I-2-3. Groupers

1) Collection period : June 1982

2) Collection area : Seribu Island

3) Collection method : Consighment collection

4) Number : 150 (size: 400g -800g)

I-3 Contents of rearing experiment

I-3-1. Experiment on growth

1) Experiment on comparative growth in each rabbit fish species (second experiment)

Species : Siganus canliculatus, Siganus javus
Period : September 1981 - April 1982
(stoppage by steal)

2) Experiment on comparative growth in each rabbitfish species (third experiment)

Species : Siganus canaliculatus, Siganus javus, Siganus guttatus
Period : October 1981 - April 1982
(stoppage by steal)

3) Experiment on full- fledged culture of rabbitfish

Start : April 1982
(stoppage by occurrence of parasite)

4) Experiment on full-fledged culture of rabbitfish (second experiment)

Start : May 1982
(stoppage by occurrence of parasite)

5) Experiment on comparative growth in each groupers species

Species : Epinephelus tauvina, Epinephelus fuscoguttatus Epinephelus merra, Epinephelus summana

6) Experiment on comparative growth in each grouper size

Species : Epinephelus fuscoguttatus
Start : July 1982

7) Experiment on comparative growth in each giant seaperch size

Start : August 1982

8) Raising experiment

Species : Lutjanidae , Lethrinidae , Carangidae

I-3-2. Food experiment

1) Experiment on effect of added plants

Species : Siganus canaliculatus

Period : October 1981 - January 1982

2) Experiment on utilization of fish silage

Species : Siganus canaliculatus , Siganus javus

Period : November 1981 - January 1982

3) Experiment on right feeding ratio

Species : Siganus canaliculatus

Start : July, 1982

I-3-3. Experiment on pond culture

1) Experimenton fertilized culture (2nd ex.)

Species : S. canaliculatus, S. javus , S. guttatus

Place : Panjang Island experimental ponds

Period : January 1982 - March 1982

2. Experiment on spawner production

2-1. Collection of spawners

1) Collection of S. chrysospilos

Period : June 1982

Place : Kongsi Island

Number : 150 fishes (Mean body weight 300 g)

2-2. Raising spawner

1) Rabbitfish

a) 200 spawners (S. canaliculatus) (MBW 300 g)

Stolen in April

b) 150 adults (S. chrysospilos) (MBW 300 g)

Raising in floating cage net

2) Giant sea perch

11 spawners(MBW 8 kg)

Raising in floating cage net

3) Groupers

15 adults (E. fuscoguttatus) (MBW 2.5 kg)

Mortality in June 1982

2-3. Experiment on artificial spawning

1) Experiment on induced spawning of Rockfish (S. [illegible])

In Aug. 1981

2-4. Experiment on culture of food organisms

1) Experiment on full-fledged Chlorella culture

Scale : 5 ton, 7-ton, 10 ton tanks 2 each

Period : April 1982 - July 19

Stopped due to generator trouble

2) Experiment on full-fledged rotifer culture

Scale : 5 ton tanks 4

Period : April 1982 - July 1982

Stopped due to generator trouble

2. Rehabilitation Studies

2.1 Year-long Survey for the Seasonal Occurrence of Juvenile Fishes in Banten Bay.
(A. Basyarie and H. Tanaka)

2.2 Result of year-long sampling of important fish, Crocodile Epinephelus tauvina and Snapper Lutjanus sanguineus
(A. Basyarie and H. Tanaka)

2.3 Fundamental studies on ecology of siganids in Banten Bay
(A. Basyarie and H. Tanaka)

2.4 Some Observation on Spawning Ecology of Siganid Siganus canaliculatus in Banten Bay.
(H. Tanaka and A. Basyarie)

2.5 Rearing experiment of juvenile siganid S. javus by some formula feed with different level of crude protein.
(A. Basyarie and H. Tanaka)

2.6 Feasibility Studies of Siganids Culture, Using Floating Cage-Nets.
(H. Tanaka and A. Basyarie)

2.7 Comparison of salinity tolerance among three juvenile siganids species.
(H. Tanaka and A. Basyarie)

2.8 Experiment on induced spawning of Siganid, S. canaliculatus.
(H. Tanaka and A. Basyarie)

2.9 An attempt of Mass Production of Rotifer Brachionus plicatilis
(K. Sugama and A. Basyarie)

[illegible] Bay[illegible] and [illegible]

Purp[illegible]: The [illegible] of natural s[illegible] is [illegible] [illegible] for [illegible] culture. This survey was a[illegible] to obt[illegible] fund[illegible] [illegible] on the object species for mariculture purp[illegible] by st[illegible]ing seas[illegible] distribution and [illegible] of [illegible] juvenile fishes throughout [illegible] Bay.

[illegible]: Juv[illegible] fishes were collected by a two stick net (5×1,5 m, 3 mm mesh size) and [illegible] (50×2 m, 0,5mm mesh size). The survey was conducted [illegible] a month from September 1979 to December 1980, in the Zostera-zone of Bojonegoro, the [illegible]hern coast of the Panjang Island, the reef flat of the Kambing Island, and the Linduk estuary. This survey was continued to the year of 1981 in the areas of Bojonegoro and the Kambing Island. Juveniles collected were classified into each species, and their total lengths and numbers were examined.

Result: At least a total of 146 species of 50 families were listed as of 1980 . Found were 49 species of 36 families in the Bojonegoro area, 32 species of 22 families in the Panjang Island area, 35 species of 23 families in the Kambing Island area, and 40 species of 30 families in the Linduk area. The major species were Siganids, Theraponids, Lutjanids and Lethrinids in the Bojonegoro area, Ambassids, Gerrids, and Atherrinids in Panjang Island area, Leiognathids, Ambassids, Siganids, Gerrids, and Atherrinids in the Kambing Island area, and Leiognatids, Ambassids Sciaenids, and Pomadasyi[illegible] in the Linduk area, respectively. The Zostera-zone of Bojonegoro was an important area in view of the fact that juveniles of useful fishes for mari culture were more abundant both in kind and in the number than the other areas. Judging from the abundance of natural seeds for mariculture purpose, the important species in Banten Bay were Siganids followed by Lethrinids, Mugilids, and Lutjanids. The juveniles of Serranids, Latids, and Carangids whose culture is generally regarded as promising were scanty in these areas above.

2. Fundamental studies on ecology of siganids fry in Banten Bay

A. Bagenal and H. Tanaka

Purpose : Much attention has recently been paid to siganids fish as object fish for culture, and a large number of siganids species live in the tropics whose ecology differs from species to species. This study was aimed to obtain basic data in selecting optimum object species for mariculture by studying ecology of various kinds of siganids living in Banten Bay.

Method : Sampling of siganids species obtained from the Karangantu fish market was made once a week to make the measurements of fish body, which was continued from August 1979 on. As for the survey on fry, their collection was made twice a month in several areas of Banten Bay by means of seine net(50 m long, 2 m wide, and 5 mm in mesh size).

Results : Siganids fish observed in Banten Bay were the nine species of S. canaliculatus, S. javus, S. guttatus, S. virgatus, S. vermiculatus, S. chrysospilos, S. punctatus, S. corallinus, and S. spinus. Species collected in quantity were S. canaliculatus, S. javus, S. guttatus, and S. virgatus. The large sized fishes were S. javus, S. guttatus, S. vermiculatus, and S. chrysospilos. These siganids fry appeared in great quantity on the coastal sea weed areas orround the reef flat from May to June, and November in 1980, and March, and from July to October in 1981. Fry ranging from 2,0 cm to 6.0 cm were observed to stay inthose areas. Most of the fry appeared were found S. canaliculatus. The sea weed areas of Bojonegara were found the most important places for collecting siganids fry in quantity. Great numbers of siganids fry (S. canaliculatus) caught by the Bagan were landed at the Karangantu fish market simultaneously when plenty of fry appeared. S. canaliculatus grow about 22 cm in total length weighing about 150 g during the year, while S. javus, about 25 cm in total length weighing about 250 g in weight.

Si[illegible] egg [illegible] Bay

H. Tanaka and A. Ba[illegible]

Purpose : This study was aimed to obtain basic data on future stud[illegible] of seeding prod[illegible]ction of S. canaliculatus, one of the important siganids in Banten Bay. Such a spawning ecology especially as spawning season, gonad maturity, and fecundity were observed. Furthermore, a diagnosis of the seasonal occurrence of its juveniles in the Bay was discussed here.

Method : Samples collection was conducted every week by fishermen in July 1981 on the south-east coast of Panjang Island, where it seemed a main spawning area of S. canaliculatus. Fish were caught by a cast-net, a trap and a fish spear. Spawning dates were determined by gonad index change, egg diameter changed and occurrence of spent ovary. The total number of eggs in the ovary was estimated from the average number of the eggs counted per 0.03 g. Each diameter of 100 - 400 eggs (per female) was measured.

Result : Spawning of S. canaliculatus occurred every month from September and the major spawning period was October. Spawning dates were determined about five days after the new moon. The minimum size of the matured fish was 20.0 cm (TL) in female and 18.6 cm (TL) in male. The number of eggs in the ovary ranged from 200,000 (22 cm TL) to 1,300,000 (27 cm TL). Found was only one dominant size of eggs in the ovary. Eggs were spawned at a time, when the eggs attained to 450 μ or larger. Early developing eggs could be observed only in the completely matured ovaries. They were found attached to dendritical filaments connecting each other's egg in the ovary. The moment the matured eggs were spawned, these immature eggs rapidly developed. The result of the year-round collection of siganids seeds in the areas of Bojonegara and the Kabung Island showed that the said spawning area near the Panjang Island was considered not to have any connection to the occurrence of juveniles in these seeds collecting areas, at least from September on.

A. [illegible] and H. Tanaka

Purpose : Siganids fish are herbivorous species and can be cultured by feeding food containing lower protein content as compared with the other fish species and attention has been paid to them as object fish for mariculture. There are quite few reports on their requirement of nutrition. The experiment was aimed to clarify the optimum level of protein in terms of their growth of feeding efficiency by making a rearing experiment using feed of different contents of protein.

Methods : Feed used for experiment consisted of four kinds (assumed content of protein : 45.0 %, 35.7 %, 27.5 %, 23.4 %). Based on the Japanese diet for sea breams, these feed were made from the mixture of wheat flour of 50 %, Tapioka starch of 25 %, and Sago starch of 25 %, to which the mixture of vitamins and minerals was added. Circulating filtration-typed (with a foam tower) aquaria of 60-liter were used in rearing. The mixture of Na_2HCO_3 and Na_2CO_3 was used to control the pH of the sea water. Average temperature at 8:00 a.m. was 28.9 C. Feed were offered to satiation four times a day at 8:00 a.m., 11:00 a.m., 2:00 p.m., and at 5:00 p.m., respectively. Rearing experiment was conducted for six weeks, during which the measurements of the total length and weight were made every two weeks. Fish fry for experiment were obtained from the Bojonegara Zostera-zone on July 23 and 25, 1981. These fry were used for rearing experiment after they had been preliminarily reared in the net-cage by feeding the mixed feed containing diet for carp and minced fish.

Results : S. javus fry showed a better growth in feed containing the protein content of 27.5 to 35.7 %. Despite the fact that feed of high protein content showed comparatively good results at the initial stage of the experiment, their growth became fish dull according as they grow. Feeding activity was inactive among fish by the feed of high protein content since the beginning of the experiment.

[illegible]

[illegible]yuki Tanaka and Achmad Basyarie

Purpose : Siganids fish culture is attracted since they can be cultured with low protein food. This study was aimed to obtain basic data regarding practical siganids culture by using floating cage-nets in this region. The fundamental experiments for finding optimum diet and growth speed were mainly examined as a preliminary to the siganids culture.

Method : All studies were carried out in the floating cage-nets anchored at the depth of 4.5 m between the Kambing Island and the Kubur Island in Banten Bay. A size of each net used was 2 x 2 x 2 m. Frequency of the net changing was once in 7 to 10 days. Pasted feed were prepared and given into a feeding tray suspended inside the cage-nets. The fish were fed to satiation principally twice a day. Siganids fry which had been captured in the sea weed areas of Bojonegara and in the reef flat area of the Kambing Island, were used occasionally for the experiments after making all of them take to feeding in the cage-nets. Water temperature, salinity, and transparency were measured every morning.

Result : According to the 1980 primary experiment on the optimum feed, a combination of trash fish and commercial diet for carp showed a good result, and a combination of fermented vegetable, rice bran, and trash fish was also effective. During the primary feeding of fry, trash fish added with vitamins and minerals compound resulted in the better yield than trash fish alone. Although additional sea weed sargassum to feed was more effective in terms of yield than that without sargassum, their growth was rather lower than that without it. A combination of that carp diet and fish silage was ineffective as compared with that of carp diet and trash fish. S. canaliculatus grew from 0.5 g to 5 g in body weight in 40 days, to 25 g in 100 days, and to 80 - 90 g in 210 days. S. javus and S. guttatus grew much faster than S. canaliculatus. In March 1981, an acute mortality of fry and young siganids occurred in the cage-nets because of the infestation of monogenetic trematodes attached on gills. They could be eradicated completely by a short-term bath treatment by pesticide Dipterex. As a result of the experiment on the raft improvement, multiple painting of three bottom points was very effective to a longer life of drams as float.

3. Trial of Aquaculture

Purpose : Siganids are generally so euryhaline species that their culture in the coastal pond is promising. This study was intended to find out suitable species for the pond culture, by determining their tolerance level to salinity. The possibility of the pond culture was examined by stocking juvenile siganids into the marine pond.

Methods : All experiments of salinity tolerance were carried out in plastic 30-liter aquaria supplied with aeration. As for the low salinity experiments, fish were directly placed in each aquarium in which the salinity of water had been readjusted to 0, 5, 10, 20, 40, 60, and 80 % sea water, respectively, and then the percentage of mortality during 48 hours was recorded. The high salinity experiments were carried out in different water temperatures. The water temperature was regulated at 30 C and 33 C, respectively, by using a heating unit and a thermostat. Salinity was gradually increased every two days by adding rock-salt. Fish were fed with crumbles of diet. The number of fish used for each experiment was 5-10 in each aquarium. The test of pond culture was carried out in the two marine ponds (100 m^2 each) of the Panjang Station. The number of the juveniles of three species of siganids stocked were 182 and 902 fish respectively. As for the pond culture, the first experimental period ranged from July 8 to October 23, 1981.

Results : The 48-hour low salinity limit in which no mortality occurred was 5 % sea water for S. javus, 10 % for S. guttatus and 20 % for S. canaliculatus, respectively. In fresh water, all S. javus died within 5.5 hours, while S. canaliculatus, 1.5 hours. Larger S. canaliculatus were more tolerant than smaller ones. In the high salinity experiments, there were no apparent differences in species, S. canaliculatus and S. javus. Feeding activity of S. canaliculatus stopped at 59 °/oo in 33 °C water and 62 °/oo in 30 C water. Mortality, in both species, occurred around 55 °/oo both in 30°C and 33°C water. However, all fish in 33°C water died around 60 °/oo while all fish in 30°C water died round 65 °/oo. Salinity tolerance may be considered to bear a relation to water temperature. No juvenile siganids could survive in the marine ponds during the period of this experiment.

[illegible] of Siganid, S. canaliculatus

H. Tanaka and A. Basyarie

Purpose : The stable supply of the seeds is indispensable in developing mariculture, and the research development of artificial seed production is an important field. This study was aimed to obtain the basic materials for seed production by looking into the effectiveness of hormone induced spawning of siganid.

Method : Matured S. canaliculatus which had been reared from their fry in the floating net-cages were used. Fish for experiment consisted of three females and nine males, total lengths and weights were 18.2 to 21.5 cm and 82 to 144 g, and 17.1 to 20.5 cm and 64 to 98 g, respectively. Gonatropin having a function of LH and FSH was used as hormone druf. Hormone injection of 500 mouse unit for female and of 250 mouse unit for male was given in intra-peritoneum at the basal part of the pectral fin, respectively. On the following day another 500 mouse unit was injected to these females. Fish as control consisted of three females and eight males whose morphological conditions were almost the same as those of fish for the experiment. Mean conditioning factor of fish for the experiment was 1.40 for females and 1.28 for males, respectively, while that of control was 1.44 for females and 1.30 for males, respectively. 3-ton rectangular FRP tanks with continous water supply (water supplied : 12-20 l/min) were used as spawning tank. Corrugated plastic boards were laid at the botton or the tank and used as a means to collect eggs.

Results : All the three female fish that the hormone inducement was given spawned, but fish without injection did not spawn even after one week. The total number of eggs obtained from the three females fish was about 890,000. The diameter of the eggs averaged 556 μ, and their hatching ratio was 87.0 % (water temperature at 29 - 30 ^{o}C).

2 - 9 [illegible] of Rot. [illegible] [illegible] of [illegible] [illegible]

K. Sugeno and A. Bautista

Purpose : Culturing food organisms as one of the most important factors in aquaculture system. Recently, the rotifer Brachionus plicatilis was proved an important food organism in rearing larvae of coastal marine animals. This experiment was aimed to provide food to rearing pigment larvae and the other fish larvae.

Methods: Two 650 Liter FRP tanks with aeration were used for this experiment. All tanks were located outdoors and sheltered with transparent plastic sheets at the Dajungan Experimental Station. Marine chlorella water was first transferred to these tanks, and then rotifer were inoculated at a seed density of 10 ind/ml and 9 ind/Ll in tank, respectively. The rotifers were fed twice a day with baker's yeast at the feeding level of 0.3 g per million rotifer per day. Average number of rotifer per 0.5 ml water in each tank was counted by binocular microscope every morning. The egg ratio of rotifer was observed in order to know the conditions of their reproductivity. After their mean population density attained to about 50 ind/ml or more, they were harvested from each tank by 30 % of them. After their harvesting, the tank was filled with marine chorella water and fresh water. Water salinity was adjusted about 30 to 25 °/°°

Results : The experiment was carried out for 16 days. The highest mean population density of the rotifer attained to 157 ind/ml and 106 ind/ml respectively in tank during this experiment. The total number of rotifer in tank 1 and 2 was 221.0 X 10^6 ind. and 147.4 X 10^6 ind respectively. The total amount of the yeast fed during this experiment was 662.7 g in tank 1 and 133.5 g in tank 2. Production rate in tanks 1 and 2 was 1.02 X 10^6 ind. and 1.34 X 10^6 ind. per gram of baker's yeast, respectively. Daily production rate was 14.6 X 10^6 ind. and 8.3 X 10^6 ind. per tank respectively.

3-2. Production Experiment on fish food and stocking seeds by reproduced Tilapia fry

Ketut Sugama and Mas'ud Yamashita

Purpose: It is essential to eliminate fry and juveniles propagated naturally in the rearing pond because they will compete with the object fish reared for food. It was aimed to stock these fry and juvenile fishes eliminated in the nursery pond or intermediate pond for breeding them into young fish, to ensure healthy stock seeds free of charge, to use the surplus fish as direct food for carnivorous fishes, to make use of them as main food materials for omnivorous fishes.

Method: 1.0 to 2.5 cm fry reproduced in the pond in the 1-st experiment were stocked in the nursery pond of 100 m^2, and more than 2.5 cm juvenile fishes were stocked in the intermediate pond of 400 m^2. The preparations such as fertilization and for these nursery and intermediate ponds had been made. The juvenile fishes which grew more than 3 cm in the nursery pond after 3 to 5 weeks were transferred to the intermediate pond.

Result: About 5,000 juvenile fishes (5 to 15 g in body weight) were harvested from the intermediate pond, whose production was about 70 % and fell short of the expectation. This may have been caused by four middle-sized carnivorous fish survived in the intermediate pond such as Barracuda, Pajus and megarops (300-500 g) despite the fact that pesticide had been used. Much attention must be paid in the future. 3,500 of juvenile fishes harvested from the intermediate pond have been already stocked in the rearing pond for the next seeds (2,500 for Tilapia monoculture, and 1,000 of juveniles for mix culture experiment with Chanos chanos), and the remaining about 1,500 juvenile fishes are being used for fish food.

K. Sugar . and H. Yamas ita

Purpose : This experiment was aimed to develop the technique of Tilapia intensive culture in the sea water pond at the Pole Panjang Experimental Station, to introduce this culture method to the coastal pond farmers, thus contribute to the future development of the solitary islands in the Indonesian archipelago.

Methods : The 1st rearing experiment was conducted for three months from July to October 1981 in the two rearing ponds of 1,000 m^2 respectively, into which 1,200 reproduced seed and 600 Sukabumi's seeds, a total of 1,800 seeds were stocked. Prior to their stocking, 50 g pesticide (Brestan), 20 kg urea, and 10 kg TSP as fertilizer were applied. During this experiment, fertilizer was used once a month. The 2nd experiment began in mid-November 1981 in the 1,000 m^2 pond, where 2,500 reproduced seeds were transferred with a view to increasing the more output than the 1st experiment. Before their stocking, the pond had been sufficiently rehabilitated and prepared for this purpose both by enemies removal and fertilization. Numerous fry propagated naturally were eliminated during the rearing period of three months to ensure the effective growth of adult fish.

Results : Seeing that fish stocked in these two ponds of 1,000 m^2 respectively in the 1st experiment numbered 3,600 weighing 15.7 kg (4.36 g on an average), and that after the three-month period the harvested was 2,891 individuals, whose survival rate was 80.3 %, weighing 145 kg (50.16 g on an average), it is assumed that the production in terms of annual production per hectar is 2,175 kg, whose weight increase is 1,940 kg. This value shows more than six times the average production larger than that produced traditionally by the coastal pond farmers. Viewed economically, the annual gross income in terms of the present market price will be Rp1,000,000 per hectar, and after reducting the cost of fertilizer, materials, and personnel, its net income exceeds Rp 500,000. For the second experiment it is expected to make a production of about 100 kg. Consequently, the production annually converted per hectar will possibly be 3,000 kg.

3-2. Production Experiment of fish feed and stocking seeds by reproduced Tilapia fry

Katuti Sugama and Masao Yamashita

Purpose: It is essential to eliminate fry and juveniles propagated naturally in the rearing pond because they will compete with the object fish reared for food. It was aimed to stock these fry and juvenile fishes eliminated in the nursery pond or intermediate pond for breeding them into young fish, to ensure healthy stock seeds free of charge, to use the surplus fish as direct food for carnivorous fishes, to make use of them as main food materials for omnivorous fishes .

Method: 1.0 to 2.5 cm fry reproduced in the pond in the 1-st experiment were stocked in the nursery pond of 100 m^2, and more than 2.5 cm juvenile fishes were stocked in the intermediate pond of 400 m^2. The preparations such as fertilization and for these nursery and intermediate ponds had been made. The juvenile fishes which grew more than 3 cm in the nursery pond after 3 to 5 weeks were transferred to the intermediate pond.

Result: About 5,000 juvenile fishes (5 to 15 g in body weight) were harvested from the intermediate pond, whose production was about 70 % and fell short of the expectation. This may have been caused by four middle-sized carnivorous fish survived in the intermediate pond such as Barracuda, Pajus and megarops (300-500 g) despite the fact that pesticide had been used. Much attention must be paid in the future. 3,500 of juvenile fishes harvested from the intermediate pond have been already stocked in the rearing pond for the next seeds (2,500 for Tilapia monoculture, and 1,000 of juveniles for mix culture experiment with Chanos chanos), and the remaining about 1,500 juvenile fishes are being used for fish food.

3 - 3 Growth [illegible] of Tilapia [illegible] in different salinity

K. Sugama and M. Yamashita

Purpose : The experiment was conducted to confirm the suitable salinity for the growth of Tilapia mossambica in rearing them in the sea water or brackish water ponds.

Method : Tilapia fry (± 0,5 g on an average) propagated naturally in the experimental ponds were prepared. 20 fry each were put into 30-liter aquarium of fresh water, 25 %, 50 %, 75 %, and 100 % sea water, respectively. For the period thirty (30) days, artificial food conforming to 10 % of their total weight was fed and reared indoors with aeration, thus compared each growthrate.

Result : 50 to 100 % of sea water gave a higher growth rate, while 0 % to 25 % sea water showed a lower growth rate. From this it can be recognized that there is a possibility of making Tilapia culture in the sea water ponds or in higher salinity brackish water ponds.

Growth conditions of Tilapia fry in different salinity

Ratio	Fresh water	100	75	50	25	0
	Sea water	0	25	50	75	100
Water salinity (°/00)		0	18,0-9,0	12,0-17,0	18,0-25,0	23,0 - 33,0
Water temperature (°C)		26,3-28,1	27,1-28,5	27,1-28,5	27,1-28,5	27,1-29,0
average body wieght, Beginning (A)		0,5 g	0,55	0,47	0,54	0,5
average Body weight, end (B)		1,725g	1,89	2,24	2,36	2,335
average weight increased (C)		1,225 g	1,34	1,77	1,82	1,835
weight gain ratio (C/A)		2,45	2,44	3,77	3,37	3,67

[illegible] on [illegible] feeding in the sea water pond by separating male from female

K. Sugama and M. Yamashita

Purpose : From the three-month rearing preliminary experiment on Tilapia mossambica, large-sized fish were found limited only to male fish. It was aimed to compare each growth rate by separating male from female.

Method : Fish of 6 cm or so in total length can be distinguished between male and female from the morphology of their anus with naked eyes. 200 of male, female, and the mixture of male and female each were stocked into three 4 m^2 net cage in the sea water pond for three month. During the period of this experiment, their gross weight was taken every month, and the mixed feed conforming to 10 % of the total weight was given every day (90 % of trash fish or young Tilapia and 10 % of rice bran).

Result : Male fish showed more remarkable increase in an average body weight than female fish or the mixture of male and female. However, the increase rate of the male fish and of the mixture of male and female was the same, but only the female fish showed a lower value.
Their reliable survival rate was not confirmed because this experiment was conducted under the high stocking density and also some fish might have escaped from the holes of each net cage damaged by crabs. It is, therefore, necessary to make an experiment in the pond under the condition of lower stocking density.

3.5. Experiment on Tilapia seeds transportation and sea water tolerance.

K. Sugama and M. Yamashita

Purpose : Reproduced seeds from the preliminary Tilapia mosambica rearing experiment were not sufficient in number for the purpose of the next full-scale rearing experiment. It was aimed to seek a possibility of rearing fresh water Tilapia seeds in the sea water ponds.

Method : 2,200 Tilapia seeds were obtained from Sukabumi, and the average 220 individuals were packed into 10 large plastic bags of about 20 liter water. The bags were tied after the oxygen had been supplied and put into a large round tank with ice, then its tank was covered by a vinyl sheet and transported to the Karangantu Station taking six hours. These Tilapia were placed into four large aquaria (1 ton each), in which fresh water was added by 400 l each. Tilapia were stocked with aeration and about 20 % of the tank water was changed with sea water to make 7 °/oo salinity. Then salinity was increased to 15 °/oo, 25 °/oo and 28 °/oo respectively during one week.

Result : During the transportation, about 120 small and weakened Tilapia died. The survival rate was 94.5 %. During the experiment on salinity tolerance, some other weakened fish died and 1,950 individuals survived in the end. The survival rate during the experiment was 93.75 % and the survival rate of the Tilapia purchased was 88.64 %. 1,250 fish survived were stocked as seeds in the Pulo Panjang pond for the 1st full-scale rearing experiment and reared for three months, and other 700 fish were used for sexual separation experiment. From this it was recognized that Tilapia could grow and propagate either in the sea water pond or in the brackish water pond.

A LIST OF THE ABSTRACTS TO BE PRESENTED
ON DECEMBER 28, 1981

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4. Carnivor fish sector

E. Danakusumah and K. Imanishi

4.1. Satiation experiment on grouper, Epinephelus tauvina.

4.2. Rearing experiment on grouper, Epinephelus tauvina.

4.3. Preliminary study on Chlorella sp. mass culture.

4.4. Preliminary study of Rotifer, Brachionus plicatilis O.F. Müller Culture.

4.1. Satiation experiment on grouper (Epinephelus tauvina)

E. Danakusumah and K. Imanishi

Purpose: Every species has its own characteristic of growth, and its tendency is relatively the same. In one species the smaller fish need more food than the bigger ones, because they need more energy for their growth. The maximum requirement of food depends upon water conditions, kind of food, or their stomach capacity. In mariculture it is necessary to know the optimum satiation rate in order to obtain the highest possible yield because a suitable feeding rate will influence upon a high yield. Prior to the net cage culture it was aimed to have the satiation rate of Epinephelus tauvina, thus to decide on the standard feeding rate.

Methods: Eight series of satiation experiments were conducted in the 2-ton tank with filtered sea water and sufficient aeration. Fish for experiment were obtained from the Karangantu fish landing place. Having been tamed to eat market fish (dead), they were used for fish for this experiment. About the same size group of the fish selected were put in the 2-ton tank, and fed with fresh fish, mainly " Ikan teri" twice a day at 9:00 a.m. and at 3:00 p.m. except for only once on the first day. Fish food was weighed before feeding. Thirty minutes after the feeding, the food left uneaten in the tanks was weighed.

Results: During the course of this experiment, the smaller fish showed a tendency to have a higher satiation rate as compared with the bigger ones. The satiation rate was 14.3 per cent for the smallest group of 103.4 g in an average body weight, while 4.6 per cent for the biggest group. The average food conversion ratio was 1.3 to 6.8.

4.2. Rearing experiment on grouper, Epinephelus tauvina

E. Danakusumah and K. Imanishi

Purpose: Grouper (Epinephelus tauvina, Kerapu lumpur, Balong) is one of the commercially important fishes in Indonesia. In order to get a basic knowledge on its culture, some studies of a possibility of its net cage culture were made.

Methods: Four sets of net cage were used and fixed by anchors on the front coast of the Bojonegoro Experimental Station. The net cages used were made up of bamboo frames and floats of cylindrical styrofoams. One inch mesh size of 2 x 2 x 2 m nylon nets were used. Fish for experiment were obtained from the Karangantu fish landing place. Prior to the rearing experiments groupers were tamed to take fresh fish, mainly ikan tori, after which they were used for fish for this experiment. In each net cage were stocked fifty-three individuals (129 g in averagebody weight), thirty-nine individuals 196 g in average body weight), twenty-six individuals (266 g in average body weight) and sixteen individuals (789 g in averege body weight), respectively in experiments 1, 2, 3, and 4. Feeding rate per day was 70 % of satiation.

Results: Food conversion ratio was 5.6, 7.7, 8.2, and 9.5 respectively in experiments 1, 2, 3, and 4. The smaller fish showed the better result in food convorsion ratio. The avorage daily weight gain was 1.7, 1.8, 2.1, and 3.0 g g respectively.

4.3. Preliminary study on *Chlorella* sp. mass culture

Edward Danakusumah and Kazuo Imanishi

Purpose: *Chlorella* sp. is an important phytoplankton as indirect food for fish and shrimp larvae culture. Some countries have been producing Chlorella as food for rotifer, (*Brachionus plicatilis*). This study was aimed to get a possibility of their stable mass culture of Chlorella.

Methods : Five 500-liter tanks with aeration were used for Chlorella culture. This experiment was conducted by medium of sea water filtered with sand and 1 ppm bleaching powder, and such fertilizer as 100 ppm amonium sulphate, 10 ppm of urea, and 20 ppm triple superphosphate were used. Initial stocking density of Clorella was 1×10^6 cell/ml. A series of harvesting were made after Chlorella density reached more than 10×10^6 cell/ml. Four such treatments as 40, 30, 20, and 10 % of harvest were made in this experiment, and the pan-lite tank without harvesting was left as a control. Thoma Haemacytometer was used for counting the density of Chlorella.

Result : The stable stock of Chlorella density had tendency to occur under the treatment by 20 % harvesting rate.

Preliminary study of rotifer (Brachionus plicatilis O.F.Muler)culture

E. Danakusumah and K. Imanishi

Purpose : It is no exaggeration to say that artificial fish seeds production depends heavily on a successful culture of rotifer, which are the most suitable food for the larvae shortly after their hatching. Preliminary study of rotifer flask culture wasmade to get some aspects on their preservation and effect under the low salinity in order to supply them smmothly for their mass culture and the order experimental purposes as well.

Methods: Ritifers used in this experiment were obtained from the Ancol Mariculture Laboratory, where they had been cultured. Culturing water (medium) used were all ultraviolet sterized water and pure water (ion exchange water). Chlorella and bread yeast were used as feed. As for the freservation of rotifers, their culture was conducted by means of 3 to 5 - liter flasks six (6) times during 24 days. Rotifers were inoculated so as to make their thensity 10 to 50 ind./ml into the chlorella sea water whose salinity was lowered slightly by adding bout 5 % of pure water. In the case of culture only by chlorella, rotifers were inoculated into the chlorella sea water of 20 X 10^6 to 50 X 10^6 cells /ml, and part of the rotifers were inoculated into the next chlorella sea water when the water had became transparent because of grazing by rotifers. In the case of the combined culture both of 10 X 10^6 to 20 X 10^6 cells/ml simultaneously feeding bread yeast and part of the rotifers were inoculated into the next culturing water when the chlorella had the and eaten up by rotifers. As for the rotifer culture under the low salinity, rotifers were cultured in the sea water of 100 %, 75 %, 50 %, 25 %, and 0 % by means of 1 - litre flask during 12 days. Rotifers, with had preliminarily been reared with bread yeast, were inoculated into the respictive sea water so as to define the number of chlorella individuals as 22 to 23 ind./ml. Yeast bread prreviously dissolved in water were fed once a day as feed. Feeding amount was defined as 0.1 g at a rotifer density of less than 150 ind./ml, 0.2 g, more than 150 ind./ml, and 0.3 g, over 900 ind./ml, resvectively such resvective amount of feed was fed into the each sea water accordingly..

Result : Rotifers used propagated rapidly in a little lower salinity water than the sea water, As for rotifers propagation, there were no great differences in propagation efficiency between the single food of chlorella and the combined food of chlorella and baker,s yeast. It took about 5 days for rotifers to reach the density of about 150/ml from 10 - 20 ind./ml. During these days of the experiment, 25 - 32 ind./ml propagated daily. When the density of rotifers exceeded 30 ind./ml, their propagation increased rapidly.

DATA FOR THE JOINT COMMITTEE

Shellfish section

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Activities of shellfish sector (~ 111 June 1982)

Indonesian - Japan
Mariculture Research and
Development Project (AIA-No.2)

1. Basical research

1). Oceanographical conditions (Fixed Point Observation)

Two times of the year round observation had been conducted during the period October 1979 to September 1981, and fundamental aspects of the environmental condition for mariculture in Banten Bay had been obtained. Results are shown in the report. Handbook making is in charge at present to establish the observation system. This observation is on the continuation by Indonesian side.

2). Fluctuation of the plankton

The observation on the seasonal fluctuation of plankton appearance and the identification of their species had been conducted during the period October 1980 to September 1981. Analisis and the report making are in charge. This observation is on the continuation by Indonesia side.

3). Bottom condition

The survey on the bottom condition with special reference to the silt contents distribution had been conducted twice in October 1981 and May 1982, before and after the rainy

[illegible] survey was made with the [illegible] to [illegible] distribution of Ark shell.
[illegible] of this survey method was already made. [illegible] of the [illegible] making are in charge at present.

4). Natural spat collection.

The [illegible] observation on the appearance of the [illegible] and the survey on the natural spat collection [illegible] conducted during the period February 1980 to July 1981 and the fundamental aspects of the natural spat collection of bivalves in Banten Bay had been analized. Report showed the suitable place, period and species on the natural spat collection in Banten Bay. Mass spat collection for Green mussel and Ark shell had been tried successfully in June and July at east area in the Bay.

2. Technical development for culture

1). Green mussel ; Studies on the spat collection and on the suspended rope culture had been observed during two years. From these studies instructions of Green mussel (Mytilus viridis) culture to the prefectural fishery office, which make the field activity, were given from March 1982. The first mass culture trial of 240 culture ropes suspended by three 8 m raft were prepared. New method of spat collection had been tried successfully in June.

2). Ark shell ; Studies on the spat collection and on the growth had been observed on Anadara indica, the dominant species in Banten Bay.

Trial of the artificial settling [illegible] substrate for [illegible] culture in Banten Bay. Studies on the [illegible] and [illegible] another [illegible] species, is continuing.

3). Oyster ; Publication of Miyagi and Hiroshima Japanese oyster (*Crassostrea gigas*), transplanted in Banten Bay, [illegible] 67 mm in the shell height within 7 months. Experiments on the local oyster were sometimes disturbed when others harvested the specimens on the natural bed. The spatfall of local oyster onto the vinyl sheet at the suface layer was recognized.

3. Artificial seed production

Studies on the food culture, the induced spawning and the early development were tried as the demonstration, and some brief report were made. Also the technological transfer of middle technical level on the artificial seed production was made during the technical training in Japan. Handbooks on the microalgae culture and on the bivalve larvae culture were made.

Title of handbooks and reports.

- Handbook on the culturing of microalgae.
- Handbook on the form in publishing a paper on a study.
- Handbook on the survey of bottom condition.
- Handbook on culturing of bivalve larvae.
- Survey on the oceanographical conditions in Banten Bay.
- Annual survey on the natural spatfall of bivalves in Banten Bay.
- Technical development on Green mussel in Banten Bay.

[illegible]

[illegible]

I. Shellfish [illegible]

M. [illegible]

1.1 Survey on the oceanographical condition in Banten Bay, October 1979 to September 1981.

1.2 Seasonal fluctuation of the plankton in Banten Bay, October 1980 to September 1981.

1.3 Bottom condition of Banten Bay, with special reference to the silt contents distribution.

1.4 Annual survey on the natural spatfall of bivalves in Banten Bay, February 1980 to January 1981.

1.5 Study on the technique for the species identification of bivalves larvae.

1.6 Some observations on the rope culture of Green mussel in Banten Bay.

1.7 Some studies of Ark shell culture in Banten Bay.

1.8 Culture of local oyster and the transplantation of Japanese oyster.

1.9 Experimental observations on the induced spawning and early development in the Green mussel, *Mytilus* (*Perna*) *viridis*.

1.1 Survey on [illegible] Capital [illegible] Bay [illegible]
October 1979 to September 1981

H. Nomura and D. Lockard

Purpose: For obtaining fundamental aspects of the environmental conditions for mariculture in Panton Bay, the first survey on seasonal fluctuation of the oceanographical conditions was conducted during the period October 1979 to September 1980, and the second survey, for the period from October 1980 to September 1981.

Methods: The survey was conducted twice a month regularly at the ten points fixed in the Bay. The data on rainfall were obtained from a weather station in Sirang. Standard thermometers were used for atmospheric and water temperatures. Kitahara water sampler and an electric thermometer were used for samplings of the deeper layers. Secchi disk was used for transparency, and a colorimeter for pH. A hydrometer and a refractometer were used for salinity, and current drogues were used for the current direction. D.O. meter was used for dissolved oxygen.

Results: In the first survey, ordinary rainfall ranged between 66 and 164 mm, but during the period December to April, ranged between 111 and 420 mm. Atmospheric temperature ranged mainly between 28 C and 31 C, and fell in January to February, May, and August. Water temperature varied from 29 C to 31 C, and fell in January to February, May, and August. Transparency ranged between 2 and 4 m, and fell in January to February and May to June. pH. ranged between 8.1 and 8.4, and fell to the range between 7.9 and 8.0 in February to March. Salinity varied between 31 and 34‰, and fell to 26‰ in February. Main current in the Bay changed in February and August. Since Panton Bay is of an open type and the current inflow from the open sea seems to control its environmental variation, it is assumed that the environmental conditions of the Bay for mariculture are stable as a whole except for part of its coastal area unlikely in the tropics.

1.2. Seasonal fluctuation of the plankton in Banten Bay, October 1980 to September 1981

F. Rumhard and M. Rosya

Purpose: The observation on the seasonal fluctuation of plankton appearance and the identification of their species were made for the period from October 1980 to September 1981 as one of the basic studies on the environmental conditions for mariculture in Banten Bay. Five dominant species of phytoplankton and four dominant species of zooplankton were observed.

Methods: Observations were made regularly twice a month at the ten fixed points by 100-liter vertical haul of the XX13 standard plankton net. All numbers of the planktons appeared were identified and counted under a microscope by the dilution method. The seasonal fluctuation of the appearance of phytoplankton and zooplankton was shown. Five dominant species of phytoplankton and four dominant species of zooplankton were also indicated.

Results: Phytoplankton increased in number of appearance during the period November 1980 to February 1981, in May, and for the period from July to August 1981, whose respective cells numbered 0.277×10^6, 0.279×10^6, and 1.41×10^6 per respective 100 liters, while zooplankton in October 1980, in March, in April, and from August to September 1981, whose respective cells were 0.130×10^6, 0.057×10^6, 0.049×10^6 per respective 100 liters. The dominant five species of phytoplankton in Banten Bay during the period October 1980 to September 1981 were Chaetoceros sp., Thalassiothrix, Rhizosolenia sp., Pleuriosigma sp., and Coscinodiscus, while Copepoda, Noctiluca, Ceratium, and Oikopleura were among the four dominant species of zooplankton. Each seasonal fluctuation was shown in a plankton calendar.

1.3. [illegible] conditions of bottom [illegible] with [illegible] to the silt contents distribution

I.Nontji and H.Posey

Purpose: As one of the basic studies of the environmental conditions for marine life in Banten Bay, a survey on its bottom conditions especially referring to the analysis of mud particles was conducted during the period October to December 1971, and was aimed to make a distribution map of the bottom silt contents of Banten Bay.

Methods: The observation was made at seventy-nine points chosen out of the points fixed at thirty seconds each of latitude and longitude. Mud of the bottom of each point was sampled by Ekman-Barge sampler and was sifted down by sieved of six different mesh sizes of 2 mm, 1 mm, 0.5 mm, 0.25 mm, 0.105 mm, and 0.053 mm. Each sample was dried to remove its water, and each dry weight was represented by the integral curve of dry weight composition, and its median size was divided into the following seven categories: (1) granule, (2) very coarse sand, (3) coarse sand, (4) medium sand, (5) fine sand, (6) very fine sand, and (7) silt.

Results: Most of the bottom in Banten Bay was of silt. The silt contents distribution map showed that the sandy areas were seen limited to the west part of the Pontang estuary, the west shore of the bay near the Linduk estuary, the Cengkok estuary, the northern part of the Panjang Island, the shouthern part of the Kubur Island, and the northern part of Tg. Kapo.

A Survey on the Natural Spatfall of Bivalves in Banton Bay, February 1979 to January 1980

N. Hoppya and N. Mochari

Purpose: For the purpose of developing the shellfish culture in Banton Bay, it is necessary to have a profound knowledge of the appearance fluctuation of planktonic larvae as well as of the spatting period and place of objective species for mariculture. In general observation on the appearance of bivalve larvae and the survey on the natural spat collection were conducted in the whole Bay during the period February 1979 to January 1980, and the fundamental aspects of the natural spat collection of bivalves in Banton Bay were analized.

Methods: The bivalves larvae were sampled by 100-liter vertical haul of the XX13 standard plankton net. Samples were taken twice a month regularly at the ten stations fixed in the Bay. The larvae sampled were gathered by separating from phytoplankton and suspended matter and counted under a microscope. Spat collection was made by using shell type and net type collectors at the main stations in the Bay. The collectors were hanged at 1 m layer and below the one meter layer at an interval of 2 m each and hauled up after one month. The species and the number of spat collected were observed.

Results: The two peak periods of larval appearance were recognized during the periods April to early July and late August to early October. Main species of the bivalves collected in the Bay were Pinctada sp., Anadara sp., Mytilus sp., and Musculus sp., and Crassostrea sp., and the dominant species was Pinctada sp. The suitable place and period for the spat collection and the bivalve species in Banton Bay were 1) Pinctada sp., Anadara sp., Mytilus sp., and Musculus sp. at stations 2 and 3 in May to July.
2) Pinctada sp. at stations 6, 7, and 8 in June to July.
3) Pinctada sp., Crassostera sp., and Mytilus sp. at station 3 in September to October. 4) Unknown species at station 10 in October.
5) Musculus sp. at station 2 in December. The shell type collectors were often found covered with barnacles.

1.5. Study on [illegible] of Bivalve [illegible]

M. [illegible] and M. [illegible]

Purpose: There are several ways to identify bivalve larvae, which are 1) A study on the early development by artificial rearing, 2) Rearing of particular species from live plankton samples, 3) Matching advanced stage larvae with the larval shell (prodissoconch) on the smallest spat collected, and this technique must be used for the studies of spatfall prediction, 3) Ecological study for the spat collection based by taxonomic features of prodissoconch of the spat collected.

Methods: Smaller spat were collected by using net type collector (500 mesh sieves), and were fixed by formalin. Spat of various sizes of the same species were chosen under the stereoscope with Turtox forceps. Entire shapes in the taxonomic features of each species of the prodissoconch were observed and some fully grown larvae were identified by each feature.

Results: Prodissoconch of Anadara sp. showed some oval shape and a shell length was approximately 310 μ. Mytilus viridis showed some semi-circle shape and their shell length was approximately 350 μ. Crassostrea sp. showed some circle shape whose position of umbones was displaced and their shell length was approximately 290 μ. Lunsbaia sp showed some triangle shape. Fully grown larvae of each species showed the similar shapes.

1.6. [illegible] of Green [illegible]

[illegible]

M. [illegible]

Purpose: Green mussel is one of the promising species in [illegible] economical value. Experiment for culturing this species were conducted [illegible] the [illegible] using the spat obtained from the survey on the natural spat [illegible]. S[illegible] results were utilized for the purpose of developing the suspended rope culture method which showed high productivity. Drying tolerance experiment was made for developing transplantation technique.

Methods: Floating bamboo collectors were used for the spat collection of this species in July 1981. Growth experiment was conducted by baskets (30 x30x10cm) hanging method to gather data on differences in culturing depth and density during the period October 1980 to February 1981. Culturing depth were 1 m, 3 m, and 5 m and culturing densities were 50, 100, 200, and 400 per baskets. The suspended rope culture has been under experiment since September 1981. Drying tolerance was also observed for 3 to 24 hours in October 1981 by using spat of 38.3 mm in shell length.

Results: Floating bamboo collector showed the result of 25,000 spat per 3.6 m^2. Culturing depths of 1 m, 3 m, and 5 m resulted in no significant differences. Different culturing densities of 50, 100, 200, and 400 individuals per basket showed a growth of 23.0 mm, 18.3 mm, 19.2 mm, and 13.4mm for three month. The suspended rope culture showed the result of a growth of 300 per day and was expected to reach 60 mm in shell length within five months from the begining of the culture. The drying tolerance showed the higher survival rates for over 24 hours under the cloudy weather but the lower rates under the low temperature conditions.

1.7. Some studies of ark shells culture in Banten Bay

M. Hosoya and M. M[illegible][1]

Purpose: Ark shells are highly marketable species consumed as Kerang bulu or Kerang darah in Indonesia. Dr. M. Horikoshi[1] identified [illegible] species of Anadara spp. of this area in October 1980. Anadara (Scapharca) indica was a dominant species collected in the survey on the natural shellfish in Banten Bay. Some studies of this species were carried out for developing ark shells culture.

Methods: Their spat collection was made in the east part of the Bay using new type collectors at the depth of 1 m and 3 m during the period June to July. Their growth experiment was conducted using hanging baskets filled with the nylon rope filament in October 1980. Their ecological survey was conducted by sampling in September 1981 and their natural setting substrate was studied in the fishing ground. Their distribution survey was carried out in Banten Bay using a dredge and it results were compared with those from the survey on the bottom conditions.

Results: Net collectors showed a good result in the spat collection and spat were seen attached more in 3 m layer than in 1 m layer. Hanging culture using baskets showed a growth of 500 μ/ day during the first one month, but 95 μ/ day since then. Natural setting substrate of this species at the Kamal fishing ground was tube worms of Tubicola, while no such tube worms were seen in the fishing ground in Banten Bay.

1) Institute of Oceanology, Tokio University.

1.8 [illegible] and the transplantation of Japanese oysters

M. [illegible] and [illegible]

Purpose : Local oysters were found on the backcoon of the Bay, on the shipwreck near Pulo Dua Island, at the estuary of the [illegible] and so on. Some of them were identified as Crassostrea cucullata and the others were identified as Crassostrea gigas. Experiment on their growth and the spat collection of local oysters were carried out.
The transplantation of Japanese oysters, Crassostrea gigas into Banten Bay was set about. It is now under experiment.

Methods : Growth experiment of local oysters, Crassostrea sp. collected from Pulo Dua was made by the raft hanging culture method in the Pulo Tanahan waters. Spat collection using 45 net collectors were made in September 1981 at station 3 based on the result of the survey on the natural spatfall.
Hiroshima strain and Miyagi strain of C. gigas were imported in November 1981, and their growth experiment by the rope hanging culture method is underway.

Results : Crassostrea sp. showed a growth from 23.0 to 30.8 mm in shell height and 64.9 % of the survival rate during 66 days. Spat collection showed a poor result of 23.2 spat per net collector. C. gigas of Hiroshima strain showed a favorable growth of 741 μ per day, while Miyagi strain, 506 μ per day.

1.9. F[illegible] of Spawning
[illegible] of C[illegible]
[illegible] (Pisces)

K. Hosoya and H. Mori [illegible]

Purpose: The technique of artificial seed production can be divided into such three stages as food microalgae culture, induced spawning, and larvae rearing. Some fundamental experiments on the artificial seed production of C[illegible] were carried out by means of the [illegible] facilities of the Bojo Aquicultural Station.

Methods: The food microalgae culture of Japan's Oyster Research Institute where 0.5 μ air filter is being used was introduced for this purpose. Microalgae culture experiment was made by using some microalgae obtained here and as a result, the effectiveness of this system was confirmed. The experiment on the induced spawning of H. viridis was made by hydrogen peroxide, sperm suspension, and thermal stimulation. The early development of this species was observed in a 25-liter container and the photomicrography of development was taken in the microscopic photography.

Results: The microalgae culture system of the Oyster Research Institute showed a high degree of accuracy in sterilization, and a long term of stationary phase of over 25 days was obtained. The cross stimulation by sperm and temperature was effected well in its induced spawning, while hydrogen peroxide was found ineffective. The early development was that morula stage was 1.6 hours, gastrula stage 3.3 hours, trochophore stage 6.8 hours, metamorphosis to D type 10.3 hours, and D type stage 12.3 hours after fertilization at water temperature ranging from 26 C to 29 C.

...king schedule of shellfish sector (fiscal year of 1984)

Indonesia - Japan Marine Culture
Research and Development Project
(AMA-197).

On the development of shellfish culture, it can be divided into three stages as 1) the basical study on biology, 2) the technical development for culture and 3) the industrialization. Some part of shellfish culture had been developed to the third stage through the works of last three years in this project. Under this situation, it is required now to study the total system which can be prospect all the steps of the shellfish culture as the fundamental view for the indonesian shellfish culture development in future.

Based on this viewpoint, important items of this fiscal year are the transfer of technology, from Japanese side to the counterpart, required for the total production system throughout the spat collection to the circulation using green mussel which has been studied as the species of high possibility for culture, and the long-term framing on the cultural development of this species should be considered. Also basical physiological studies, ecological studies and environmental survey should be observed for the sake of technical development on oysters and ark shell which are still in the first or second stage of the development. Accompained these studies it is very important to increase the technical level of the counterpart for the future expantion.

Contents.

I. Environmental survey

1). Routine survey (Fixed point observation)
establishment of the observation system (Handbook).
2). Special survey (Construction of the plankton)
report making (last 2 years), continuation.
3). Special survey (Toxic plankton & water pollution)
counterplan for P.S.P. (Paralitic Shellfish Poisoning)
4). Special survey (Bottom condition)
report making.
5). Special survey (Plankton larvae & Spat collection)
continuation.

II. Technical development on shellfish culture

1). Green mussel	(on the stage of Industrialization) mass culture on the raft. establishment of culture system (Handbook). investigation of total production system.
2). Ark shell	investigation of "artificial bottom culture substrata" for Anadara indica. basical study on useful species, A. inflata, A. granosa, etc.
3). Oyster	investigation on the transplantation and trial on the artificial reproduction of Crassostrea gigas, investigation on useful local oysters for culture.
4). Others	Counterpart will develop studies on Windowpen shell and Asian moon scallop.

III. Artificial seed production

This is an important item on the technical transfer. Some part of this technique were already studied on the technical

training in Japan, and hanbook was made. Some model production will be observed in this year, and expansion of basical study on biology will be instructed to the counterpart.

IV. Management on references and the observation apparatus

Effort for collecting references and management of observation apparatus will be made by all the project members.