledge to extension workers and to other personnel engaged in fish breeding activities.

The contents deal with the induced spawning, specifically of **Pangasius pangasius** (Hamilton) which has successfully been the firstfruit of the author's trials carried out in South Sumatra province, Indonesia. It outlines the general biological aspects and presents the artificial breeding technique of this species. Preparation of broodstocks, spawning and fertilization, incubation method and subsequently larval rearing technique are discussed. The preparation of hormone, collection of pituitary glands, injection technique are also dealt with. Finally, to make the manual more comprehensible, steps of activities are also profusely illustrated.

Samruay Meenakarn
Fish Breeding Advisor

Jakarta, July 1986.

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INDUCED SPAWNING ON
Pangasius pangasius (Hamilton)
CARRIED OUT IN SOUTH SUMATRA, INDONESIA

I. INTRODUCTION.

Pangasius pangasius one of quite popular freshwater fish species belongs to medium-size riverine catfish. The species is distributed over areas of open-water in Indonesia with great potential in South Sumatra and Kalimantan. The fish is familiarized with local name of "Ikan Patin". A great deal of catch comprise marketable-size and only a small part of that consists of fingerlings which are then usually reared and stocked in floating cages or earthen ponds.

Pangasius pangasius being an omnivore, is characterized by its ability to grow very fast in captivity with any kind of food. In Palembang area, the species reared in the floating cages or earthen ponds is extensively fed with locally available food stuff like small trash fish or food remnants such as frog's leg, chicken gut, soy bean curd even with all kinds of food wastes disposed from the kitchen or market. Considering that the area is quite rich with other better-quality food ingredients such as fish meal, soy bean meal, rice bran, broken rice etc, recommendation should therefore be made to intensify the fish culture by utilizing the locally available diet to improve the feeding practices.

Moreover, one of other constraints that hinder the effort in intensifying the culture of Pangasius pangasius is caused merely by lack of fingerlings. This is one of the reasons that the Directorate General of Fisheries, in collaboration with the United States Agency for International Development implement applied research on induced breeding trial and subsequently in increasing seed production.

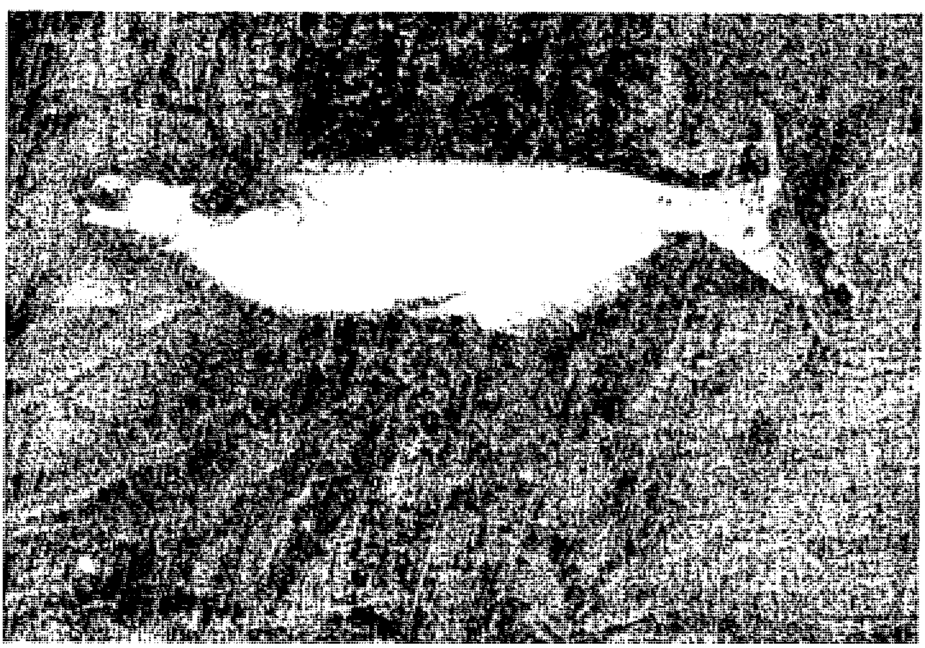

Figure 1. Pangasius pangasius (Hamilton).

2. BIOLOGY.

Pangasius pangasius originally is riverine fresh-water species, potentially found in Kalimantan, South Sumatra and also Thailand. This species may be recognized by a combination of structural characteristics and unique colour feature. The vomerine teeth were in 2 separate quadrate patches as broad as the eye, flanked by 2 narrow lenticular palatine patches as long as the eye. The maxillary barbels barely reached the base of the pectoral fins. The anal rays were iii, 28 or 29. The exil of the pectoral fins had 4 distinct pores. Back light grey-green, top of head light green, sides pearly white, belly dazzling white, sides of head and front jaws pure creamy white: dorsal fin hyaline-pink, caudal mostly pink, with dorsal part of upper lobe grey, anal hyaline distally, pink at base, ventrals and pectorals hyaline, adipose fin green-grey with a broad white posterior margin.

The largest fish attains nearly one metre and weighing 15–18 kg. They are omnivorous, subsist on any kind of food material, but during the begining of life until attaining fingerling size, they rather be more carnivorous. As riverine fishes, they spawn in the river during rainy season. The brooder produces adhesive eggs with fecundity about 100,000 – 130,000/1 kg of female weight. The incubation period is about 40 – 44 hours at water temperature of 27–29°C. Larvae and fingerlings subsist on zooplanton and water insects.

3. PREPARATION OF BROODSTOCKS.

3.1. Collection of broodstocks.

As previously mentioned that all-sizes of fish are captured by the fishfarmers from the natural habitat. The larger-size fishes, are supposedly quite appropriate for prospective broodstock, but since the size is too big the fishermen find it difficult to handle and transfer the adult fishes from the fishing ground to the floating cages, because they can easily get injured themselves and will cause high mortality during transportation.

Fingerlings seem to be more conveniently collected for prospective broodstock, although they have to be reared for a further year to obtain the sexually mature brooders. The adult fish will be effectively spawned during their 3 to 7 year of age.

Figure 2. Collection of broodstocks.

3.2. Rearing of broodstocks.

At Gandus (Musi river) where the station of trial was located, the brooders were reared in the floating cages measuring 2 x 3 x 1,5 m^3 in which males and females were stocked together with the stocking density for 10 fishes per square metre. Cooked food with protein content of about 30% was prepared for the feeding and was given at the rate of 4% (dry weight) of body weight. Trash fishes or small fishes at about 10% of body weight were supplemented twice a week. The cooked food was formulated as follows.

Fish meal	40%
Rice bran	40%
Broken rice	18%
Vitamin	2%

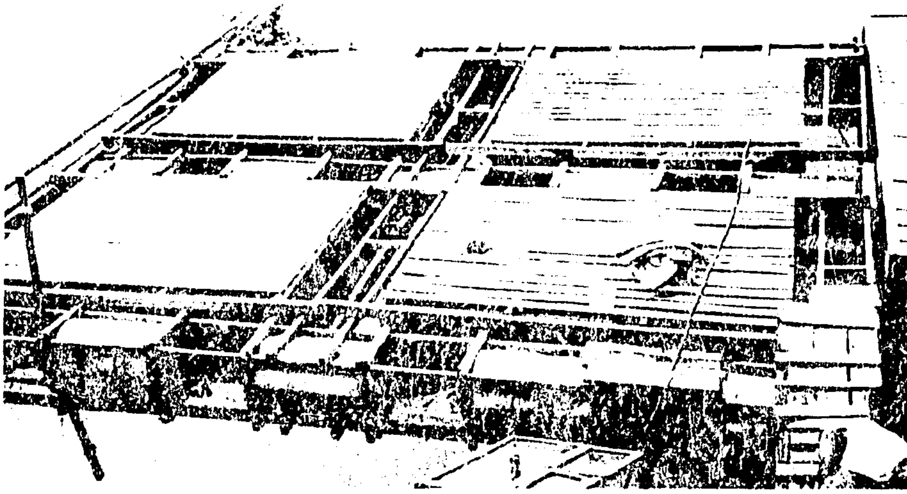

Figure 3. Floating cage for rearing broodstocks.

3.3 Selection of mature brooders.

Pangasius pangasius will normally be able to ovulate and ready for spawning during the rainy season between October to March. Since sexually mature and healthy brooders are prerequisite for any kind of induced spawning procedure, therefore, mature female and male brooders must be selected with care and exact.

Figure 4. Selection of mature brooder.

In mature females, the ripe eggs should attain the fourth stage of development process. The eggs will be rounded shape and greenish grey, the ovaries weighing about 10—15% of body weight. There are physical indications of male and female brooders that are in ready-to-spawn condition.

The females have big, well-rounded and soft belly, vent reddish and swollen, whereas in males, the genital opening becomes reddish and the milt will be in oozing condition when the abdomen being stripped.

4. PREPARATION OF HORMONE.

4.1. Hormone.

Hormone normally administered for induced breeding is made up of biological compound produced in the pituitary gland of endocrine system. The hormone is secreted to control reproductive events. In nature, the reception of environmental stimuli such as, day length (photo period), temperature, and the amount of rainfall is mediated by nervous system and involves the passage of information from sensory receptors to brain. This neural information, upon reaching the hypothalamus, determines the activity of the pituitary gland through chemical messengers termed releasing hormones. These in turn, stimulate the pituitary gland to release, into the general circulation, a hormone whose target organ is the gonad. This hormone is termed a gonadotropin. In young animals the hormone is not well developed until they reach adult stage in which the pituitary gland produces sex hormone to facilitate reproduction.

Figure 5. Pituitary gland.

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The pituitary gland is located underneath the mid brain of animals. Environmental stimuli such as rainfall, optimum temperatuie and water quality conditions facilitate the spawning of fish. This is one of the reasons that almost all riverine species require favourable conditions in bringing about the pituitary gland to secrete the hormone in enhancing maturation of eggs and sperm before natural spawning takes place.

There ate two hormones considered to be effective for inducing the spawning process, i.e. Luteinizing Hormone (LH) and Folicle Stimulating Hormone (FSH). The pituitary gland of adult fish usually contains both LH and FSH which are important factors for induced breeding.

4.2. Source of hormone.

The pituitary gland being employed to induce the female to release eggs, is usually collected from the same species or termed "homoplastic pituitary extract". However, after several experimentations, it has been indicated that the pituitary gland of common carp can be effectively manipulated to induce every other species, particularly in induced spawning of Pangasius pangasius, the pituitary gland of common carp is, in point of fact, more effective than that of Pangasius pangasius itself. Therefore common carp is referred to as "universal donor".

In some species, i.e. Pangasius pangasius, Pangasius sutchi, Pangasianodon gigas, Leptobarbus hovenii, ready-made hormone-extract is currently being employed, because this pure hormone contains about 90% LH and 10% FSH. Therefore, in induced breeding process the hormon-extract used should be complemented with the extraction of homogenized pituitary gland extract to supplement the FSH content which is lacking in the hormone-extract. Without the addition of crude extract of pituitary gland, the process of spawning will not effectively take place.

Following are a number of hormone-extracts that commonly administered for induced breeding practices in Thailand.

Those are :

Name	Unit
HCG (Human Chorionic Gonadotropin)	IU *)
Pregnyl	IU
Physex	IU
Chorion	IU
Synahorin	RU **)
Pare hormone	RU

*) International Unit
**) Rodent Unit

4.3. Administration of hormone.

In induced breeding procedure, the pituitary gland are collected from donors. The dosage of pituitary gland hormone mixture that injected to the brooders should be in optimum ration, otherwise the process of spawning will not successfully take place.

There are two methods of calculating the amount of pituitary gland required for induced spawning by applying weight (mg) of gland and dosage. The first method is considered rather laborious, for the glands should be preserved in pure acetone or absolute alcohol before being dried up in dessicator. The dried tissue is then accurately weight up.

The dosing method is preferable recently, particularly in Thailand because it is easier to measure body weight of both recipients and donors in adjusting the optimum dosing requirement.

$$\text{dose} = \frac{\text{donor}}{\text{recipient}}$$

$$1 \text{ dose} = \frac{1 \text{ unit donor}}{1 \text{ unit recipient}}$$

4.4. Preparation of hormone solution.

The pituitary gland located underneath the brain is removed using a pair of forceps by chopping off and opening up the upper part of donor's head. The gland should then be finely ground in a homogenizer and added with either distilled water or 0.7% sodium chloride solution. The whole solution is used to inject the brooders.

The volume of solution is adjusted between 1–2 mls depending on the size of the brooders. Normally 1 ml of solution is administered to 1 kg body weight of recipient.

5. INJECTION TECHNIQUE.

Figure 6. Intramuscular Injection.

The solution is injected intramuscularly to the female recipient on any part of area such as pectoral girdles, the side part between lateral line and dorsal fin, on pelvic girdles and dorsal girdles etc. The **Pangasius pangasius** is very conveniently injected at the back part of dorsal fin, because the brooders can be kept in the water while the injection takes place.

Two instalments of injection are given to the **Pangasius pangasius** brooders; the introductory or preparatory dose of 1.0 plus 200 IU followed by final or decisive dose of 3.0 plus 500 IU hormone-extract. Between the preparatory and decisive dose there is a time-lapse of 10 to 12 hours.

The detail of dosage is as follows :

Sample	Weight (kg)	1st instalment of injection		2nd instalment of injection		Time-lapse between 1st – 2nd instalment	Ovulation after 1st injection (hours)	Hatched out (%)
		PG (dose)/ donor's weight (kg)	HCG (IU)	PG (dose)	HCG (IU)			
1	3,5	1/3,5	200	3/10.5	500	11	18	80
2	3,0	1/3.0	200	3/9,0	500	11	18	80
3	2,5	1/2.5	200	3/7.5	500	11	22	50

Donor : Using Common carp

6. SPAWNING AND FERTILIZATION.

Immediately, after the final injection the brooder should be returned to the hapa which has been suspended in the tank or cage. The brooders must be carefully watched for indications that the eggs and sperm are ready to be stripped.

In **Pangasius pangasius**, stripping is a convenient way to enhance fertilization process. When the eggs begin to flow freely, in which case the event can occur between 18–22 hours after the first injection, the females to be netted gently for being stripped first during their ovulation period and the eggs are then placed in a dry container (Plastic bowl). Immediately, the males are also stripping off and the sperm(milt) is then put into the same container. The eggs and sperm are mixed together very gently using feather for half of a minute before adding water to cover the eggs and stirred for 1–2 minutes to rinse and release mucous. In this dry method, the fertilization takes place immediately after the water is added. In wet method, the eggs and sperm are mixed together with water in a container. Following this process which completely takes about 1 hour, the eggs will be transferred into an incubator or hatching devices.

Figure 7. Stripping eggs or sperm (Dry method)

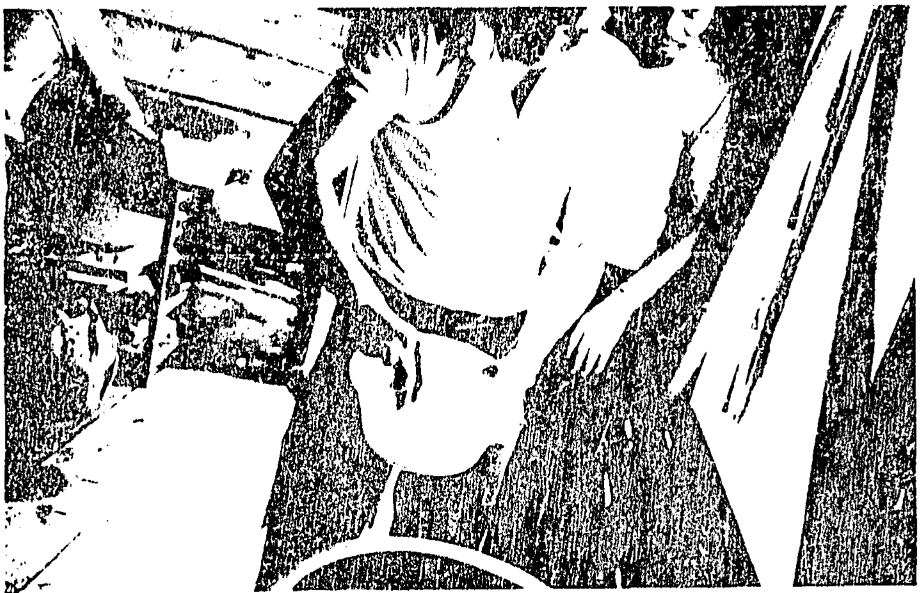

Figure 8. Fertilization process takes place while the eggs being rinsed off.

7. INCUBATION METHOD.

The eggs of **Pangasius pangasius** is adhesive type. Hatching kakaban or hapa system immersed in stagnant water is used for hatching this type of eggs. Hatching funnel or jar system can also be operated, provided that the fertilized eggs must be rinsed with muddy water to release the mucous before hatching.

Water quality is a critical factor during the hatching process. The water must be fresh, clean and clear. Temperature should be maintained between 27–30°C for hatching this adhesive type of eggs. The hatching period of **Pangasius pangasius** eggs takes about 40–44 hours at water temperature of 27–30°C.

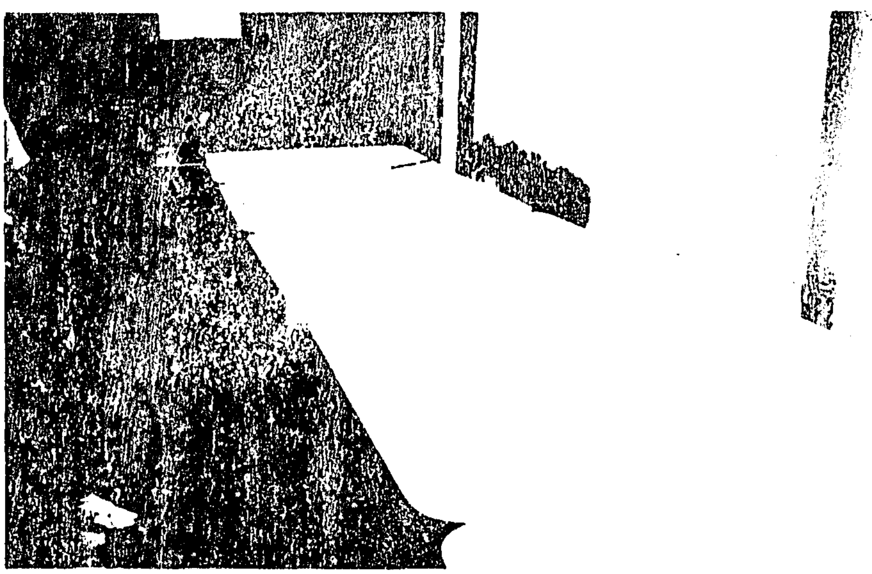

Figure 9. Hatching of eggs (hapa).

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8. LARVAL REARING.

Larval rearing is one of the activities should be carefully prepared because the production of fingerlings will particularly depend on the way the larvae being treated during their critical period, although every step of breeding process like selection of brooders, iniection technique, fertilization and hatching should be carried out thoroughly.

There are several crucial points should be taken into account in the process of **Pangasius pangasius** larval rearing :

8.1. Type of container

After the fertilized eggs are hatched out, the newly larvae are suitably reared in the aquarium or concreate tank during their first 15-day of life in order to make the cleaning of container easier. After 15-day of age the larvae can then be tranferred into the nursery earthen pond or floating net with small size meshes.

8.2. Food and Feeding.

Two different types of food are given to fish fry in a form of life food such as zooplankton, tubifex, brine shrimp or artemia etc. and supplementary food like egg-yolk, rice bran, fish meal etc. Moina is particularly good for larvae rearing.
Within 2–3 days after the eggs hatched out, when the yolk sac begins to disappear, the **Pangasius pangasius** larvae will be able to eat immediately.

Live food, is crucially required for feeding fry during 15 day of life, because the food will retain longer in every part of water and will not pollute the container. Supplementary food is given to the fry after 15 days old when the fry being reared in the earthen ponds. Live food is still required during the period of life in the nursery which can be provided by way of fertilizing the pond.

The feeding rate can not be calculated from the percentage of body weight, but the amount of food should be estimated according to the density of fry and the size of container.

8.3. Water supply

The water, during the first 15-day of life supplied for the young fry should be clean and should contain no harmful substances. During this period the container should be cleaned and the water should regularly be changed every day for about one third of the volume. After 15-days of their life where the fry are nursed in the earthen pond, fertilizer should be applied to provide live-food.

8.4. Hatchery management.

Hatchery management is the most important aspect to be undertaken. Preparation of food, optimum feeding rate, feeding time, preparation of water supply, control of temperature, aeration system, prevention of diseases and predators should be carefully prepared.

Diagram of Larval Rearing for **Pangasius pangasius.**

Age	Activity
Fertilization	– Stripped eggs, sperm, dry method.
Hatching out	– In hapa, indoor hatchery, during 40–44 hours at water temperature 27–29°C.
Newly Larvae	– Moved to aquariums or fibreglass tank. – Put antibiotic about 250 mg/aquarium. – Put some salt (Sodium chloride).
2 – 15 days	– Feeding with live moina twice/day. – Clean the bottom of aquarium by syphoning technique. – Change the water about a half of aquarium. – Put some salt (Sodium chloride) about 0,1%.
15 – 20 days	– Feeding with tubifex, red worm twice/day. – Change water, clean the bottom of aquarium, antibiotic, and salt still being applied.
30-----------------days	– Size about 1.5 inches. – Moved to the nursery cages (in the river) or earthen pond. – Fed with supplementary food (cooked food) or minced trash fish.
Remark	Temperature should be maintained about 28–30°C.

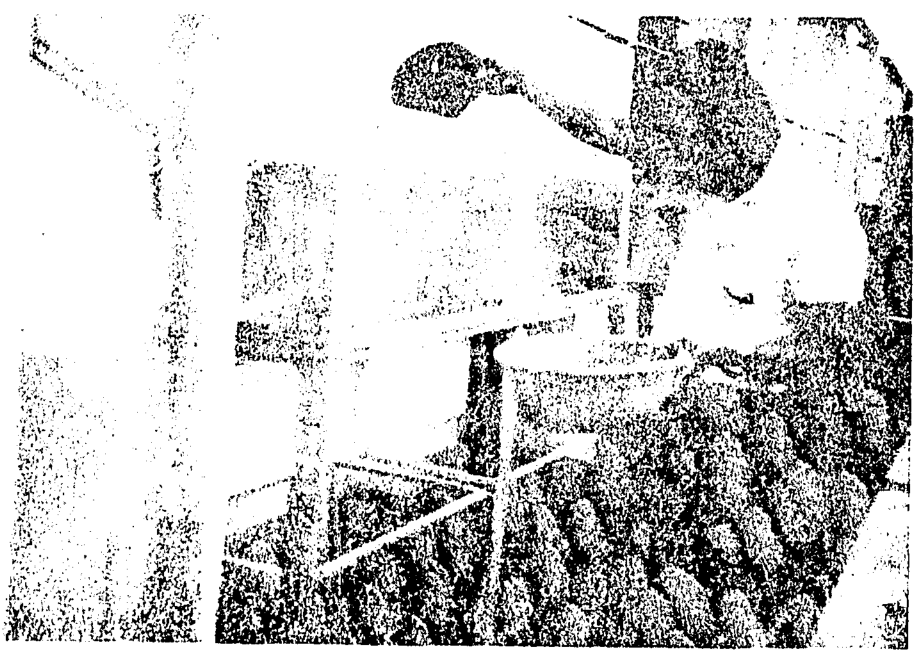

Figure 10. Larval rearing activity.

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I am most grateful to the Freshwater Fisheries Research Institute (BBPAT) personnel, namely Messrs Atmaja Harjamulia, Ondara and Zainal Arifin for their provision and care of the Pangasius pangasius brooders for the project, without those the outcome of induced breeding practices would not have become a reality.

My sincere appreciation goes to Dr. Josephine Wiryanti for her assistance in preparing this manual.

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ANNEX I

NATURAL BREEDING OF *Notopterus borneensis*

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USAID / ARD 497–0286 AID 497–0286–S–00-4062–00

BREEDING OF Notopterus borneensis (BLEEKER) CARRIED OUT IN SOUTH SUMATRA, INDONESIA

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The Directorate General of Fisheries, Indonesia,
in collaboration with
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in the Cage Culture and Seed Production Sub-project
of the Small Scale Fisheries Development Project.
Jakarta, August 1986.

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PREFACE

This manual has been prepared within the framework of the Small Scale Fisheries Development Project implemented by the Directorate General of Fisheries in collaboration with the United States Agency for International Development.

Its primary objective is to disseminate the author's technical and practical knowledge to extension workers and to other personnel engaged in fish breeding practices which ultimately to increase fish production.

The contents of this manual deal with natural breeding of Notopterus borneensis (Bleeker) under controlled conditions, which has successfully, for the first time, been carried out in South Sumatra province. It outlines the general biological aspects of the species, preparation of broodstocks, setting-up the spawning ground, spawning activity, incubation of eggs and the subsequent rearing of larvae and fry. To make the manual more comprehensible, steps of activities are also illustrated.

Samruay Meenakarn
Fish Breeding Advisor

Jakarta, August 1986.

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1. INTRODUCTION.

Notopterus borneensis (Bleeker), is very popular among freshwater species in Indonesia, particularly, in South Sumatra province with the local name known to be "Ikan Belida". The fish is traditionally important commodity, because of its good taste and flavour and it is also excellent for making crackers and fish ball. The products are not only consumed locally, but also distributed to other regions.

It is evident, however, that the production from the nature does not seem to sufficiently meet the high demands. There is also indication that due to some changes in environmental conditions, the species is threatened by extinction in their natural habitat and that the production shows declining trend.

Realizing these facts, the Directorate General of Fisheries in collaboration with the United States Agency for International Development have set up a Programme on breeding of Notopterus borneensis under the establishment of the Small Scale Fisheries Development Project.

Figure 1 Notopterus borneensis brooder.

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2. BIOLOGY.

Notopterus borneensis belongs to one of large-size freshwater fishes, found in rivers, and swampy areas distributed over Java, Kalimantan, Sumatra, India, Burma, Malaysia and Thailand. The body is elongated, broad, compressed and finely scales. The fish is also consisted of large membranous opercular flap; teeth on jaws; tonges; vomer; palatines and pterygoids; double serrated ridge along the median line of the very short abdomen; small tuftlike dorsal fin inserted near the middle of the long back; ribbonlike anal fin with 100 or more rays occupying seven – eights of the length of the head and body; small caudal fin confluent with the anal, and rudimentary ventral fins. Upper part of the body is black-grey colour, and silver or grey at the lower part, normally without spotted in the caudal fin region.

Notopterus borneensis is a carnivore, subsists on insects, and small surface-swimming fishes. They naturally belong to the mating spawning fishes, eggs deposited to stumps and cared for by the males. The fecundity is about 5.000–10.000 eggs, depending on the female size with the incubation period takes about 6–7 days at water temperature of 29–31°C.

Figure 2 Fence–system for rearing brooders.

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3. PREPARATION OF BROODSTOCKS

The breeding programme of <u>**Notopterus borneensis**</u> was initiated during the fiscal year of 1985–1986 of the Small Scale Fisheries Development Project. The brooders were collected from swampy areas at Tanjung Pering district and were strictly selected according to their age and size. Usually, males and females attain their weight of over 3 and 4 kgs, respectively, to become sexually mature, and be in ready-to-spawn during the season. At the time, more or less 50 pairs brooders, in about their second year were collected for stock. The sex ratio being one female to one male.

The male's sex organ is distinguishable from the female's one. A small and tiny papilla, next to the opening of cloaca is easily recognized, whereas the female's organ forms a small rounded tiny opening.

Figure 3 Selection of male and female fish.

In the swampy areas at Tanjung Pering and Lebung Karangan districts, the brooders were reared in fence-system made of bamboo measuring 10 x 20 x 4 m^3 in which males and females were stocked together.

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The stocking density being one fish in 4 m^2, and small fishes were used for feeding. The breeding preparation was commenced 3 months before the spawning season in September, 1985, when the water level fluctuated between 1 to 4 metres deep.

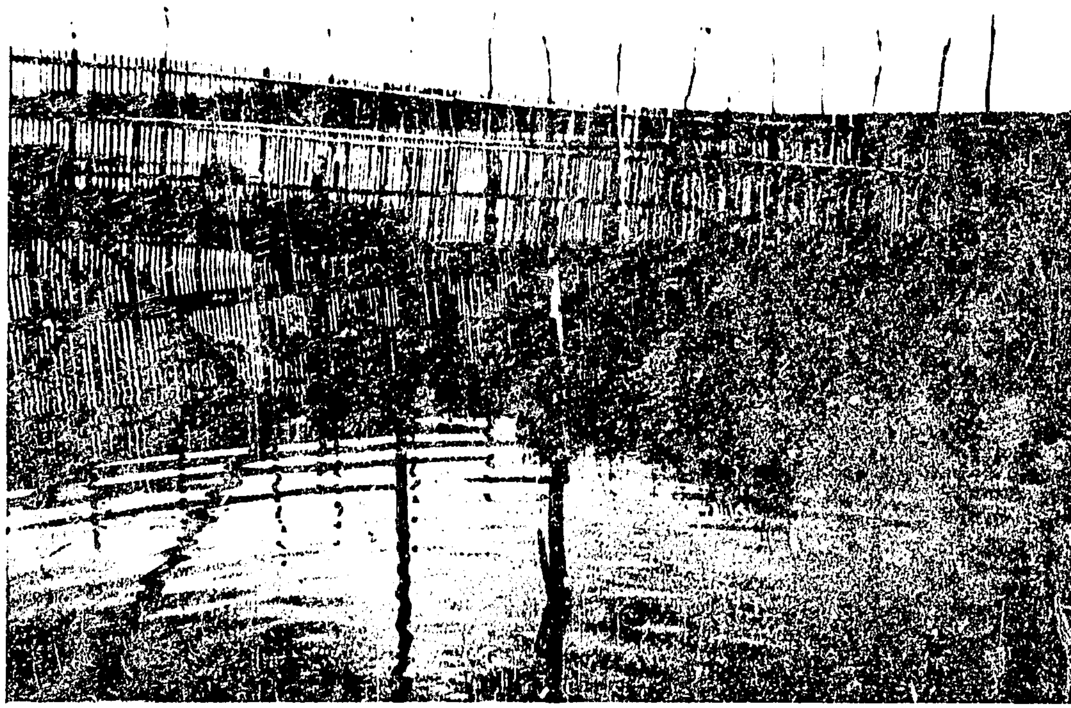

Figure 4 Spawning ground.

4. SETTING-UP THE SPAWNING GROUND.

Two bamboo fences of 10 x 20 x 4 m^3 constructed on the flat and muddy bed of the swampy areas, were not only used for rearing the brooders but were also, at the same time, set up for the spawning ground. Inside, the stumps or wooden sticks were posted every 2 metres interval for the eggs being attached to. Floating weeds found on the surface and other water plants were left to grow and used as hiding place for the fish.

5. SPAWNING ACTIVITY.

The brooders were started to be collected and reared in September 1985 and the males and females were stocked together in the bamboo fence. During the rainy season (in October March) the water in the swamp normally rose and in the spawning ground fluctuated between 1 to 4 metres.

In December 1985, when the water level in the spawning ground remained 2 to 3 metres in depth, there was an indication that the brooders were in the mating behaviour. When they were in pairs swimming around the posts and frequently splashing about the surface, this indicated that during this period the spawning activity was taking place. Fertilized eggs were laid and deposited to the posts, about half to one metre above the bottom of the ground or about 1.5 to 2 metres under the surface.

During the spawning activity the parental care of eggs developed only on male fish.

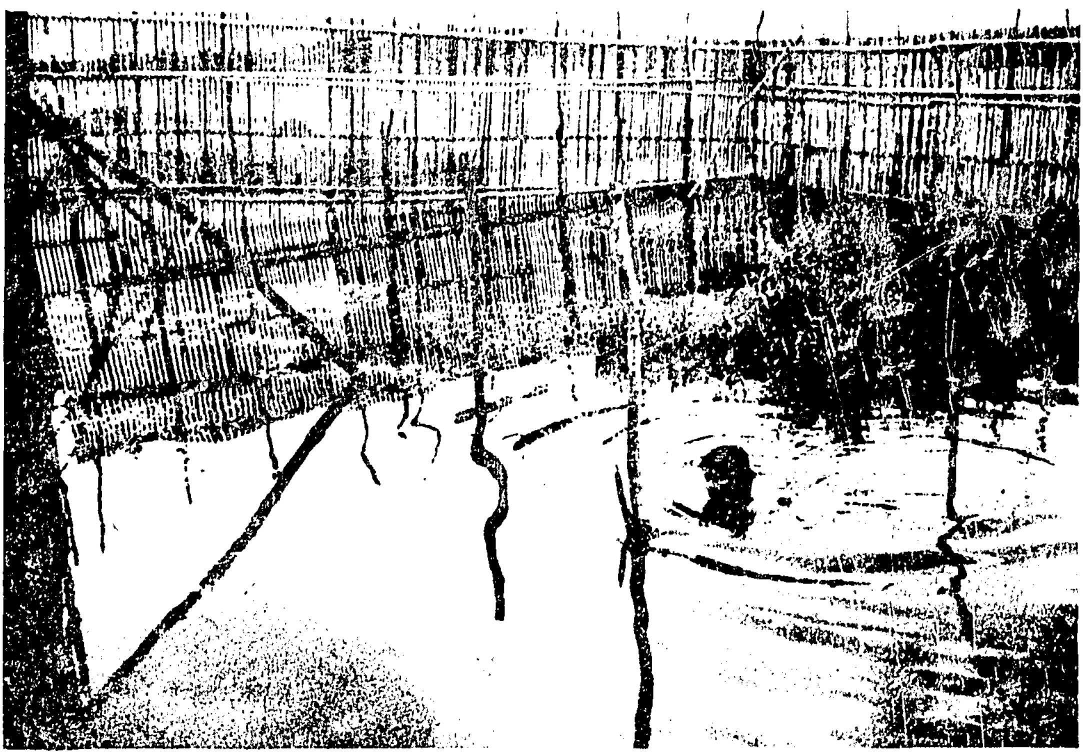

Figure 5 Checking the egg-nests.

Throughout the hatching period the male usually is in assiduous attendance. Natural enemies comprising, for the most part, of small fishes are driven off. An equally important duty of the male is keeping the eggs aerated and free from the sediment by fanning movements of the tail. In the sluggish water of swamp the eggs may became covered with sediment, which prevents normal development and induces the growth of fungus. If the guardian is removed the eggs are preyed on by small fishes and those that escape are coated with sediment and ultimately asphyxiated.

Figure 6. Cutting the eggs-laden stump.

6. INCUBATION OF EGGS.

In the fence-system, the fertilized eggs that attached to the posts were easily destroyed by small fishes and sedimentary particles. This was evident, especially in the swampy areas where the project being implemented the water was almost stagnant in which **Rasbora spp** was predominant. This was one of the reasons that in the natural water the hatching rate of this species become very low.

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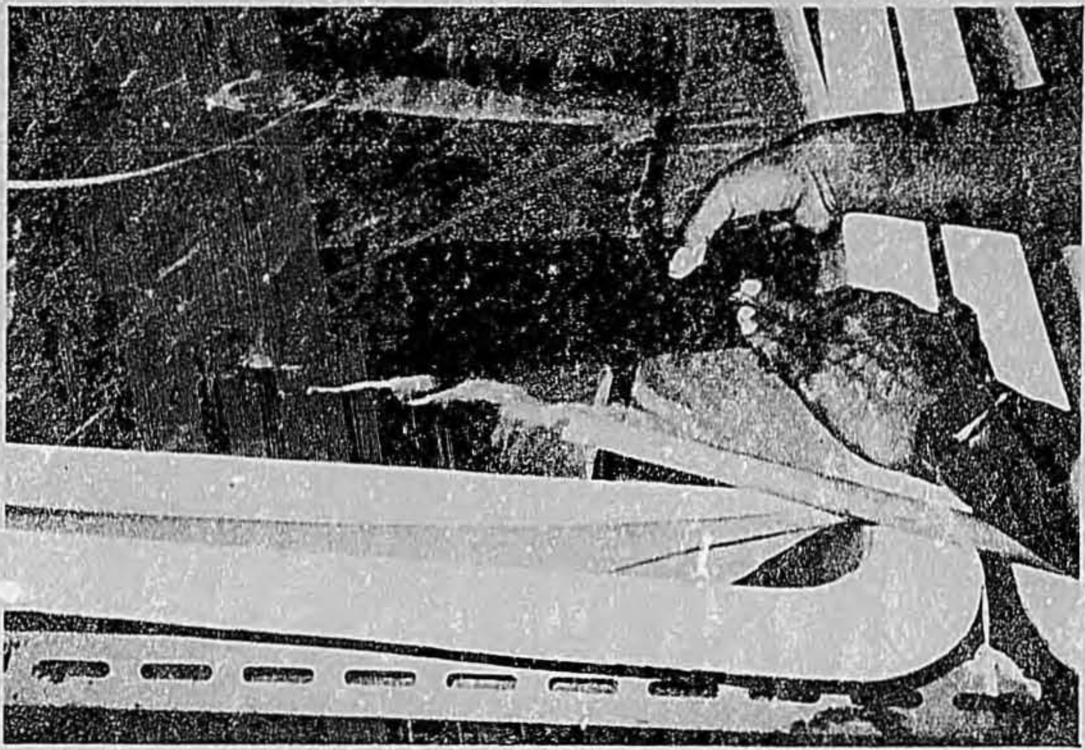

Figure 7. Incubation of eggs.

To control the seed production, an improved technique was applied by way of cutting off the stump-part where the eggs deposited to, which referred to as "nests" and transferring the whole nests equipped with aeration system to the indoor hatchery. The eggs still attached to the nests were then incubated in the fibreglass or concrete tank or aquarium for 6–7 days at the water temperature of 29–31°C for subsequently hatching.

During the spawning season the nests should be inspected regularly, at least once a week, otherwise when the male fish being off its guard the eggs would be preyed on by small fishes.

When the spawning was over, the eggs-laden stumps should then be detached, cut-off and immediately transferred for hatching under controlled conditions. The number of eggs deposited on the stump, might be several thousands and the eggs produced from one brooder at a time, might exceed 5,000 or even greater than 10.000.

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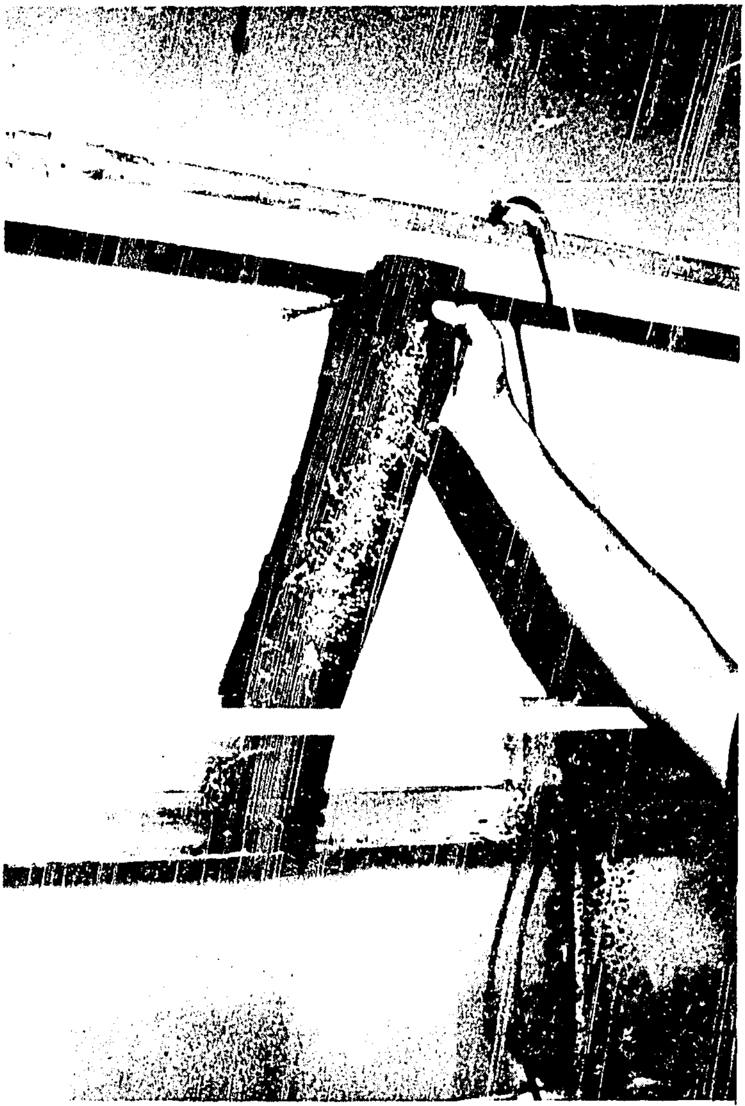

Figure 8. Eggs deposited on the stump.

Transferring the eggs-laden stump from the spawning ground to the hatchery was quite painstaking because a great deal of eggs were broken during transportation. The low hatchability was merely due to a technical problem that the eggs-laden stump, being put in the oxygenized bag, consistently got in contact with and unavoidably caused friction between the stump and the container's wall. The transportation technique should, therefore, be improved to prevent the eggs being crushed by employing a rolling device to hold the stump and that to avoid the stump touching the wall of the bag.

To prevent and protect contamination of fungi, the eggs should be treated with malachite green at a concentration of 1 : 15 ppt (part per thousand) for about 15–30 seconds prior to incubation step.

Figure 9. Larval rearing.

7. LARVAL REARING.

The size of newly hatched-out larvae were considerably large, about 7–8 mm in length, tiny blade bodies and big yolk sacs. They sank and lay down on the bottom, move slowly in some periodically. After 3–4 day of age, when their yolk sacs began to disappear, they were able to eat live food. **Moina** and **Daphnia** were suitable for feeding, because their mouths were large enough to consume the bigger-size live food directly and that they were not necessarily fed with egg yolk or Rotifer during their early life.

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Notopterus borneensis fry had a nocturnal eating habit. They preferred to eat at night time and were also very active. During the day time they stayed shoaling pasively at the corner of container or hiding places. In the indoor hatchery, the newly larvae were reared in the aquarium equipped with aeration-system. They could also be reared in a concrete tank filled with tap-water which left for a few days to let the water settle down before use.

After the yolk sacs disappeared, they were fed every day with live moina until their 3–week of life. Fresh fish minced finely was then given to the fry or alternatively they could also be fed with supplementary feeding which was easier to find in the region.

During the larval rearing, the water quality should be carefully inspected. To avoid pollution, the water should be changed and refilled regularly.

Figure 10. Changing the water.

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DIAGRAM OF LARVAL REARING FOR

<u>Notopterus Borneensis</u>

Age		Activities and facilities
1. Fertilization	:	Natural spawning in fence-system.
2. Hatched out	:	In aquarium and fibreglass tank in indoor hatchery during 6–7 days period at water temperature of 29–31°C.
3. Newly larvae	:	– Reared in aquarium, Antibiotic being applied at about 250 mg per aquarium.
4. 4–21 days old	:	– Fed with life moina and given in the evening – Changed the water about a half of aquarium every day. – 0.1% Salt (Sodium Chloride) was applied after the water been changed.
5. 3–6 weeks old	:	– Size attained about 1 inch or larger. – Fed with minced fresh fish. – Changed the water, cleaned the bottom of aquarium. – Antibiotic and salt still being applied.
6. 1½ month of age	:	Size obtained about 2 inches.

REFERENCE

Smith, H.M. (1945). The fresh water fishes of Siam or Thailand.
Bull. U.S. Nah. Mus. 188.

ACKNOWLEDGEMENTS

I am most grateful to those, in particular to the key-farmers from Tanjung Pering and Lebung Karangan districts, who have enthusiastically provided their assistance and facilities in my carrying out the programme.

My appreciation goes to Dr. Josephine Wiryanti for her assistance in preparing this manual.

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ANNEX J

LEAFLET FOR *Leptobarbus hovenii* and *Pangasius pangasius* CULTURE

uk makanan ikan Patin
ngasius pangasius).

kan rucah atau product sampingan dari
kan/isi perut.
imbah pasar atau dapur.
si perut ayam.
i.
as menir atau dedak.
dsb.

Bahan makanan

LAMA PEMELIHARAAN

Antara 8 - 12 bulan, dipanen dengan perlakuan yang baik untuk dipasarkan.

BUDIDAYA

Ikan Jelawat (*Leptobarbus hoevenii*)
dan
Ikan Patin (*Pangasius Pangasius*)

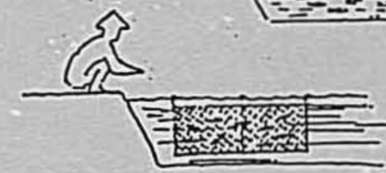
Oleh :
Samruay Meenakarn
Cage Culture Advisor

Kerjasama antara :
Direktorat Jenderal Perikanan
dengan USAID
1986

PENDEDERAN

Lama pemeliharaan 2-3 bulan dari benih sampai fingerling.

Kolam



Karamba terapung

WADAH

- jaring hapa atau karamba terapung ukuran (2 x 3 x 1,5) m³
- kolam beton ukuran (4 -30) m², kedalaman 1 m
- kolam tanah (200 - 800) m², dengan kedalaman 1 m.

KOMPOSISI MAKANAN

- tepung ikan 40%
- tepung kacang kedele 25%
- dedak 25%
- tapioka 9%
- vitamin (campuran) 1%

PEMBERIAN MAKANAN

5% dari berat badan ikan diberikan 2(dua) kali dalam 1(satu) hari. Makanan diberikan dalam bentuk kering.

CARA PEMBUATAN MAKANAN

Cara memasak

- campurkan semua bahan makanan yang dikeringkan terlebih dahulu.
- masak air sampai mendidih dalam panci.
- campurkan bahan-bahan makanan kedalam air mendidih.
- aduk sampai rata.

Cara membuat pellet

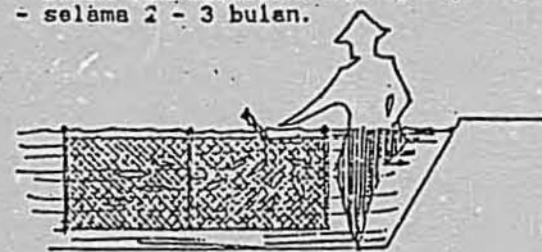
- campurkan semua bahan makanan.
- masukan kedalam mesin pellet untuk dicetak.
- setelah itu dikeringkan dengan panas matahari/diangin-anginkan.

Dijadikan pellet

Makanan dimasak

CARA PEMBERIAN MAKANAN

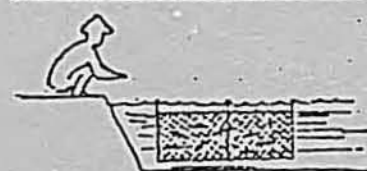
- Tebarkan makanan/pellet kedalam wadah pemeliharaan.
- Berikan makanan sebanyak 5% dari berat badan dan diberikan 2(dua) kali sehari
- selama 2 - 3 bulan.



Cara pemberian makanan

PEMBESARAN

(Pemeliharaan sampai ukuran konsumsi)



Keramba terapung

Kolam

Wadah pemeliharaan

-karamba yang terbuat dari waring bambu, kayu dengan ukuran (2 x 3 x 1,5) m³.
-kolam tanah ukuran 400 m² atau lebih dengan kedalaman ± 1 - 1,5 m.

BAHAN DAN KOMPOSISI MAKANAN

Bahan makanan yang sempurna terdiri dari :

- tepung ikan	26%
- tepung kedele	20%
- dedak halus	25%
- menir	25%
- mineral	3%
- vitamin (campuran)	1%

Bahan-bahan pengganti dapat diberikan

Untuk makanan ikan Jelawat (*Leptobarbus hoevenii*).

- daun-daunan/sayur-sayuran (kangkung, daun singkong, dsb).
- biji karet
- pupuk organik
- limbah dapur/pasar
- dsb.

Bahan-bahan makanan