AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

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Batch 66

1. SUBJECT CLASSIFICATION

A. PRIMARY
Serials Y-AM00-0000-G732

B. SECONDARY
Food production and nutrition--Fisheries--Philippines

2. TITLE AND SUBTITLE
Inland fisheries project; technical report,July-Dec.1972

3. AUTHOR(S)
(101) Philippines National Science Board; AID/ASIA/USAID/Philippines

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1973	106p.	ARC RP639.209914 J94

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Auburn

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(In NSDB project no.2235)
(Research summary)

9. ABSTRACT

10. CONTROL NUMBER
PN-AAE-261

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Freshwater fishes
Philippines

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/ea-180 CTS

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

AID/ea-180 & 75
PN-AAE-261

INLAND FISHERIES PROJECT

PROGRESS REPORT FOR NSDB-ASSISTED PROJECT NO. 2.235

(JULY 1, 1972, THROUGH DECEMBER 31, 1972)

Cover Photo: Freshwater Station under construction in Nueva Ecija.

INLAND FISHERIES PROJECT

Participating Agencies

National Science Development Board
University of the Philippines College of Fisheries
Central Luzon State University
National Food and Agriculture Council (Department of Agriculture and Natural Resources)
Bureau of Fisheries
National Economic Development Authority
Province of Iloilo
Municipality of Leganes, Iloilo
United States Agency for International Development

Technical Staff

Rogelio O. Juliano	Project Director
Jose A. Carreon	Asst. Project Director
Melchor M. Lijauco	Project Leader
Virgilio A. Dureza	Project Leader
Gaudencio Villaroman	Asst. Project Leader
Juanito Galsim	Pond Superintendent
Romulo C. Aure	Research Assistant
Ramyle T. Pelayo	Research Assistant
Michael Cuenco	Research Assistant
Lourdes A. Dureza	Research Assistant
Joel R. Canlas	Research Assistant
Gregorio T. Banacia	Research Aide
H.R. Schmittou	Technical Advisor
John H. Grover	Technical Advisor

FOREWORD

This technical report of the Inland Fisheries Project (IFP) covers the activities of the project in research, training, extension services and construction of two research stations from July 1 to December 31, 1972. The report shows the progress of work, with emphasis on research undertaking, in an effort to present methodologies; development of techniques in fertilization of ponds; comparative performance of different techniques of pond culture (lab-lab and plankton method of fish production); intensive culture of hito in small ponds, tanks and cages; salinity tolerance of bangus; and results on physical and biological surveys. All of these are done with the end in view of increasing fishpond production in the country.

All research reports are not meant to be research publications.

The IFP gratefully acknowledges the cooperation given by Mr. Jose Legarda, Dr. Saturnino Abesamis, Atty. Jose Batungbacal, Mr. Tirso Jamandre, Jr., Mr. Ernesto Jamandre, and Atty. Eufemio Domingo in providing facilities for research. The project also highly appreciates the participation and provision of facilities by the Western Visayas Demonstration Fish Farm of the Bureau of Fisheries (Iloilo City), the Iloilo Regional School of Fisheries (Barotac Nuevo, Iloilo), the Philippine Federation of Fishpond Producers, and the Philippine Research Society on Fish Culture (Iloilo City).

The project appreciates and acknowledges the financial assistance and support given by the National Science Development Board and the United States Agency for International Development. To the administrative support given by the University of the Philippines and the Central Luzon State University, the IFP is thankful.

The cooperation and dedication to work shown by the IFP staff are gratefully acknowledged. It is worth mentioning here that all the IFP technical staff had a hand in writing this report.

ROGELIO O. JULIANO
Project Director

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I. INTRODUCTION

The Inland Fisheries Project (IFP) objectives in research, training and extension have been outlined and treated in the first technical report (FY 1971-72). In said report the subprojects (the Brackishwater Fish Culture Research Station at Leganes, Iloilo, and the Freshwater Fish Culture Research Station at CLSU, Munoz, Nueva Ecija) were briefly discussed.

This semi-annual technical report of the IFP, covering the period from July 1 to December 30, 1972, gives the research, training and extension activities undertaken within the six-month period including the progress of the construction of physical facilities (ponds and buildings) of the two stations and the programmed activities for the next six months (January through June, 1973).

The project is impatiently waiting for the physical facilities of the subprojects (stations) to become operational for expanded and centralized research activities. The project's research activities are still in the preliminary stages and more or less exploratory to find out possibilities and potentials of certain techniques and methods for culture of bangus and hito. The rationale for concentrating on these species was given in the first IFP technical report. It is hoped that by the time the two stations become operational the project would have enough knowledge and experience to undertake research to refine the techniques necessary to increase the production in aquaculture.

Research activities were done mostly in privately owned ponds whose owners cooperated with the project in the activity and also in facilities owned by the Bureau of Fisheries and the Central Luzon State University, the co-proponent of the Freshwater Station.

Researches reported herein are those which were in progress at the time of the first technical report and what have been undertaken in the six-month period since. The project has decided to set aside for a while pellet feeding of bangus because of technical problems encountered with stability in water of the pellet and the efficiency of fish growth on pelleted material. Since the growing of lab-lab in ponds to provide natural food for the bangus has been accepted by our bangus producers as a method of obtaining high yields from their ponds, experiments with this method have been undertaken by the project. Also, based on the project's hypothesis that bangus is an efficient strainer of microscopic organisms (plankton) in water as evidenced by the gill morphology of the fish, studies are being made to culture bangus in ponds with plankton as the natural food grown with the help of inorganic fertilization. The "plankton method" or "deep water method" as we commonly call the latter technique of bangus culture has basic advantages

over the "Lab-lab method" because of the following:

1. Time needed for preparation of ponds prior to stocking can be considerably shortened. Inputs on labor to prepare the ponds is also reduced.

2. Inputs of fertilizers (inorganic) is reduced with the use of platforms which allows gradual solution of the fertilizer to the water and thus avoids waste of fertilizers. The use of organic fertilizer (chicken manure) has been stopped in ponds with good organic base.

The "deep water method", however, requires the ponds to hold water at a depth of about 0.7 meter. Not all fishponds in the Philippines are designed and engineered to contain water that deep. If this method is proved to be good in terms of increasing production and the profit of the producer, some fishponds will have to be modified in their construction if the owners wish to go into this method culture.

Hito culture experiments in small ponds has indicated certain problems which are hereunder mentioned.

1. Food conversion rates of the IFP pelleted feeds and trash fish (Thailand method of feeding) have been less than satisfactory. More studies need to be done in the area of catfish feeds.

2. Rates of growth of the hito in our particular studies have been slow and growth appears to taper off after a certain period of culture.

3. Diseases in catfish are common and may cause high mortalities.

Data on hito will have to be pooled for purposes of analyses for possible problem patterns which may exist. Work on the culture, propagation or breeding and disease control of hito will continue in the project.

The IFP has also performed studies on salinity tolerance of the bangus, biological surveys of fishponds, soil texture of the ponds of the Freshwater Station, turbidity studies of the Freshwater Station ponds, and others.

References in the report of the following terms mean:

1. Bangus - the milkfish, a euryhaline fish which can be cultured in both brackishwater (or saltwater) and freshwater ponds. Its scientific name is Chanos chanos.

2. Hito - a freshwater catfish which is an airbreather. Its scientific name is Clarias macrocephalus.

3. Dalag - the mudfish or murrel, Ophiocepalus striatus.

4. Lab-lab - a complex mixture of microscopic plant and animal organisms which develop as a pond scum on the pond bottom producing a greenish to brownish colored mat which sometimes floats to the water surface. This serves as food for bangus under culture.

5. Lumut - a complex of filamentous green algae sometimes cultivated in ponds as food for bangus.

II. RESEARCH ACTIVITIES

A. Research Completed

1. Bangus Production in Brackishwater Ponds with Lab-lab and Supplementary Feed (Iloilo Part)

Introduction

The cultivation of lab-lab to provide the main source of food for bangus in brackishwater ponds has gained popular acceptance among fish culturists in the Philippines. In fact, the so-called "improved technique" in bangus culture is synonymous to lab-lab culture.

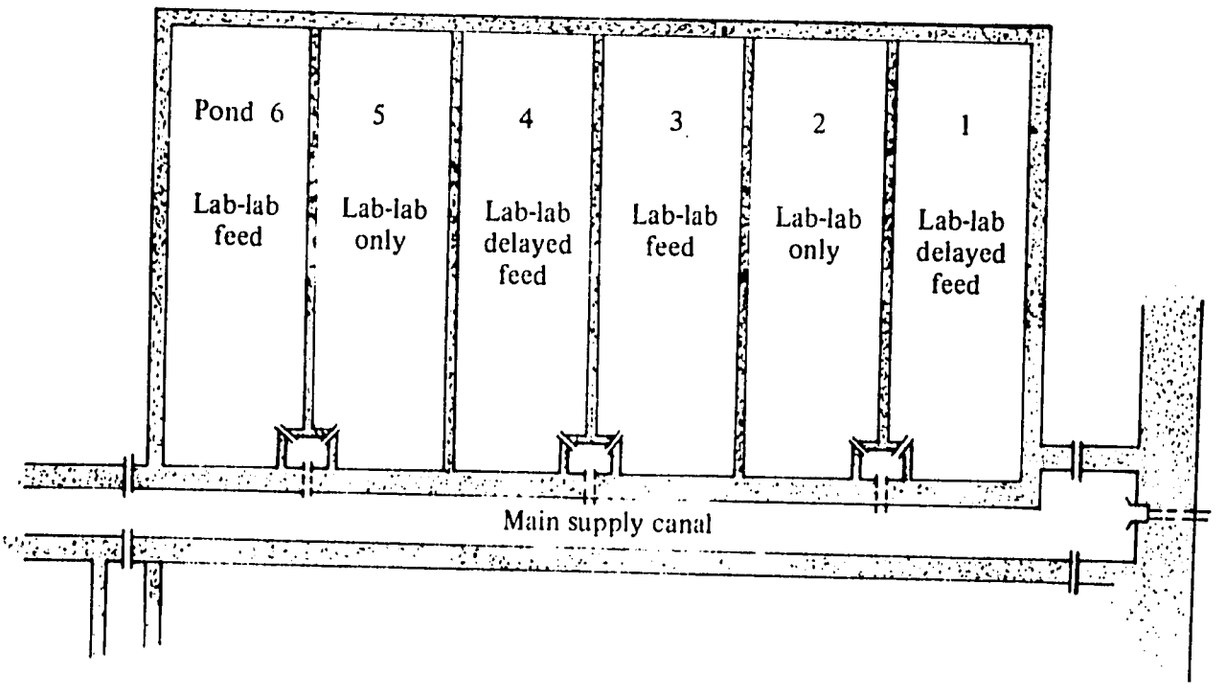
Another aspect of pond culture which has inherent potentials to increase production is the use of supplementary feed. Eventual adoption of feeding as a standard practice, however, will have to be based on factual accounts of increased production yields and of favorable cost/profit ratios.

The main objective of the present study was to compare growth rates, yields and costs of inputs in ponds with lab-lab only and with lab-lab and supplementary feed.

Materials and Methods

The study was conducted at the Bureau of Fisheries Western Visayas Demonstration Fish Farm (BF Molo Farm), Iloilo City, in 6 rectangular ponds (Fig. 1.01). The ponds averaged 0.11 ha with maximum water depths of near 40 cm.

Fig. 1.01 - Diagram of study ponds showing pond numbers and treatments, BF Molo Farm, Iloilo City.



The study consisted of 3 treatments with 2 replications each. Lab-lab was produced in all 6 ponds as the basic food of the fish. Treatments were as follows:

1. Lab-lab only - This treatment served as the control; no supplemental feed was used.

2. Lab-lab-immediate feed - Supplementary feed was used baginning the day following stocking.

3. Lab-lab-delayed feed - Supplementary feed was used but was delayed until lab-lab supply appeared nearly depleted.

All ponds were allowed to dry from March 24 through April 14. The fertilization program began on April 15 (Table 1.01). Chicken manure was broadcast over the pond bottoms at a rate of 2000 kg/ha on April 15 in ponds 4, 5 and 6 and on April 17 in ponds 1, 2 and 3. All ponds were filled with water to a depth of 3 cm. Inorganic fertilizer 16-20-0 and rice bran were broadcast over all ponds at the rate of 100 kg/ha and 600 kg/ha, respectively, on April 21. The ponds were then filled to a depth of 5 cm. An additional application of 100 kg 16-20-0/ha was done in solution on April 21. Water depth was increased gradually over a period of 15 days to about 30 cm.

All ponds were stocked on May 11 with bangus fingerlings averaging 6.8 g. The fingerlings were purchased from a local fingerling producer. The fish were transported from the private pond to the BF Molo Farm in plastic bags (approximately the size of a 50-kg fertilizer bag) one third filled with pond water and provided with oxygen gas Each bag contained about 100 fish. The time the fish remained in the bag was approximately 2 hr. At BF Molo Farm the fish were transferred into a net enclosure suspended in a supply canal. The fish were individually counted into plastic buckets and stocked into designated ponds. A total of 348 fish were sampled at random from the net enclosure, anaesthetized in quinaldine-MS222 solution, measured and weighed prior to stocking.

The initial stocking density was 5000 fish/ha in all ponds; however, a reduction in density was brought about by a partial kill of fish in each pond during the first few days following stocking (Table 1.02). The kill was believed to have been caused by bacterial disease resulting from stress caused by conditions prior to and during transport; prolonged handling under warm temperature and direct sunlight during stocking; and a sudden and drastic change in water salinit: during transfer from net enclosure to ponds.

Table. 1.01 – Amounts of chicken manure, rice bran and 16–20–0 fertilizer used in the study ponds at the BF Molo Farm from April 15 through July 13.

Date	Kg fertilizer used/ha of pond/treatment								
	Lab-lab only (ponds 2 and 5)			Lab-lab feed (ponds 3 and 6)			Lab-lab-delayed feed (ponds 1 and 4)		
	Chicken manure	Rice bran	16-20-0	Chicken manure	Rice bran	16-20-0	Chicken manure	Rice bran	16-20-0
April 15 and 17	2000	–	–	2000	–	–	2000	–	–
April 21	–	600	100	–	600	100	–	600	100
April 27	–	–	100	–	–	100	–	–	100
May 29	–	–	100	–	–	100	–	–	100
June 30	–	–	100	–	–	–	–	–	–
July 13	–	–	100	–	–	–	–	–	–
Total	2000	600	500	2000	600	300	2000	600	300

Table 1.02 - Stock densities following adjustment for known dead fish in lab-lab-feed experiment at the BF Molo Farm, Iloilo City, May, 1972.

Treatment	Pond no.	Area (m^2)	Stocking density (corrected) per pond	per ha
Lab-lab only	2	1050	497	4733
	5	1066	520	4878
Lab-lab-immediate feed	3	1130	526	4655
	6	1115	474	4251
Lab-lab-delayed feed	1	1110	538	4890
	4	1130	553	4894

All ponds received 100 kg 16-20-0/ha in solution on May 29. In addition ponds 2 and 5, the lab-lab only treatment ponds, received the same dose on June 30 and again on July 13.

The feed used in both feed treatments was IFP-1 formula pelleted feed. The feed was applied once daily by broadcasting or by placing the day's ration on feeding platforms. The platforms were wooden table-like structures having a top surface area of 0.6 m^2. The platforms were first positioned 15 cm below the water surface and later lowered to within 10 cm of the pond bottoms. The fish were fed at a daily rate of 2% of their body weight from May 17 to June 18, and at 3% from June 19 to July 30.

The feeding program was interrupted from June 28 to July 10 because of lack of feed. The feeding schedule, amount applied and method of feeding are presented in Table 1.03.

The stocks were sampled on May 25, June 16 and on July 10 corresponding to the 14th, 36th and 60th days of culture. Samples of about 40 fish from each pond were made and individual fish were weighed and measured.

Table 1.03 – Dates and amounts of feed and methods applied in the feed treatments at the BF Molo Farm from May 17 through July 30.

Period (dates)	Feeding method	Immediate Feed				Delayed Feed			
		Pond 3		Pond 6		Pond 1		Pond 4	
		kg/period	kg/ha	kg/period	kg/ha	kg/period	kg/ha	kg/period	kg/ha
May 17 to May 25	Broadcast	0.63	5.58	0.58	5.20	–	–	–	–
May 26 to June 18	Broadcast	4.60	40.71	3.48	31.21	–	–	–	–
June 19 to June 28*	Platform	15.69	138.85	13.87	124.39	13.50	121.62	14.77	130.71
July 11 to July 30	Platform	42.36	374.87	38.02	340.99	43.42	391.17	44.88	397.17
	Total	63.28	560.01	55.95	501.79	56.92	512.79	59.65	527.88

*Ponds 1 and 4 did not receive feed on June 28.

The stocks were inventoried on August 2, the 83rd day of culture, when the ponds were drained and the study terminated. Fish were counted and 100 fish from each pond were individually weighed at harvest. Total weight per pond was estimated based on the mean weight of the samples.

Weekly samples of lab-lab were taken for qualitative and quantitative analyses. In the absence of a suitable and standard sampling technique, a sampler was devised to collect lab-lab within a column extending from the water surface to pond bottom. The sampler consisted of a piece of polyvinyl pipe with approximately 8 cm inside diameter and 75 cm length. The lab-lab sample was centrifuged in graduated tubes at a speed of 3,595 rpm for 5 min. Estimate of lab-lab abundance was calculated as ml/m^2 of pond area.

Periodical tests on the water chemistry of the ponds were made for dissolved oxygen, pH, salinity, CO_2, total alkalinity and water temperature. Water samples were taken at about 9:00 AM. Rainfall and air temperature were also recorded.

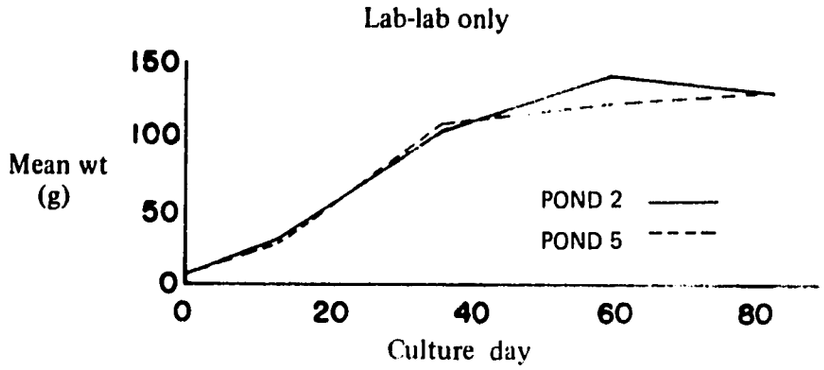
Results and Discussions

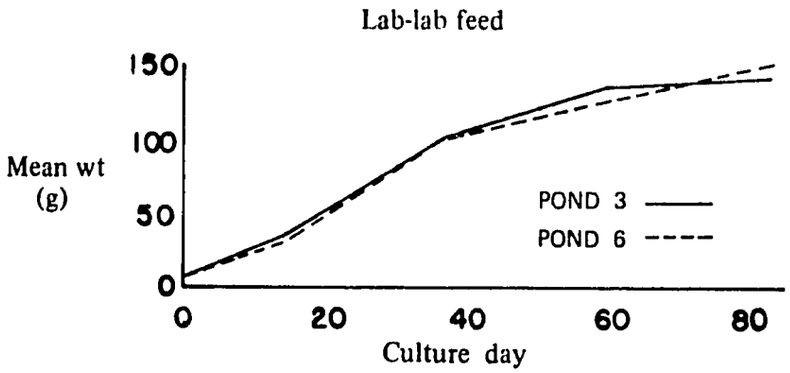
Data from fish samples were used to plot empirical growth curves (Fig. 1.02). The curves show a moderate semblance with the theoretical sigmoid curve, with the points of inflection located at approximately the 36th day of culture.

Growth rates of fish within and between treatments are shown in Table 1.04. Net gains computed after the 14th and the 36th day appeared to differ insignificantly between treatments indicating that supplementary feeding was not promoting growth. Going to the 60th day, weight increase/fish/day in the lab-lab-delayed feed and lab-lab-feed treatments were relatively higher at rates of 1.6 g and 1.3 g/fish/day, respectively, as compared to 1.1 g/fish/day for the lab-lab only treatment. The worsening condition in the lab-lab only ponds was further evidenced by the loss in weight of the fish at termination on the 83rd, while those in the feed ponds were continuing to increase, although at very low rates.

Production yields from all ponds are summarized in Table 1.05. Net gain in the lab-lab-feed and delayed feed treatments was greater by 3% and 28%, respectively, than in the lab-lab only treatment.

Fig. 1.02 – Empirical growth curves of bangus in ponds of given treatments at BF Molo Farm, Iloilo City.





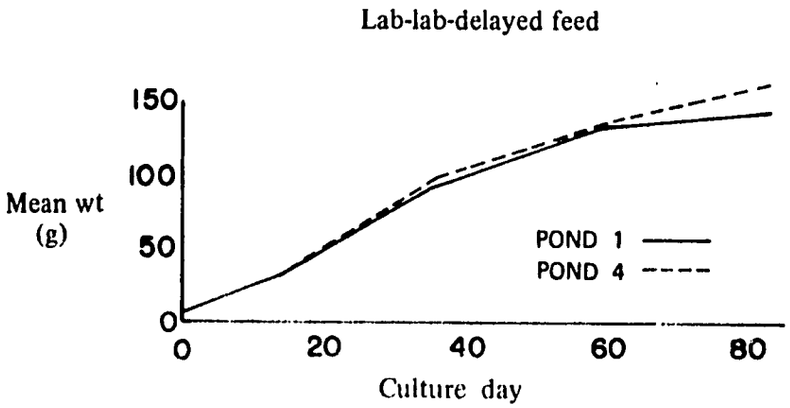


Table 1.04 – Growth of bangus during lab-lab feed experiment at the BF Molo Farm, Iloilo City, May to July, 1972. Fish had a mean weight of 6.8 g at stocking.

Treatment	Pond	14th day		36th day		60th day		83rd day	
		Mean wt (g)	Net gain (g/fish/day)	Mean wt (g)	Net gain (g/fish/day)	Mean wt (g)	Net gain (g/fish/day)	Mean wt (g)	Net gain (g/fish/day)
Lab-lab only	2	33.1	1.9	104.0	3.2	142.3	1.6	130.4 3/	-0.5
	5	30.8	1.7	108.0	3.6	122.5	0.6	129.4	0.3
	Mean	32.0	1.8	106.0	3.4	132.4	1.1	130.0	-0.1
Lab-lab immediate feed 1/	3	33.7	1.9	100.6	3.0	136.1	1.5	142.3	0.3
	6	29.2	1.6	99.0	3.2	126.3	1.1	151.0	1.1
	Mean	31.5	1.8	99.8	3.0	131.2	1.3	146.7	0.7
Lab-lab delayed feed 2/	1	32.7	1.9	93.8	2.8	134.6	1.7	142.6	0.4
	4	32.0	1.8	99.3	3.1	136.1	1.5	161.5	1.1
	Mean	32.4	1.9	96.6	3.0	135.4	1.6	152.1	0.8

1/ - Feeding started on the 6th day.
2/ - Feeding started on the 39th day.
3/ - Mean weight decreased.

Table 1.05 - Bangus production in ponds with lab-lab only, lab-lab-immediate feed and lab-lab-delayed feed.

Treatment	Pond no.	Stocked (kg/ha)	Harvested (kg/ha)	Net gain (kg/ha)	Net gain (Kg/ha/da)
Lab-lab only	2	32.2	531.2	499.0	6.0
	5	33.2	493.9	460.7	5.6
Average		32.7	512.6	479.9	5.8
Lab-lab-immediate feed	3	31.7	536 3	504.6	6.1
	6	28.9	521.9	493.0	5.9
Average		30.3	529.1	498.8	6.0
Lab-lab-delayed feed	1	33.3	604.1	570.8	6.9
	4	33.3	687.9	654.6	7.9
Average		33.3	646.0	612.7	7.4
Total		192.6	3375.3	3182.7	38.4

The combined cost of fertilizers and feeds per kilogram of net yield (Table 1.06) gave further indication of the low efficiency of the feed. The yield costs in the lab-lab-feed and lab-lab-delayed feed ponds increased by about 56% and 27%, respectively, over that of the lab-lab only ponds. These increases were not in economic proportions with the increase in yields.

Table 1.06 - Total cost of fertilizers and feed per kilogram of fish produced in bangus culture experiment at BF Molo Farm, Iloilo City, May to July, 1972.

Treatment	Pond no.	Fertilizer	Feed	Total	Net Gain (kg/ha)	Cost (₱/kg of fish)
Lab-lab only	2	611.00	0	611.00	499.00	1.22
	5	611.00	0	611.00	460.7	1.33
Lab-lab-immediate feed	3	518.00	503.19	1021.19	504.6	2.02
	6	518.00	451.53	969.53	969.0	1.97
Lab-lab-delayed feed	1	518.00	465.75	983.75	570.8	1.72
	4	518.00	475.11	993.11	654.6	1.52

1/ - Based on the following costs:

₱ 3.20/50-kg sack of chicken manure
₱10.00/25-kg sack of rice bran
₱25.00/50-kg sack of 16-20-0
₱ 0.95/kg IFP-1 feed

Feed conversions were extremely poor in both feed treatments, especially in the lab-lab-feed treatment (Table 1.07).

Table 1.07 - Conversion values (C) for the feed used in lab-lab-feed experiment at BF Molo Farm, Iloilo City, May to July 1972.

Treatment	Pond no.	Net gain (kg/ha)	Feed (kg/ha)	C 1/
Lab-lab-immediate feed	3	504.6	560.00	22.7
	6	493.0	501.8	38.3
Lab-lab-delayed feed	1	570.8	512.8	5.6
	4	654.6	527.9	3.0

1/ - C conversion was calculated by dividing the total amount of feed used in a pond by the difference between net gain in said pond and the average net gain in lab-lab only treatment (479.9 kg/ha).

Likely causes for the poor conversion values obtained were:

1. The method of feeding was quite indeterminate, since no specific feeding technique for bangus has ever been known. The response to feed when placed in heaps at several spots along the dikes and when placed on platforms about 15 cm below the water surface was relatively poor. Feeding somewhat improved when the platform were lowered to within 10 cm of the pond bottom during the final 20 days of the culture period.

2. The physical characteristics of the IFP-1 feed were not suitable for bangus.

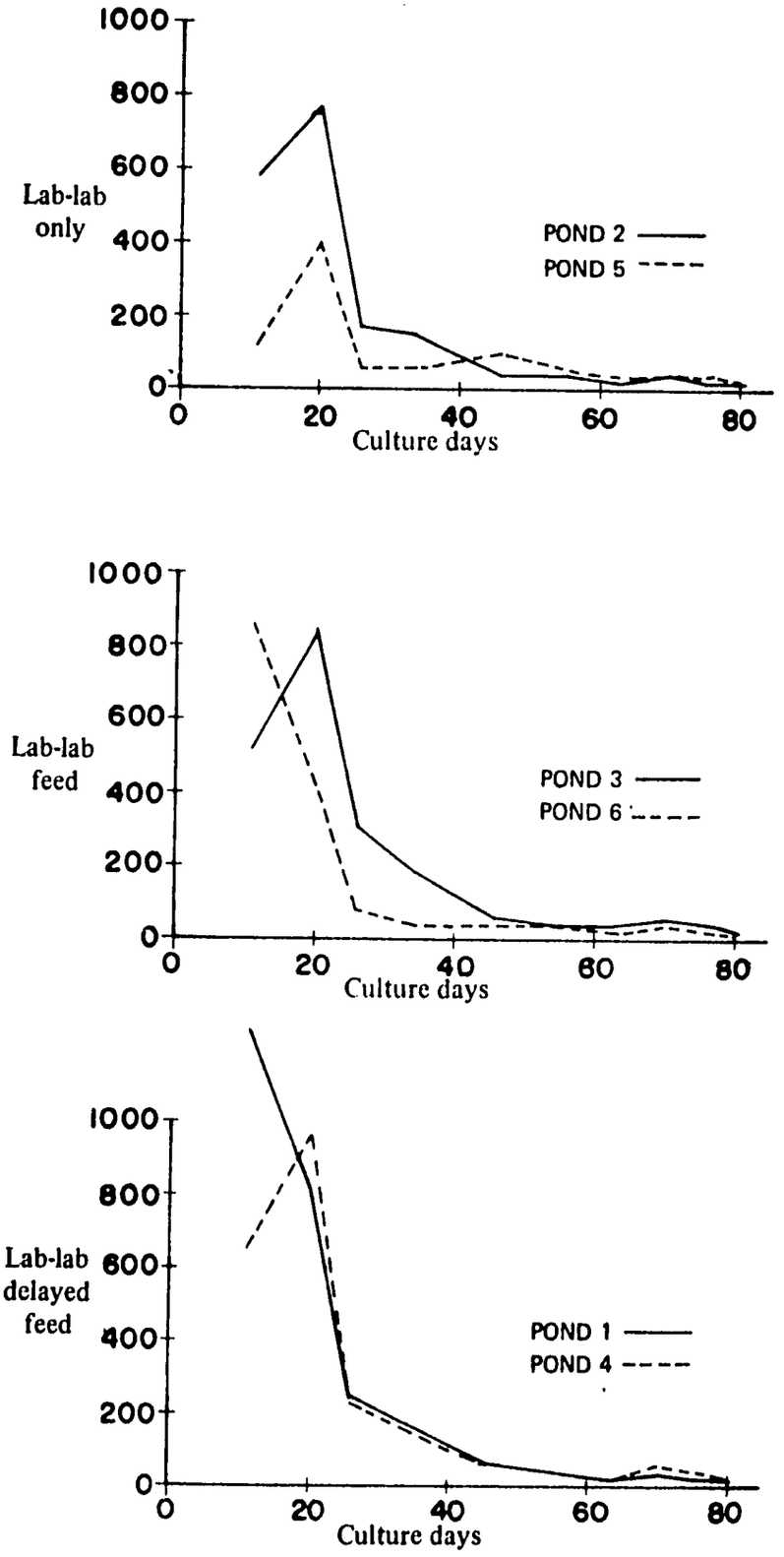
3. The competition for feed from Tilapia and Poecilia.

More than as measures of the efficiency of the feeds, the conversions obtained made up a valuable set of indices comparing the efficiency of the feed treatments. The conversions further substantiated what appeared to be an advantage in a delayed feeding program over that of an immediate feeding in ponds initially grown with abundant lab-lab and other natural food organisms.

Qualitative analyses of lab-lab showed mostly the presence of blue-green algae, diatoms, protozoans, crustaceans, rotifers and nematodes. The most predominant were Oscillatoria, Lyngbya and Spirulina among the filamentous blue-greens; Navicula and Pleurosigma among the diatoms; Chaetomorpha and Enteromorpha of the filamentous green algae; and copepods and cladocerans.

All six ponds exhibited essentially similar trends in the estimated standing crop of lab-lab and other natural food organisms (Fig. 1.03). There was a steady increase in the first three weeks in the culture period followed by a sharp decline in the fourth week. Afterwards, the standing crop levelled off at relatively low values in spite of repeated fertilization. The period of sharp decline coincided with the period of highest net gains in weight of the stocks. Heavy rains occurred during the period of sharp decline in a lab-lab.

Fig. 1.03 – Standing crops of lab-lab and other natural food organisms in study ponds at BF Molo Farm, Iloilo City.



The physio-chemical conditions of the pond water did not change much either within or between treatments, though marked variations in the salinities occurred during certain periods. Prior to stocking, salinities in all ponds were mostly above 60°/oo. After stocking, and for about 45 days, salinities were more or less constant about 40°/oo. Prolonged rains t. at followed caused further decrease and an extremely low 2.9°/oo was obtained on the 82nd day. A marked deterioration in the condition of lab-lab occurred after each heavy rain. Whether the cause is mechanical in nature (wind and wave action) or one associated with the rapid and often extreme lowering of salinity is not known.

The amounts of rainfall and mean salinity, water temperature, dissolved oxygen, free carbon dioxide, pH and total alkalinity for all ponds are shown in Fig. 1.04.

The free dissolved oxygen content in all ponds ranged from 0.5 ppm to 14.0 ppm. Values of less than 3.0 ppm were experienced only on few occasions and there were no visible effects on the fish.

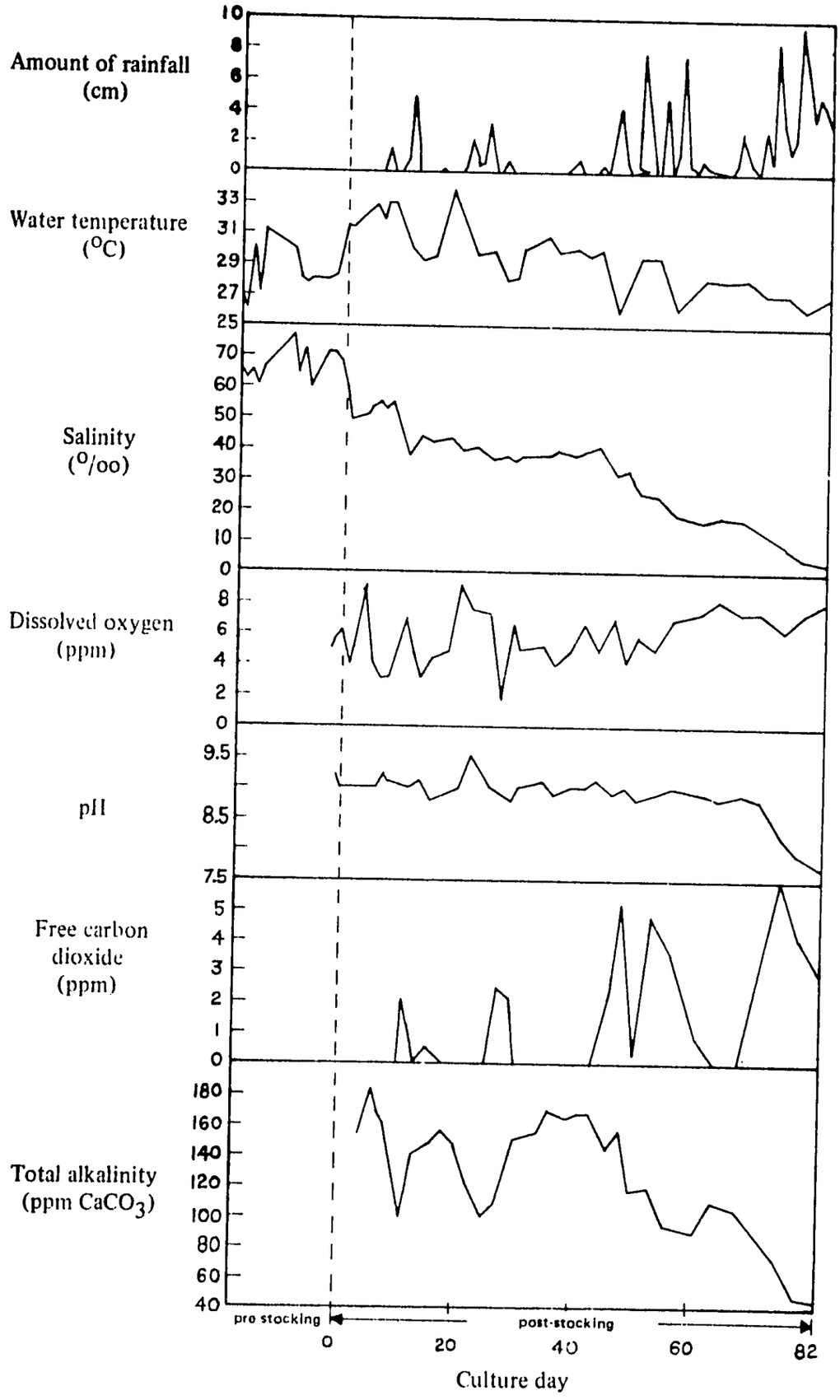
The pH remained essentially constant ranging from pH 8 to 10, except during the last week when pH 6.8 to 8.0 were obtained.

Free CO_2 was seldom present. During the few occasions when it occurred, ranging from 2 to 16 ppm, it was associated with a lowering of total alkalinity. Total alkalinity ranged from 34 to 208 ppm $CaCO_3$ in all ponds. The appearance of CO_2 and lowering of total alkalinity simultaneously occurred with very heavy rains.

2. Bangus Production in Brackishwater Ponds with Lab-lab and Supplementary Feed (Bataan Part)

The introduction to this work is the same as the previous paper. Two separate trials were begun near the community of Orani, Bataan; one on the fish farm of Atty. Jose Batungbacal and one on the fish farm of Mr. Jose Legarda. The Batungbacal Farm experiment used 6 ponds ranging in size from 0.18 to 0.27 ha. Two replicates for each of the three treatments were programmed. The Legarda Farm experiment used 5 ponds ranging in size from 0.76 to 0.94 ha. One pond was started with feed immediately upon stocking, two received feed on a delayed schedule and two depended on lab-lab only. For both experiments, ponds to receive feed were stocked at 5000 fish/ha and ponds to receive no feed were stocked at 2000 fish/ha.

Fig. 1.04 – Rainfall and mean water conditions for all study ponds at BF Molo Farm, April 24-August 2, 1972.



Torrential rains of July in Central Luzon caused both experiments to wash out before scheduled completion. On the basis of earlier sampling some results were obtained and some conclusions can be drawn.

Batungbacal Farm

Bangus fingerlings averaging 14.4 g were stocked on April 15, 1972, in all ponds. The ponds were all remarkably similar having been started with lab-lab using inorganic fertilizer applied on platforms. Sampling of fish was done on May 3 (18th day), May 27 (42nd day) and June 28 (74th day). Fertilizer was added to the platforms on May 4, July 2 and July 18 at the rate of 20 kg 18-46-0/ha. The fertilizer cost averaged ₱42.50/50 kg sack so the total of fertilizer cost for the preparation and the three subsequent applications was ₱68/ha.

Fish receiving feed were given pelletized IFP-1b feed at the rate of 3-1/2% to 5% of their weight/day. The ponds in the delayed feeding treatment first received feed on May 4, the 19th day of the experiment. Feeding rates were adjusted after each sampling based on the weight at the time of sampling. Feed cost was ₱0.91/kg. Results are summarized in Tables 2.01 to 2.03.

Table 2.01 -- Production of bangus in experiment at Batungbacal Farm, Orani, Bataan, April 15 to June 28, 1972, based on assumed 90% survival.

Pond no.	Treatment	Pond size (ha)	No. stocked /pond	No. stocked /ha	Size of fish (g) June 28, 1972	Net production (kg) /pond	Net production (kg) /ha	Amount of feed (kg) /pond	Amount of feed (kg) /ha
1	Lab-lab only	0.23	460	2000	207.1	79.14	344		-
2	Delayed feed	0.22	1100	5000	132.5	115.38	524	100.3	456
3	Immediate feed	0.18	900	5000	135.5	96.76	538	167.6	931
4	Immediate feed	0.27	1350	5000	134.7	144.26	534	200.6	743
5	Delayed feed	0.22	1100	5000	130.7	113.59	516	131.7	599
6	Lab-lab only	0.18	360	2000	181.8	53.7	298	-	-

Table 2.02 - Growth of bangus in experiment at Batungbacal Farm, Orani, Bataan, April 15 to June 28, 1972.

Treatment	Pond no.	Mean size (g) of fish at sampling			
		Day 0	Day 18	Day 42	Day 74
Lab-lab only	1	14.4	66.6	115.2	207.1
	6	14.4	47.8	98.0	181.8
Delayed feed	2	14.4	57.3	91.7	132.5
	5	14.4	54.4	95.1	130.7
Immediate feed	3	14.4	59.4	104.4	135.5
	4	14.4	43.4	89.2	134.7

Table 2.03 - Production summary by treatment of bangus in experiment at Batungbacal Farm, Orani, Bataan, April 15 to June 28, 1972, based on an assumed 90% survival.

Treatment	Net gain (kg/ha)	Total feed (kg/ha)	Feed conversion*	
			S	C
Lab-lab only	321	-	-	-
Delayed feed	520	528	1.02	2.65
Immediate feed	536	837	1.56	3.89

* S - values are based on total uncorrected net gain, C values are based on net gain corrected for expected gain with lab-lab only

Legarda Farm

Bangus fingerlings averaging 12.2 g were stocked on April 15, 1972, in all ponds. The ponds had been prepared with lab-lab using inorganic fertilizer applied on platforms. Sampling of fish was done on May 3 (18th day), May 27 (42nd day) and June 27 (73rd day). Fertilizer was added to the platforms May 4 and June 3 at the rate of 20 kg 18-46-0/ha. The fertilizer cost for the preparation and two subsequent applications was ₱51/ha.

Fish feeds used were the same as those tried at the Batungbacal Farm. The ponds receiving delayed feeding were started on May 30, the 45th day of the experiment. All fish died in pond 5A in the period from June 8 to 10. The pond had received a total of 432 kg feed. Pond water was exchanged when mortalities were first noticed but the fish continued to die. Results are summarized in Tables 2.04 through 2.06.

Table 2.04 – Production of bangus in experiment at Legarda Farm, Orani, Bataan, April 15 to June 27, 1972, based on assumed 90% survival.

Pond no.	Pond size (ha)	No. of fish stocked	Size of fish (g) June 27, 1972	Net production (kg)		Amount of feed (kg)	
				/pond	/ha	/pond	/ha
5A	0.79	3950	153.0**	496**	628**	598**	757**
5B	0.91	1820	189.3	288	316	-	-
5C	0.94	4700	123.4	465	494	454	483
5D	0.82	4100	169.3	575	701	396	483
5E	0.76	1520	207.8	266	350	--	--

**Fish died June 8 to 10, values projected from May 27 sampling.

Table 2.05 - Growth of bangus in experiment at Legarda Farm, Orani, Bataan, April 15 to June 27, 1972.

Treatment	Pond no.	Mean size (g) of fish at sampling			
		Day 0	Day 18	Day 42	Day 73
Lab-lab only	5B	12.2	56.5	138.3	189.3
	5E	12.2	54.2	148.4	202.8
	5C	12.2	36.9	73.1	123.4
	5D	12.2	37.2	120.8	169.3
	5A	12.2	43.0	108.6	-

Table 2.06 - Production summary by treatment of bangus in experiment at Legarda Farm, Orani, Bataan, April 15 to June 27, 1972, based on an assumed 90% survival.

Treatment	Net gain (kg/ha)	Total feed (kg/ha)	Feed conversion*	
			S	C
Lab-lab only	333	-	-	-
Delayed feed	598	483	0.81	1.82
Immediate feed	628**	757**	1.21**	2.57**

* S - values are based on total uncorrected net gain, C values are based on net gain corrected for expected gain with lab-lab only.

**Fish died June 10 to 12. Value projected from May 27 sampling.

Conclusions from Bataan

1. Fish growth was rapid in all treatments.

2. Fish stocked at 2000/ha grew faster in the first period after stocking than fish stocked at 5000/ha though net production was greater with the more densely stocked fish.

3. Fish receiving supplementary feeding from the beginning did not grow faster than "delayed-feeding fish" and both groups of fish grew at similar rates when feeding was given both groups. Delayed feeding is consequently more economical than continuous feeding.

4. Fish not fed and stocked at 2000/ha grew faster but gave lower net productions than fish stocked at 5000/ha and either immediately fed or fed on a delayed schedule.

5. One continuously-fed pond experienced a complete fish kill without explanation or apparent relationship to the feeding program.

3. Bangus Production with Lab-lab Produced by Inorganic Fertilizer (Pangasinan Part)

The purpose and design of this experiment were presented in the Annual Technical Report FY 1971-72. Six ponds of about 0.15 ha each were being used to compare bangus production using different fertilizer treatments. The ponds, located on the farm of Dr. Saturnino Abesamis in Bani, Pangasinan, were prepared with lab-lab and stocked at the rate of 3000 fish/ha. Heavy rains in July in Central Luzon caused the experiment to wash out without more data than the June 14 (30th day) sampling, the results of which are given in Table 3.01. The only conclusion possible is that fish were growing well in all ponds.

Table 3.01 - Results of sampling of bangus in experiment on Abesamis Farm, Bani, Pangasinan, June 14, 1972. Fish averaging 32.8 g were stocked on May 16.

Treatment	Pond no.	Mean size (g) of fish in sample
No fertilizer	3	143.8
	6	118.7
0-20-0 fertilizer	1	138.3
	2	152.5
16-20-0 fertilizer	4	158.7
	5	117.0

4. Bangus Production in Ponds with Plankton (Iloilo Part)

Introduction

An experiment on bangus production was conducted in ponds at the BF Molo Farm, Iloilo City, from October to December, 1972. The main objective was to obtain information on bangus production with plankton in shallow ponds.

Materials and Methods

Four ponds with an average of 0.11 ha were used in the study. The ponds were treated with Gusathion to eradicate *Tilapia* and *Poecilia*. After four days of drying, water was admitted to a depth of about 40 cm.

The fertilization program followed in each pond is presented in Table 4.01.

16-16-0 fertilizer was applied in each pond on October 6 at the rate of 10 kg P_2O_5/ha with half of the required amount applied in solution and the remaining half applied on a platform. Subsequent applications were made using 0-20-0 and 21-0-0.

Table 4.01 -- Fertilization program for plankton ponds at the BF Molo Farm, Iloilo City, October 6 to December 21, 1972. Ponds 4 and 5 had 8000 fish/ha; ponds 3 and 6 had 5000 fish/ha.

Pond no.	Fertilizer no.	Culture day 1/									
		Pre-stocking			Post-stocking						
		-6th 2/	-5th	-2nd	22nd	29th	35th	46th	56th	64th 2/	68th
4	Type	18-46-0	18-46-0	0-20-0	0-20-0	21-0-0	–	21-0-0	21-0-0	0-20-0	0-20-0
	Kg	2.45	2.45	5.20	5.20	5.40		5.40	5.40	5.30	5.00
5	Type	18-46-0	18-46-0	0-20-0	0-20-0	–	21-0-0	–	21-0-0	0-20-0	0-20-0
	Kg	2.3	2.31	5.60	5.60	–	5.00	–	5.00	5.60	5.00
3	Type	18-46-0	18-46-0	0-20-0	0-20-0	21-0-0	–	21-0-0	21-0-0	0-20-0	0-20-0
	Kg	2.45	2.45	5.20	5.20	5.40	–	5.40	5.40	5.20	5.00
6	Type	18-46-0	18-46-0	0-20-0	0-20-0	–	21-0-0	–	21-0-0	0-20-0	0-20-0
	Kg	2.42	2.42	5.70	5.70	–	5.30	–	5.30	5.70	5.00

1/ - Culture days were measured from stocking, culture day 0, on October 12.

2/ - Applications made on these days were applied on platforms; all others were applied in solution.

The ponds were stocked with fingerlings averaging 30.4 g at the rate of 5000/ha in ponds 3 and 6, and at 8000/ha in ponds 4 and 5.

With the aid of a Secchi disk, water transparency was checked regularly to indicate condition or density of plankton. Ponds showing visibility of more than 35 cm were immediately fertilized. A weekly estimate of abundance of plankton in each pond was also made by filtering 378 liters of pond water through a standard plankton net and concentrating the collected plankton in an electric centrifuge at a speed of 3,595 rpm for 5 min. Samples were taken at the same spot near the control gate each time abundance was measured.

The fish were sampled on the 28th, 42nd and on the 70th days of culture. On December 21, the 76th day of culture, the ponds were totally drained and the fish individually counted. Evaluation was made on the basis of 70 culture days.

Results and Discussion

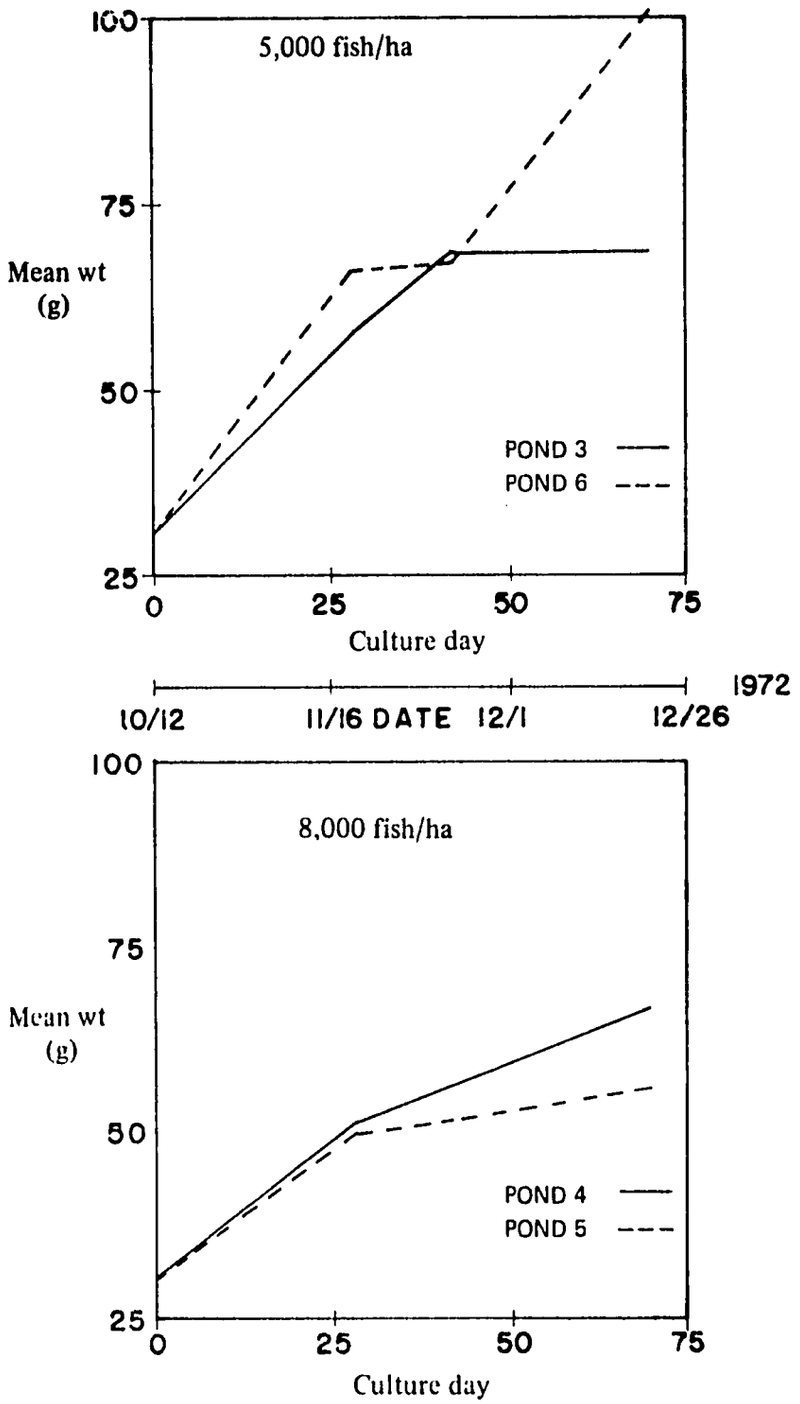
Figure 4.01 shows the plotted growth curves of the fish in each of the four ponds. Growth varied between the two stocking densities, although there were inconsistent results obtained in the 5000/ha ponds 3 and 6. Based on sample mean weights on the 28th day, the fish in these two ponds appeared headed for a comparatively good growth, averaging about 1.2 g/fish/day net gain which was approximately 1.5 times the average rate obtained in ponds 4 and 5 at 8000 fish/ha (Table 4.02).

In the period after the 28th day there was a decline in the growth rate in all populations except in pond 6 where the population showed a growth recovery after the 42nd day. The average net gain in the 5000/ha ponds remained about 1.5 to 2 times higher than that obtained in the 8000/ha ponds.

The estimated standing crops per sampling date are presented in Table 4.03. It was noted that the averages of standing crops between treatments did not vary as much as those of net gains in weight. On the 70th day the standing crop for the 5000/ha was 410 kg/ha, while that for the 8000/ha ponds was 437 kg/ha. The results indicate that under the conditions of this study all four ponds had a common carrying capacity of about 420 kg/ha which was reached sometime between the 42nd and 70th day of culture.

Production and survival are shown in Table 4.04. The average net production for all ponds amounted to about 220 kg/ha in 70 days of culture.

Fig. 4.01 – Growth curves plotted for bangus in shallow ponds with plankton at given stocking densities, BF Molo Farm, Iloilo City, October 12 to December 21, 1972.



Weekly estimates of relative abundance of plankton are plotted in Fig. 4.02. It is evident that there was a period of sharp decline about the 15th to the 20th day of culture. Plankton failed to recover strongly despite repeated fertilization. There was a slight increase starting about the 40th day, but it did not contribute substantially to the growth of the fish. However, the trend only vaguely followed that of Secchi transparency. Although transparency remained at less than 40 cm and usually less than 30 cm in both treatments, estimated plankton volume in the 5000/ha treatment was about twice the level in the 8000/ha treatment.

Table 4.02 – Mean and net gains of bangus raised in shallow plankton ponds at BF Molo Farm, Iloilo City, Oct. 12 to Dec. 15, 1972.

Treatment	Pond no.	Mean wt. (g)	28th day		42nd day		70th day		Mean Net gain (g/day)
			Weight (g)	Net gain (g/day)	Weight (g)	Net gain (g/day)	Weight (g)	Net gain (g/day)	
5,000	3	30.4	57.6	1.0	68.6	0.8	68.5	0	0.6
fish/ha	6	30.4	66.1	1.3	67.3	0.1	101.2	1.2	0.9
Average		30.4	61.9	1.2	68.0	0.5	84.9	0.6	0.8
8,000	4	30.4	51.5	0.8	56.4	0.4	67.5	0.4	0.5
fish/ha	5	30.4	49.7	0.7	51.7	0.1	56.3	0.2	0.3
Average		30.4	50.6	0.8	54.1	0.3	61.9	0.3	0.4

Table 4.03 -- Estimated standing crops of bangus in shallow plankton ponds at the BF Molo Farm, Iloilo City, Oct. 12 to Dec. 21, 1972.

Treatment	Pond no.	Standing crop (kg/ha) per culture day1/			
		0 day	28th day	42nd day	70th day
5,000	3	155	283	327	327
fish/ha	6	153	323	323	493
Average		154	353	325	410
8,000	4	248	381	381	451
fish/ha	5	253	394	385	422
Average		251	388	383	437

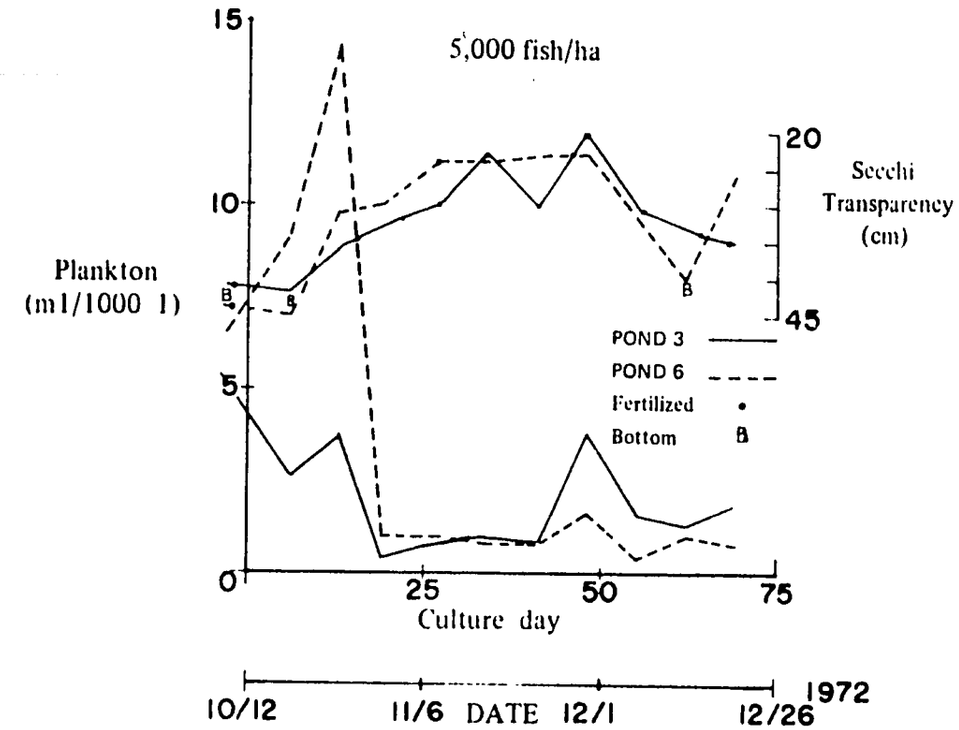
1/ – Assumed that 50% of mortalities occurred between the 0 to 28th day and the remainder between the 29th to 70th day.

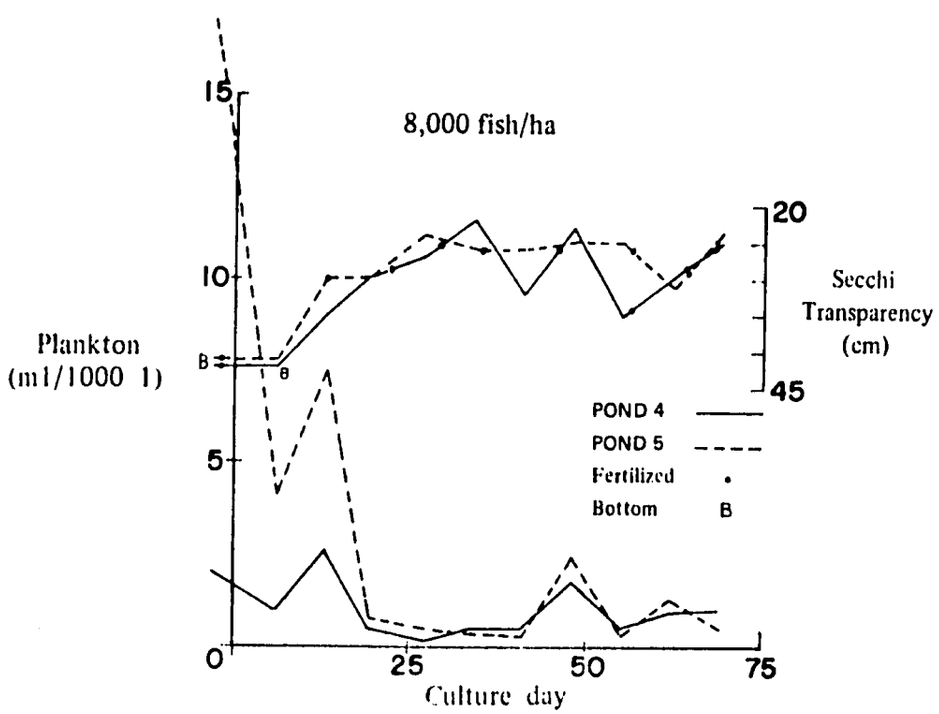
Table 4.04 -- Production and rate of survival of bangus in shallow plankton at the BF Molo Farm, Iloilo City, Oct. 12 to Dec. 21, 1972.

Treatment	Pond no.	Stocked		Harvested		Production		Survival
		No./ pond	Mean wt. (g)	No./ pond	Mean wt.1/ (g)	Total (kg/ha)	Net (kg/ha)	%
5,000	3	575	30.4	535	68.5	327	172	93
fish/ha	6	558	30.4	540	101.2	493	340	97
Average		567	30.4	537	84.7	410	256	95
8,000	4	904	30.4	760	67.5	451	203	84
fish/ha	5	890	30.4	795	56.3	422	169	89
Average		897	30.4	778	61.9	437	186	87

1/ – Mean weights on the 70th day.

Fig. 4.02 – Water transparency and estimated relative abundance of plankton in shallow ponds, BF Molo





5. Bangus Production in Ponds with Plankton (Bataan Part)

This experiment was originally designed to compare bangus production between ponds with phytoplankton and lumut as the primary food However, after the project was underway, the lumut failed to become established and the experimental design was altered to compare two different stocking densities of bangus in ponds with plankton as the food source.

A total of 5 ponds ranging in area from 0.10 to 0.17 ha were provided for the study by Mr. Jose Legarda near Orani, Bataan. One pond was stocked on April 11 with 1000 fingerlings/ha, the other 4 ponds were stocked on May 28 with 1000 fish/ha in each of 2 ponds and 2000 fish/ha in the other 2 ponds. Sampling was conducted in the ponds on June 27 with the results summarized in Table 5.01. Heavy rains in Central Luzon in July caused the experiment to wash out with no further data being available.

The ponds had received an application of agricultural lime on May 1 at the rate of 2 metric tons/ha. This was an attempt to clear the brown color from the newly formed ponds and promote lumut and plankton growth. The ponds received inorganic fertilizer (18-46-0) on May 10 and May 28 at the rate of 20 kg/ha. The May 10 application was applied one-half in solution and one-half on a fertilizer platform. Pond 1 earlier received 3 kg of 16-20-0 fertilizer on a platform on April 11 and 0.8 kg 18-46-0 in solution on April 15.

The ponds never did develop satisfactory plankton growth. Conclusions from sampling data should be regarded as tentative though it appears that individual fish in ponds with the lower stocking rate grew faster than fish in ponds with the higher stocking rate. Data also show that fish can grow in ponds where no lumut or lab-lab are present.

Table 5.01 – Bangus growth in 5 ponds treated with inorganic fertilizer to produce plankton, Legarda Farm, Orani, Bataan, April to June, 1972.

Treatment	Pond no.	Pond size	Stocking rate [pond	[ha	Mean weight (g) at stocking	Mean weight (g) on June 27	Net gain (kg) [pond	[ha
Plankton	1	.096	96	1000	44.3	185.5 (77th day)	13.6	141.7
Lumut	2	.143	143	1000	62.9	116.3 (30th day)	7.6	53.2
Plankton	3	.151	302	2000	62.9	65.3 (30th day)	0.7	4.6
Lumut	4	.154	308	2000	62.9	103.0 (30th day)	12.4	80.5
Plankton	5	.165	165	1000	62.9	137.7 (30th day)	12.3	74.6

6. Lab-lab and Bangus Production in Brackishwater Ponds Treated with Combination Organic and Inorganic Fertilizers and with Phosphate Only Fertilizer

Introduction

This report presents the observations made on the effects of combination chicken manure and 18-46-0 fertilizers and of phosphate only fertilizer on the production of lab-lab and bangus in brackishwater ponds. The study was conducted in the nursery ponds and concrete tanks at the BF Molo Farm, Iloilo City from August 4 to September 13, 1972.

The main objectives were 1) to determine the efficiency of phosphate only fertilizer in producing a good growth of lab-lab and other natural foods as compared to that of combination organic and inorganic fertilizers, and 2) to compare growth and production of bangus between the two treatments.

Materials and Methods

Six rectangular ponds, each about 0.11 ha were assigned treatments as shown in Table 6.01.

Table 6.01 - Treatment and area per study pond at the BF Molo Farm, Iloilo City.

Pond no.	Area (m^2)	Treatment	Rates of Application
1	1100		
2	1050	Phosphate only fertilizer	20 kg P_2O_5/ha
3	1130		
4	1130		2000 kg/ha and
5	1066	Chicken manure and 18-46-0	20 kg P_2O_5/ha,
6	1115		respectively

The ponds were dried for a period of 7 days from August 4 to August 10. On August 11 chicken manure was applied by broadcasting in ponds 4, 5 and 6. Chicken manure was not used in ponds 1, 2 and 3. All ponds were filled with about 5 cm water.

On August 14, 18-46-0 and 0-20-0 fertilizers were applied in solution to assigned ponds at the rate of 20 kg P_2O_5 per hectare. On August 17, the ponds received half doses of inorganic fertilizer after a partial draining made necessary by a heavy rain that occurred after the initial fertilization. Another half-dose was applied per pond on August 21. Gusathion was applied on August 21 at a concentration of approximately 0.1 ppm to rid the ponds of Tilapia and Poecilia. Pond depth was increased gradually to 30 cm over a period of about 10 days.

Aside from the ponds, six 1 m^2 cylindrical concrete tanks were prepared to serve as replicates of the treatments. Each was filled with 10 cm soil taken from a patch of uncultivated area adjacent to the experimental ponds. The tanks were fertilized at the same rate and time as the ponds. Water depth was kept at 5 cm in the first week and increased to 10 cm for the rest of the observation period.

Bangus fingerlings avering 7.0 g were stocked into the ponds on August 29, eighteen days after flooding. Each pond received a stock density equivalent to 5000 fish/ha. The tanks were not stocked.

Samples of lab-lab and other natural food organisms in ponds and tanks were regularly taken for qualitative and quantitative analyses using a plastic tube to capture a vertical column of water and bottom organisms. Samples were centrifuged to determine volume of food organisms.

Periodical analyses on the physio-chemical conditions of the pond water were made which included salinity, dissolved oxygen, free CO_2, pH, alkalinity and temperature. Water samples were taken at 9:00 A.M. Analyses for percent organic matter were made on composite soil samples from the ponds and the tanks. Amounts of rainfall were also recorded during the entire period.

The experiment was terminated on the 16th day of culture when a loss of about 400 fish from pond 5 was discovered. Some of these fish escaped into the canal and some were accidentally put into pond 6.

Results and Discussion

All ponds showed steady increases in the relative abundance of lab-lab and other natural foods. Peaks of production occurred in the fourth week from day of flooding in five of the six ponds. The exception was in pond 4 where the peak occurred in the third week at 637 ml/m^2, a mark which was the highest for all ponds. Pond 1 was lowest with 403 ml/m^2.

On the basis of periodic abundance (Table 6.02), the combination chicken manure and 18-46-0 treatment showed a slightly better response than the phosphate only treatment during the initial stage in the development of lab-lab and other natural foods. Averages in the first ten days were 168 ml/m^2 and 129 ml/m^2 for the two treatments, respectively. The early application of chicken manure, three days before that of 0-20-0, could have influenced the result. A corrected curve of the production of lab-lab in 0-20-0 only ponds showed that productions in both treatments were essentially equal in the first two weeks (Figure 6.01). In the succeeding periods, however, developments in ponds 1, 2 and 3 with phosphate only fertilizer appeared slightly better than in ponds 4, 5 and 6 with combination fertilizer.

Fig. 6.01 – Production of lab-lab and other natural foods in bangus ponds with different fertilizer treatments, BF Molo Farm, Iloilo City.

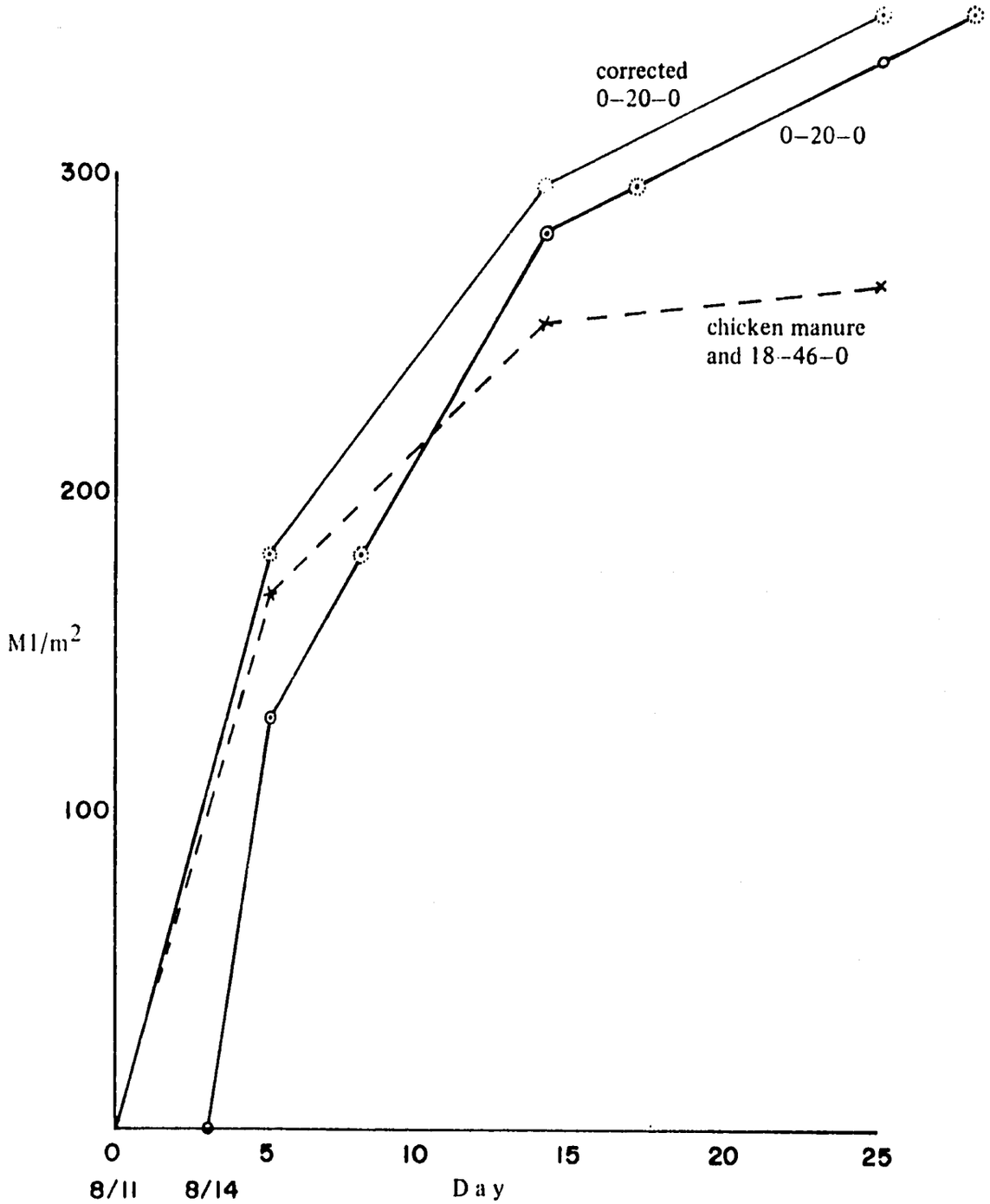


Table 6.02 - Mean standing crop of natural foods in bangus ponds at BF Molo Farm, Iloilo City.

Treatment	Pond no.	Food organisms (mg/l)/culture period (days) 0 - 10 (3 samplings)	11 - 17 (2 samplings)	18 - 32 (3 samplings)
0-20-0	1	192	278	314
	2	77	298	326
	3	118	269	365
Average		129	281	335
Chicken manure and 18-46-0	4	230	485	205
	5	115	182	272
	6	160	91	314
Average		168	253	264

In tanks the phosphate only fertilizer treatment exhibited better response during the initial five days, after which the combination fertilizer treatment showed better growth. Thus, the trends observed in tanks and ponds were opposite. One possible reason for the opposing response was the difference between the organic content of the soils in ponds and in tanks. The pond soils had been receiving heavy doses of chicken manure regularly and including an application about four months prior to the study. The same was not true of the soil used in the tanks. Analyses made by the Soils Laboratory, Bureau of Soils, Iloilo City, gave the organic content of soils in ponds and in tanks as 3.4% (average of the six ponds) and 1.0%, respectively.

A high percentage of error in the assessment of relative abundance of natural food was considered possible because of the undetermined accuracy of the improvised sampler and method used.

Qualitative analyses on the kinds and types of plant and animal food organisms in ponds showed that filamentous blue green algae and diatoms were most abundant in the first three weeks. During the fourth week, the filamentous greens dominated the plant community, especially in ponds 1, 2 and 6.

The growth attained and the standing crop of fish was used as another criterion for comparison between treatments. Table 6.03 summarizes the net gain in weight attained by each of the six pond populations and the corresponding standing crop of each. There appears to be no difference between treatments based on the rate of growth and in the standing crop after 15 days of culture. On the average, the mean weight of the fish in ponds 1, 2 and 3 increased from 7.0 g to 20.4 g in 15 days. In ponds 4, 5 and 6, the increase was 7.0 g to 20.8 g for the same period. The net increase in weight for all populations was about 0.9 g/fish/day. Standing crops estimated on the 15th day of culture based on a 90% rate of survival, were 91.7 kg/ha for ponds 1, 2 and 3 and 95.2 kg/ha for ponds 4, 5 and 6.

The period of study coincided with the wet season. Although there were occasional days that were sunny, rains came almost daily in the afternoon or late evening. The average rainfall was 1.2 cm a day throughout the study period.

Water temperature ranged from 25.4 C to 31.5 C averaging 28.4 C during the pre-stocking period and 27.6 C during the culture period.

The ponds started off with comparatively high salinities ranging from 25.0°/oo to 34°/oo, but constant rains caused salinities to drop to as low as 9.0°/oo. The mean salinity for the period was 18.0°/oo for all ponds. Dissolved oxygen content was relatively high throughout the period, averaging 8.5 ppm for all ponds. Free carbon dioxide was absent most of the time except after heavy rains. It averaged 0.5 ppm in all ponds.

The ponds had pH values on the alkaline side having a mean of 8.8. Total alkalinity was observed to be higher in combination fertilizer ponds than in 0-20-0 ponds with means of 104 ppm and 66 ppm $CaCO_3$, respectively.

Table 6.03 - Net weight increase and standing crop of fish per pond per treatment at BF Molo Farm, Iloilo City.

Pond no.1/	No. stocked	Mean wt. stocked (g)	Mean wt. 15th day (g)	Net increase total/fish	Net increase fish/day	Standing crop 15th day (kg/ha)2/
1	550	7.0	20.4	13.4	0.9	91.8
2	525	7.0	18.2	11.2	0.8	82.0
3	565	7.0	22.5	15.5	1.0	101.4
Average		7.0	20.4	13.4	0.9	91.7
4	565	7.0	23.8	16.8	1.1	107.2
5	553	7.0	18.7	11.7	0.8	87.4
6	558	7.0	19.8	12.8	0.9	90.9
Average		7.0	20.8	13.8	0.9	95.2

1/ Ponds 1, 2 and 3 were applied with 0-20-0 only; ponds 4, 5 and 6 were applied with chicken manure and 18-46-0.

2/ Estimated based on an assumed 90% survival.

Summary and Results

Although inconclusive due to lack of adequate replications and of a good sampling technique for assessing the abundance of lab-lab and other natural foods in the ponds, the present study has brought forth the following observations:

1. Phosphate only fertilizer was as effective as combination chicken manure and 18-46-0 in producing good growth of lab-lab and other natural foods on soils containing 3.4% organic content. Phosphate only was less effective than combination fertilizer in concrete tanks on soil containing a 1% organic content.

2. Production of lab-lab and other natural foods in both treatments were essentially equal in the first two weeks, but production in phosphate only treated ponds was slightly better from the second to the fourth week.

3. Bangus fingerlings averaging 7.0 g attained an average of 20.6 g after 15 days of culture, or an equivalent net gain of 0.9 g/fish/day, in brackishwater ponds with a comparatively high amount of lab-lab and other natural foods during the rainy season.

7. Tank Experiments on the Effect of Various Fertilizer Materials on the Growth of Natural Food Organisms in Brackishwater

Introduction

The main objective of the experiment was to gain knowledge on the efficiency of the most commonly used organic and inorganic fertilizer materials used in promoting production of natural foods for cultured fish in brackishwater ponds.

Materials and Method

Three studies, hereafter referred to as Study I, II and III, respectively, were undertaken separately and on three different occasions at the BF Molo Farm, Iloilo City, using cylindrical concrete tanks 60 cm high and with a water surface of approximately 1 m^2. In each study, the tanks were each provided with an identical 10-cm bottom soil fill. A soil sample was taken for analyses of pH, phosphorus and organic content. To insure uniform compactness, the bottoms were moistened and then allowed to dry before starting each study.

Study I was conducted from May 19 to June 28 using chicken manure, rice bran and 16-20-0 fertilizers. It consisted of six treatments with two replicates of each using a total of twelve tanks (Table 7.01).

Table 7.01 - Treatments of a fertilization experiment at the BF Molo Farm, Iloilo City, May 19 to June 28, 1972.

Tank	Treatment
1,5	16-20-0 only
2,12	Rice bran and chicken manure
3,10	Rice bran only
4,8	Chicken manure only
6,9	16-20-0 and chicken manure
7,11	16-20-0 and rice bran

All tanks received complete treatments during initial application on May 19 except tanks 2, 13, 6 and 9 which received only chicken manure. The addition of either rice bran or 16-20-0 in these four tanks, which was purposely programmed after flooding, was made on the 12th day. The rates of fertilizer application on a per hectare basis were 2000 kg chicken manure, 600 kg rice bran and 100 kg 16-20-0. Application was by broadcasting.

The tanks were filled initially to a depth of 5 cm and then raised to and maintained at 10 cm from the 7th to the 35th day. The progress of lab-lab growth was assessed by regular visual observation and occasional qualitative analyses. Water quality determination was also undertaken.

Study II was conducted in October using chicken manure, 18-46-0, 21-0-0 and nitrogen:phosphorus (N:P) ratios of 1:1, 1:2 and 1:4. The N:P ratios were obtained by mixing proportionate amounts of 21-0-0 and 0-20-0 fertilizers. Treatments are presented in Table 7.02.

Table 7.02 - Treatments of a fertilization experiment at BF Molo Farm, October, 1972.

Tank	Treatment	Rate of application
1, 2	Chicken manure	2000 kg/ha
3, 4	18-46-0	20 kg P_2O_5/ha
5, 6	21-0-0	20 kg N/ha
7, 8	1:1 (N:P)	10 kg N/ha - 10 kg P_2O_5/ha
9, 10	1:2 (N:P)	10 kg N/ha - 20 kg P_2O_5/ha
11, 12	1:4 (N:P)	10 kg N/ha - 40 kg P_2O_5/ha

The fertilizers were applied on the 1st and 15th day of the study at full doses in both instance, except for chicken manure which was only applied at the start. The inorganic fertilizers were applied in solution after flooding, while chicken manure was spread evenly over the soil before flooding.

Weekly samples of lab-lab were taken for qualitative and quantitative analyses using an improvised column sampler as described in earlier sections in this report. The study was terminated after 26 days.

Study III was undertaken from November 17 to December 22. Treatments were essentially replicates of those of Study II, except that the soils of all tanks received lime ($CaCO_3$) at the rate of 1000 kg/ha before flooding. Also the subsequent application of inorganic fertilizers was deleted.

Results and Discussions

The Office of the Bureau of Soils, Iloilo City, gave the analyses made of the soil fill materials in all three studies as follows: pH - 7.8; organic matter = 1.0%; Olsen's P = 12 ppm; K = 420 ppm.

Study I: Within seven days after flooding, lab-lab appeared firmly established in all six tanks applied with chicken manure only and in both tanks applied with 16-20-0 only. Lab-lab formations ranged in color from light green to yellowish brown. A difference observed, however, was a slightly less stable mat formation in chicken manure treated tanks compared to that of 16-20-0 treated tanks. Especially in the afternoon hours there were more patches of lab-lab floating in the former tanks than in the latter.

Lab-lab production was practically insignificant in rice bran only and in combination rice bran and 16-20-0 treatment tanks until about the 21st day. Characteristic to all tanks applied with rice bran were a reddish brown oily film on the water surface and a rusty red to black mat on the soil surface, and in some tanks the appearance of turbid and murky water. The film and red bottom material appeared similar to those produced by iron bacteria. These conditions occurred in both tanks 2 and 12, initially treated with chicken manure only, immediately after rice bran was spread over healthy lab-lab growths. In tanks 6 and 9, also initially treated with chicken manure, the addition of 16-20-0 slightly improved lab-lab growth. In general, rice bran alone or in combination with either chicken manure or 16-20-0 produced poor lab-lab growths and appeared to create conditions actually detrimental to lab-lab.

Growths started declining in chicken manure only, 16-20-0 only and in combination chicken manure and 16-20-0 treatments on or about the 18th day, leaving only scattered patches by the 40th day.

Analyses of lab-lab showed Oscillatoria, Lyngbya, Navicula Pleurosigma and Nitzchia as the most common organisms in all tanks. Chaetomorpha and Enteromorpha appeared about the 30th day.

Salinity varied from $16^{o}/oo$ to $27^{o}/oo$. Water pH ranged from 6.8 to 9.5. Free CO_2 was recorded only on the 14th day with readings of 21 and 51 ppm in tanks containing combination rice bran and chicken manure.

Studies II and III: The observed progress in the growth of lab-lab are summarized in Tables 7.03 and 7.04. The overall rankings between treatments gives indication of better response from nitrogen-phosphorus fertilizer materials than from either chicken manure only or nitrogen only fertilizer.

The N:P ratio of 1:2, together with the 18-46-0 treatment which is a 1:2.6 N:P mixture, appeared to give the best result in the growth of lab-lab, followed closely by either the 1:1 or 1:4 ratios. In both studies chicken manure ranked poorly at fifth and fourth positions, respectively. Response from 21-0-0 was consistently the poorest in both instances. These results further support the role of phosphorus in controlling lab-lab production. An additional treatment using phosphate only fertilizer would have been desirable in this experiment.

Results of Study III were similar to those obtained in Study II except production with 18-46-0 was very poor. In all three studies, chicken manure and 1:1 N:P ratio, which is about equivalent to 16-20-0, produced essentially the same result. No attempts were made to determine possible effects of the addition of lime to the tank soil in Study III, and no effects were observed.

The greater efficiency of phosphorous bearing inorganic fertilizer materials, when compared to organic chicken manure only or nitrogen only fertilizer, was distinctly demonstrated by the response from treatments in Studies II and III.

Table 7.03 - Lab-lab production in study tanks receiving different fertilizer treatments at BF Molo Farm, Iloilo City, October, 1972.

Treatment 1/	ml lab-lab/m^2 of tank surface/sampling day 1/				Overall rank
	5th day	12th day	19th day	26th day	
Chicken manure only	312 (4)	230 (6)	180 (4)	560 (1)	5
18-46-0	500 (1)	380 (3)	250 (2)	450 (3)	1
21-0-0	312 (4)	270 (5)	280 (1)	150 (6)	6
1:1 (N.P)	438 (2)	310 (4)	210 (3)	250 (5)	4
1:2 (N:P)	438 (2)	430 (2)	70 (6)	500 (2)	2
1:4 (N:P)	350 (3)	450 (1)	170 (5)	340 (4)	3

1/ Values are averages of two replications; number in parenthesis indicates rank in abundance relative to other treatments.

Table 7.04 - Lab-lab production in study tanks receiving different fertilizer treatments at BF Molo Farm, Iloilo City, November 17 to December 22, 1972.

Treatment[1/]	ml lab-lab/m^2 of tank surface/sampling day[1/]					Overall rank
	4th day	11th day	18th day	25th day	32nd day	
Chicken manure only	120 (3)	149 (4)	115 (6)	202 (2)	125 (3)	4
18-46-0	70 (6)	159 (2)	144 (5)	144 (4)	67 (6)	5
21-0-0	87 (5)	106 (6)	178 (3)	140 (5)	72 (5)	6
1:1 (N:P)	140 (2)	154 (3)	207 (1)	159 (3)	168 (2)	2
1:2 (N:P)	144 (1)	144 (5)	187 (2)	245 (1)	192 (1)	1
1:4 (N:P)	106 (4)	168 (1)	159 (4)	159 (3)	120 (4)	3

1/ Values are averages of two replications; number in parenthesis indicates rank in abundance relative to other treatments.

Summary of Results

1. Various fertilizers and combinations of fertilizers were used in concrete tanks to study their effect on lab-lab production. The tank soils had a pH of 7.8 and consisted of 1.0% organic matter, 12 ppm P_2O_5 and 420 ppm K_2O.

2. Rice bran when applied alone or in combination with chicken manure or 16-20-0 was essentially ineffective in producing lab-lab and appeared to create conditions actually detrimental to lab-lab growth.

3. Lab-lab mats produced with chicken manure were less stable and tended to detach and float to the surface more than mats produced by 16-20-0.

4. Without being grazed lab-lab began declining about the 18th day after the first fertilizer application and consisted only of scattered patches on the 40th day.

5. The application of nitrogen-phosphorus inorganic fertilizers obtained comparatively better results than that of chicken manure only or of nitrogen only fertilizer.

6. A nitrogen-phosphorus ratio of 1:2 appeared to be the most effective followed closely by either 1:1 or 1:4.

7. Phosphorus appeared to have a limiting influence on growth of lab-lab as evidence by poor results obtained in the use of nitrogen only fertilizer.

8. There was no indication of specificity as to treatment on the composition of lab-lab. Most predominant algae were Oscillatoria, Lyngbya, Pleurosigma, Navicula and Nitzchia.

Conclusions made from these results are tentative because conditions in concrete tanks are not the same as in ponds. However, these results should be considered when designing fertilization trials in fishponds.

8. Salinity Tolerance of Bangus

Introduction

This report presents the results of preliminary tests on the effect of sudden changes in salinities on bangus fingerlings.

Materials and Methods

The tests conducted in two trials were undertaken May 18 to 30 and June 30 to July 3 at the BF Molo Farm, Iloilo City. Plastic buckets were used as containers in the first trial and cylindrical concrete tanks in the second.

Trial One· Preliminary runs were conducted in 4-gallon plastic containers filled with about 10 l of brackishwater. Salinities were adjusted to desired levels using solar salt crystals and well water to concentrate or dilute as required.

The bangus fingerlings used as test fish were held and acclimated in 35°/oo salinity for at least 2 days. The fish averaged 6.8 g. Two runs each were made for salinities of 5°/oo, 15°/oo and 25°/oo; and three each for 44°/oo, 53°/oo, 64°/oo and 74°/oo A 35°/oo control salinity was provided during each of the above runs. Two fish were introduced into each test bucket at the beginning of each run. The behavior of the fish was constantly monitored for the first 8 hr or until the fish died, whichever came first. Salinities and temperature were periodically checked. The water in the buckets was agitated periodically to prevent oxygen depletion.

For each salinity, the appearance of any sign of stress on an individual test fish was marked in time as the onset of stress. Recovery time was considered when all the fish appeared to have regained their normal behavior. Time of death was recorded for each fish.

Trial Two: Additional tests were conducted in 1 m^2 cylindrical concrete tanks following essentially the same procedure outlined for Trial One. Two runs each were made for salinities of 60°/oo, 70°/oo and 80°/oo; and three runs for 90°/oo. Five test fish averaging 6.0 g each were introduced into each tank.

Results and Discussion

Table 8.01 and Table 8.02 summarize the observed results obtained in trials one and two. Results indicate that stress occurred when fish were transferred directly from 35°/oo salinity into 53°/oo or above, and into 15°/oo or below. On a combined average, the onset of stress was timed at 49.7 min after introduction into 53°/oo, 64°/oo and 74°/oo; and 5 min when introduced into 15°/oo and 5°/oo. Death of 100% was recorded in 74°/oo salinity within 45 to 225 min; 66.6% death at 64°/oo within 75 min to 5 days; and 33.3% death at 53°/oo within 17.5 to 18.5 hr. No deaths were observed in the 15°/oo salinities although the fish remained stressed after 7 hr of exposure. No fish died or were observed to be stressed in the control buckets after 330 min to 7 days.

All runs at 60°/oo, 70°/oo, 80°/oo and 90°/oo salinities in concrete tanks resulted in 100% stress and death. Fig. 8.01 shows the range and mean of stress onset time and death time for bangus fingerlings subjected to direct transfer from 35°/oo to higher salinities. The greater the salinity transition, the sooner stress begins and death occurs. No fish died or were observed to be stressed in the control tanks for 60 to 225 min.

Table 8.01 – Observed time[1/] of stress, recovery and death for bangus fingerlings[2/] introduced from 35°/oo salinity directly into water in plastic buckets of given salinity levels.

Salinity (°/oo)	Run no.	Water temperature (°C)	Stress time (min)	Recovery time (min)	Time range death	Period of exposure
74	1	28.0–30.7	30		85–90 min	90 min
	2	34.0–36.0	30		45–60 min	60 min
	3	29.8–31.0	27		50–225 min	225 min
64	1	31.4	0	30		120 min
	2	27.8–36.0	75		75–150 min	150 min
	3	27.0–31.2	30		5 days	5 days
53	1	31.4	120			120 min
	2	28.8–36.4	90			150 min
	3	27.2–30.2	45		17.5–18.5 hr	18.5 hr
44	1	31.6	15	30		120 min
	2	29.2–36.0				150 min
	3	27.0–31.3				7 days
35 (Control)	1	28.6				330 min
	2	29.2–31.3				420 min
	3	27.0–32.0				7 days
25	1	28.8				330 min
	2	28.0				420 min
15	1	28.6	0	20		330 min
	2	28.0				420 min
5	1	28.4	15			330 min
	2	28.3	0			420 min

1/ - All time measured from introduction into buckets of given salinities.

2/ - All runs included two test fish per bucket except run 3 of 64°/oo salinity which included only 1 fish.

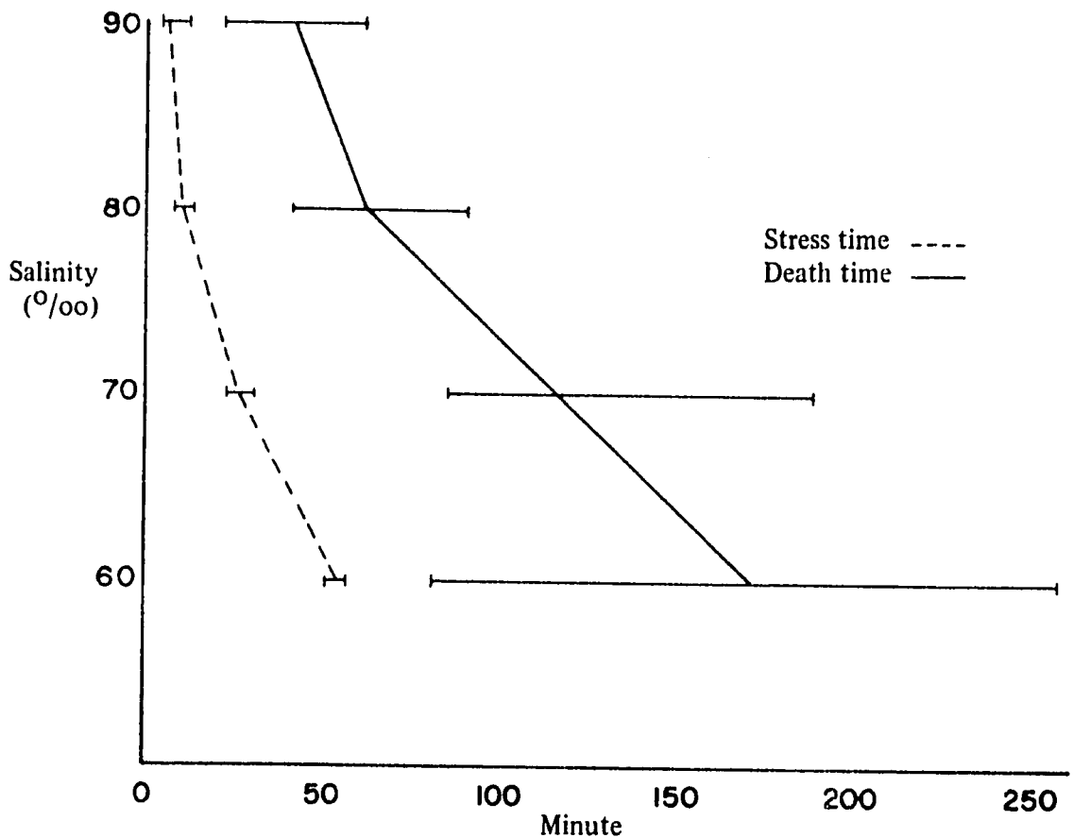
Table 8.02 – Observed time[1/] of stress, recovery and death for bangus fingerlings[2/] introduced from 35°/oo salinity directly into concrete tanks of given salinity levels.

Salinity (°/oo)	Run no.	Water temperature (°C)	Stress time (min)	Recovery time (min)	Time range death (min)	Period of exposure (min)
	1	29.0	5		21–45	45
90	2	to	5		35–50	50
	3	34.0	10		41–60	60
	1	29.0	13		48–90	90
80		to				
	2	34.0	8		40–70	70
	1	28.7	23		85–135	135
70		to				
	2	32.4	24		123–187	187
	1	28.7	50		165–255	255
60		to				
	2	32.4	55		80–160	160
	1	28.7				255
35 (control)	2	to				187
	3	32.0				60

1/ - All time measured from introduction into concrete tanks of given salinities.

2/ - All runs included five test fish per tank.

Fig. 8.01 – Mean time for onset of stress and death for bangus fingerlings transferred from 35°/oo salinity directly into higher salinities in concrete tanks.



Salinity stress was exhibited by the following signs or behavior:

1. Light to heavy shade of greyist coloration along the dorsal region especially at the base of the dorsal fin and around the caudal peduncle.

2. Difficulty on the part of the first fish affected to keep up with the group; the groups or schools broke up as the fish became stressed.

3. Body listing and difficulty in maintaining normal upright swimming position.

4. Frequently breaking surface with snout, dorsal and caudal fins.

5. Paired fins fully extended and stiffened.

6. Occasionally rolling over to belly-up position, then falling down helplessly to the bottom.

The above signs and behavior became more definite as time of exposure increased. Death was usually preceded by a short period of frenzied struggle before the fish turned belly-up and settled at the bottom.

Summary of Results

1. Bangus fingerlings weighing about 6.0 and 6.8 g acclimated to $35^{o}/oo$ salinity appeared subjected to more stress and greater mortality when introduced directly to higher salinities than to lower salinities.

2. After direct transfer from $35^{o}/oo$ salinity, stress was observed at $15^{o}/oo$ and below and at $53^{o}/oo$ and above.

3. The greater the salinity transition, the sooner the stress began and the shorter the stress period before death.

4. In salinities ranging from $60^{o}/oo$ to $90^{o}/oo$, death occurred within 21 to 255 min after direct introduction from $35^{o}/oo$ salinity.

9. Hito Production in Ponds at Four Densities

Introduction

This study was conducted in four ponds of the U.P. College of Fisheries, Quezon City, and was reported as research in progress in the first Annual Technical Report. The objectives were to determine optimum stocking density, rate of growth and feed conversion using IFP-1b pelleted feed.

Materials and Methods

The ponds averaged 23.4 m^2 and had normal water depths of 50 cm which was to be maintained by pumping water from a nearby deep well.

The hito fingerlings were obtained from Victoria, Mindoro Oriental, and were donated by Atty. Eufemio C. Domingo. The hito arrived in two batches and were held in concrete tanks. Both fish groups were treated with Terramycin, a water soluble powdered antibiotic, and formaldehyde solution. At stocking, on February 28, 1972, 97 hito were randomly selected, anaesthetized with quinaldine solution (0.2 ml to 2,250 ml of water) to facilitate handling, and individually measured for length and weight. The mean length and weight of the fish samples stocked into the ponds were 154.8 mm and 28.9 g. The stocking rates for each pond are given in Table 9.01.

Table 9.01 - Stocking schedule for hito in 4 ponds at UP experiment which began February 28, 1972.

Pond no.	Area (m^2)	No. stocked /pond	No. stocked /m^2	No. stocked /ha (X1000)	Kg stocked /pond	Kg stocked /m^2	Kg stocked /ha
1	25.2	252	10.0	100	7.1	0.3	2890
2	22.0	285	17.5	175	11.2	0.5	5058
3	23.2	580	25.0	250	16.8	0.7	7225
4	23.2	754	32.5	325	21.9	0.8	9393
Average	23.4	493	21.3	213	14.3	0.6	6142

Fish were fed at a rate of 5% of their weight per day based on the first day's weight. Feeding rates were adjusted every 20 days. The daily ration of IFP-1b feed was fed half in the morning and half in the afternoon, with the pellets being broadcast over the pond surface.

Bacteriological isolation at harvest time was done by the U.P. College of Veterinary Medicine Microbiological Laboratory. Dissolved oxygen was measured using the standard Winkler method.

Samples of fish were made periodically to determine growth. Where possible, a group of 40 fish were seined from each pond every 30 days. The fish were anaesthetized and individually weighed and measured for total length, and then returned to their respective ponds.

Observations and Results

The pond soil was so porous that a continuous water supply from a nearby deep well was necessary. However, the well pump did not function properly, so it was difficult to maintain the desired water depth. A small amount of water from the municipal system was added to permit the experiment to continue, though water level sometimes dropped to as low as 5 to 8 cm. Heavy rains occurred through most of July and August, which helped the water supply but disrupted feeding schedules and security measures.

On August 11, 165 days in the experiments, all the fish were harvested. Results are given in Table 9.02. Lack of fish at harvest maybe attributed to escape through overflow or poaching during the rainy period. The loss of fish makes statistical analysis of doubtful validity. Nevertheless, if productions are estimated from sampling values obtained after 122 days in the experiment, assuming a 75% survival, some summary is possible (Table 9.03). No apparent difference in growth could be attributed to density differences (Fig. 9.01). Feed conversions were poor, meaning commercial use of fish feed would not be advised for hito at this time.

Though fish growth was slow, individual fish appeared in good condition at the various sampling dates. Sexual differences were distinct after 60 days in the study ponds. Females were recognized by their distended abdomens from ovarian development and rounded genital opening. Males were more slender and had a small posteriorly pointed process on their genital openings. The good condition of the fish and their sexual development indicated that the feed was nutritionally adequate.

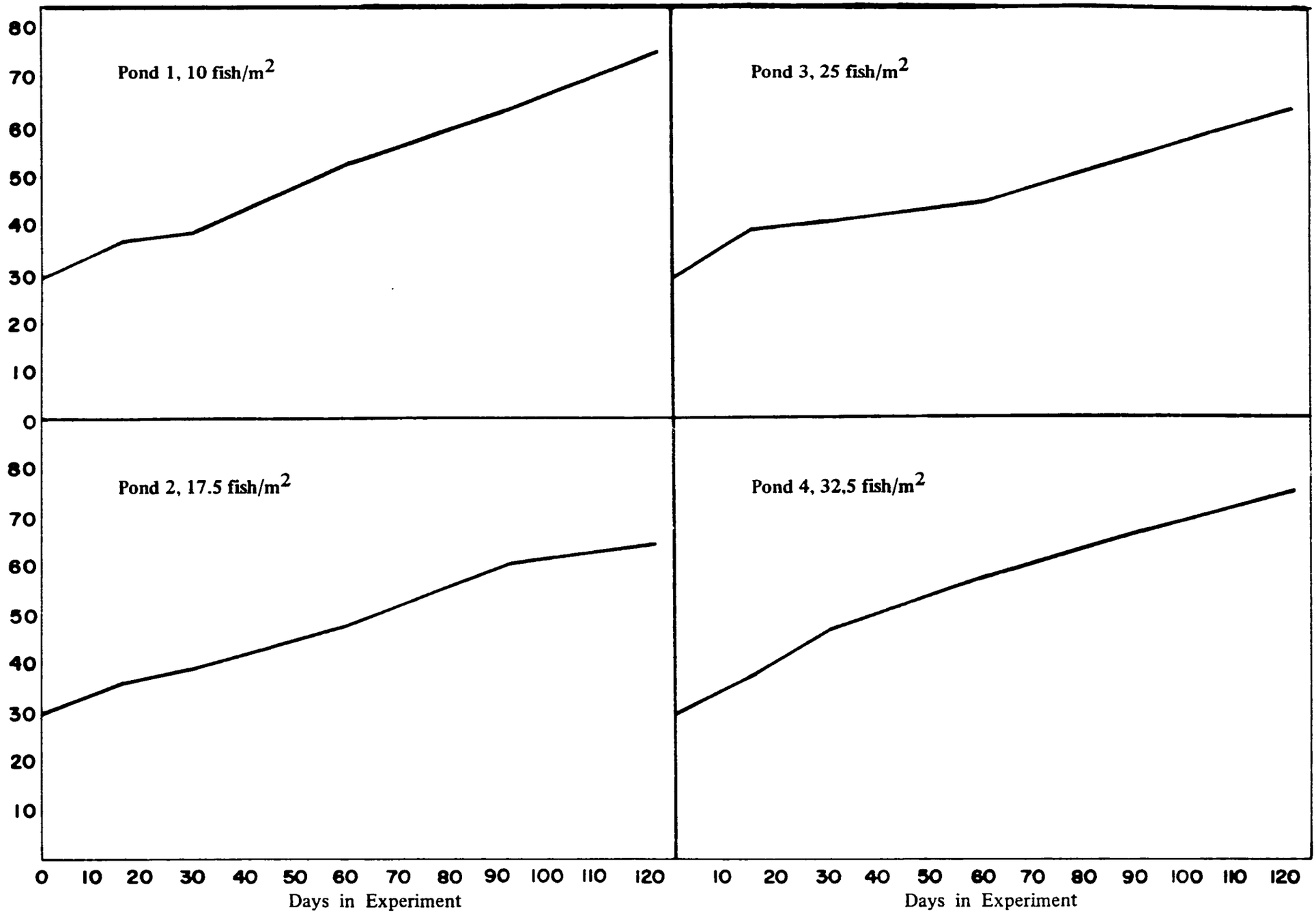
Table 9.02 – Harvest results of hito culture at four densities from Feb. 28 to Aug. 11, 1972.

Pond no.	No. of fish harvested		Recovery (%)	Mean weight of fish (g)	Gross production (g)		Net production (g)	
	/pond	/m^2			/pond	/m^2	/pond	/m^2
1	1	0.04	0.4	131.8	131.8	5.23	103	9.09
2	0	0	0	0	0	0	0	0
3	22	0.95	3.79	79.8	1,753.9	75.60	1,117.6	48.17
4	329	14.18	43.53	80.3	26,434.8	139.43	16,910.6	728.90

Table 9.03 – Results of hito culture at 4 densities at UPCF ponds from Feb. 28 to June 29, 1972, assuming 75% survival.

Pond no.	Gross weight (kg)				Net production (kg)		Amount feed (kg)		Feed conversion
	Stock		Sampling at 122nd day						
	/pond	/m^2	/pond	/m^2	/pond	/m^2	/pond	/m^2	
1	7.28	0.2889	14.12	0.5603	6.84	0.2714	70.06	2.78	10.24
2	11.13	0.5059	18.55	0.8432	7.42	0.3373	109.36	4.97	14.74
3	16.76	0.7224	27.54	1.1871	10.78	0.4647	162.34	6.99	15.06
4	22.66	0.9767	44.25	1.9073	21.59	0.9306	204.74	8.83	9.48

Fig. 9.01 –Empirical growth curves of *Clarias macrocephalus* raised at different stocking densities in small ponds at the U.P. College of Fisheries, February 28 to June 38, 1972.



At harvest, 30 of the 352 recovered fish were considered in unacceptable condition for further experimental use because of physical deformities or disease lesions. Particularly common were "stub tails" and "crooked spine" deformities. Also a few fish had open lesions in their nape and pectoral area giving the appearance they had been stepped on, which in fact was not the case. Pectoral spines in most of the fish were eroded to slightly shorter than usual length and the base of the pectoral fins were hemorrhagic in some of the fish.

Sexual differences were still apparent at harvest time, though females were less distended than when sampled earlier. Possibly, ovaries were beginning to be reabsorved. Neither males or females gave out sex products when pressed on the belly.

Twenty five fish (15 females and 10 males) were donated to the UP Institute of Fisheries Development and Research for use in hatchery experiments. The remaining 297 fish were placed in concrete holding tanks at UPCF. Disease broke out among these fish resulting in survival of only 6 fish after 17 days. Bacterial smears of ulcerous skin lesions and of the liver of sick fish showed gram-negative, rod-like, unidentified bacteria, which were suspected to cause the disease. Two types of bacterial colonies were isolated on blood agar plates. The colonies were tested for sensitivity to different kinds of antibiotics, namely Aureomycin, Neomycin, Penicillin and Terramycin. Results are presented in Table 9.04.

The dissolved oxygen in the tanks where the epizootic occurred was zero.

All fish had a rounded occipital process, characteristic of Clarias macrocephalus. Specimens were sent to Dr. John Ramsey, Auburn University, for more positive identification.

Table 9.04 - Antibiotic sensitivity of bacterial colonies isolated from diseased hito cultured in UPCF experimental ponds.

	Antibiotic used and zone of inhibition (mm)			
Isolate	Aureomycin	Neomycin	Penicillin	Terramycin
Small colony	8	1	0	9
Large colony	0.5	3	0	0

Summary of Results

1. Hito were cultured in four ponds averaging 23.4 m^2 each for 165 days using IFP-1b feed. Fish were stocked at four densities: 10.0, 17.5, 25.0 and 32.5 per m^2.

2. Growth was slow, taking about 80 days for the fish to double their weight. No growth pattern related to the densities were apparent.

3. Feed conversions were poor, ranging from 9.48 to 15.06. The feed was nutritionally adequate enough to support sexual maturation.

4. Disease of suspected bacterial origin were common.

5. Pond conditions in the experiment were not considered good for fish production.

10. Culture of Hito in Concrete Tanks with Intensive Feeding

Introduction

A considerable interest has recently developed in the country in raising hito catfish in ponds. Reports from Thailand indicate that catfish culture is a highly profitable industry. The reports cite estimated yields as high as 100 metric tons/ha over a period of 4 to 5 months of intensive culture. The fish are stocked at the rate of 50 to 100 fish/m^2 and are fed with a wet mash of ground fish and rice bran or cooked broken rice. The reports claim conversions of 6:1 with this type of feed.

This study was an attempt at raising catfish in small tanks with two types of feed. The efficiency of specially formulated pellets was compared with that of mixed ground fish and rice bran. The study was intended to provide working experience in the care and handling of catfish in culture and also to provide knowledge in catfish behavior under culture conditions.

Materials and Methods

The experiment was conducted at the BF Molo Farm, Iloilo City, from October to December, 1972.

Four cylindrical concrete tanks 1 m^2 in water surface and 40 cm in water depth were used. The tanks were each provided with a 5-cm bottom soil.

Fingerlings measuring 9 to 17 cm in total length were collected from creek fishermen in nearby towns at ₱0.05 per fingerling. The fish were initially confined in a holding tank and treated for 72 hours with 20 ppm formaldehyde solution for parasite control.

A total of 120 fingerlings were used in the study. Each tank was stocked with 15 fish ranging from 5.4 to 15.0 g (small group), and 15 individuals ranging from 20.3 to 41.0 g (large group). The density of stock was 75 fish/m^3. Fish in two tanks received pelleted IFP-1b feed and fish in the other two received a mash consisting of ground Poecilia and rice bran at a 7:3 ratio, by weight. The dry weight ratio of the pelleted feed to mash feed was found to b 1:2.1 after equal amounts of each (200 g) were dried in an oven at 60 to 80 C for 18 hours. Prior to stocking, the Poecilia were collected from a brackishwater pond, ground and mixed with rice bran. A two month supply of ground fish-rice bran feed was put in a jar and stored in a freezer to prevent spoilage.

Feeding began on the first day after stocking at a rate of 5% of body weight per day based on the dry weights of the feeds. A day's ration was fed half in the morning and half in the afternoon. In the second month the rate was reduced to 3%. The amounts of feeds were adjusted after every sampling and whenever mortality occurred.

The stocks were sampled on the 15th and on the 32nd day of culture to assess the rate of growth. Sixteen fish, 8 from each size group, were sampled and measured from each tank on the 15th day. All fish were weighed and measured on the 32nd day. Total harvest was made on the 62nd day when all fish were individually weighed and measured.

Water was partially changed after the first sampling and totally drained and replaced after the second sampling.

Results and Discussion

Growth of fish in all tanks was poor (Fig. 10.01, Table 10.01). In 62 days the fish in all tanks had increased their weight by only 65%. Growth was slightly better but probably not significantly so in the IFP feed treatment than in the ground fish-rice bran treatment.

Fig. 10.01 – Empirical growth curves of hito cultured in tanks using IFP-lb feed and ground fish-rice bran.

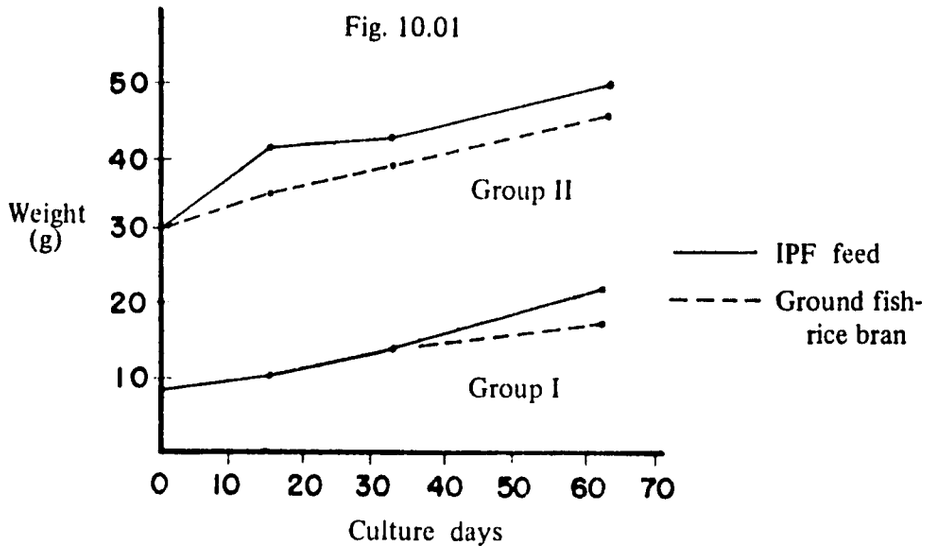


Table 10.01 – Rate of growth of hito raised in tanks per feeding treatment for given culture period.

Treatment	Tank	Size 1/ group	Mean weight (g) 0 day	15th day	32nd day	62nd day	Net gain 62 days (g)
IFP-lb feed	1	I	9.2	10.2	15.2	-	6.0 2/
		II	30.4	41.1	43.1	52.5	22.1
		Average	19.8	25.6	32.6	-	12.8 2/
	2	I	9.2	10.0	13.4	21.9	12.7
		II	30.4	41.4	41.0	47.3	16.9
		Average	19.8	25.7	31.8	34.6	14.8
Ground fish and rice bran	3	I	9.2	11.3	14.1	17.8	8.6
		II	30.4	34.9	39.0	44.2	13.8
		Average	19.8	23.1	26.5	31.0	11.2
	4	I	9.2	10.3	14.2	17.8	8.6
		II	30.4	35.7	39.6	48.1	17.7
		Average	19.4	23.0	26.9	32.9	13.1

1/ - I - small-sized ; II - large-sized 2/ - Net gain after 32nd day.

In the first two weeks of culture there was a very evident difference in growths between size groups in both treatments. The large-sized fish in the IFP feed treatment increased by 35.7% over its initial body weight as against 9.8% for the small-sized fish. Competition for feed was considered the most logical but not necessarily the only reason for this variation. Growth between size groups appeared to be little or no different after the first two weeks.

Between the 15th and 32nd day of culture, 18 of the combined total of 30 small-sized fish died in the IFP feed tanks. By the 62nd day only 3 (10%) of the small-sized fish and 22 (73%) of the large sized fish were alive in both IFP feed tanks. Total survival was only 42% in the IFP feed tanks. In contrast all fish (100%) of both size groups survived in the mix-feed tanks.

Dead fish, although visibly emaciated, contained particles of the pelleted feed in their stomachs indicating some amount of feeding activity. Aflatoxin in the IFP feed could have been partially or wholly responsible for the mortalities. Analysis for aflatoxin in other batches of IFP feed revealed mycotoxins ranging up to 43 ppb. Examination revealed no sign or presence of ecto-parasites. What appeared as the most likely cause of death was the extremely and more polluted conditions of the water in the IFP feed tanks.

Water in all tanks turned black and heavy with suspended matter, the surface became thick with gas bubbles and plankton. A strong foul odor coming from the tanks was evident from several meters distance. This condition, which was first noticed on the 8th day developed more rapidly in the IFP feed tanks than in mix-feed tanks. The IFP feed tanks also contained greater amounts of suspended matter and were generally more polluted when the tank water was replaced on the 15th and 32nd days and when drained on the 62nd day. This variation between treatments indicated either a lower acceptance of the IFP feed, surplus feeding or less digestibility which resulted in the greater accumulation of pollutant materials.

A comparison of the C conversion for the two feeds is shown in Table 10.02. On the dry weight basis IFP-lb feed gave an average of C of 3.1, compared to 5.0 for the ground fish-rice bran feed after 31 days. Conversions from the 32nd to 62nd day were 3.8 and 5.2, respectively. These are poor conversions. The fish were evidently being overfed. Whether the fish were not feeding normally or if they were unable to utilize all the feed given them or both, was not known.

Table 10.02 - Conversion ratios for IFP-1b and ground fish-rice bran mix feed on catfish raised in concrete tanks.

Treatment	Tank	Culture days	Total increase in weight (g)	Total feed (g)	C Conversion
IFP-1b feed	1	0 - 31	314.0	986.4	3.14
	2	0 - 31	323.4	988.8	3.05
		Average	318.7	987.6	3.10
Ground fish and rice bran	3	0 - 31	201.0	1038.5	5.17
	4	0 - 31	213.0	1038.5	4.87
		Average	207.0	1038.5	5.02
IFP-1b feed	1	32 - 62	86.6	272.8	3.22
	2	32 - 62	107.4	478.9	4.36
		Average	97.0	375.8	3.79
Ground fish and rice bran	3	32 - 62	135.0	794.3	5.88
	4	32 - 62	180.0	794.3	4.41
		Average	157.5	794.3	5.19

The maximum standing crop obtained was in tank 4 with 987 g or 9.9 metric tons/ha. The weight stocked was 5.9 metric tons/ha.

Poor growth and the corresponding poor feed conversion are consistent with results obtained in hito culture at UPCF and at the Freshwater Station (See other papers in this report). These results indicate that the hito can tolerate the highly polluted environments, but that growth in such conditions may be adversely affected. Also, it is possible that hito has a slow growth potential and could not grow much more rapidly under less intensive situations. At any rate, the results obtained here have not approximated those reported in Thailand. The hito is Clarias macrocephalus which, according to Thai reports, does not grow as fast as C. batrachus in culture ponds.

Concrete tanks with soil bottoms are probably less than ideal as culture environments, however, there is no reason to assume that the tanks per se were a factor in the results obtained in the study. Pollution was considered to be a factor and culture tanks could easily be constructed providing some means of controlling the accumulation of pollutant materials.

Summary

1. Hito were stocked into 4 concrete tanks 1 m^2 and 40 cm water depth at 75 fish/m^3 (33 fish/m^2). Fish in two tanks were fed IFP-1b pelleted feed and the other two tanks were fed a mixture of 7 parts ground fish and 3 parts rice bran for a 62-day period.

2. Growth of fish in all tanks was very poor. Weight increase per fish was only 65% in the 62nd-day culture period. Hito fed with IFP feed grew at a slightly greater rate than those fed with ground fish-rice bran.

3. Standing crops stocked were 5.9 metric tons/ha. The maximum produced was 9.9 metric tons/ha.

4. Feed conversions (C) on a dry weight basis were 3.5 for the IFP feed treatment and 5.1 for the ground fish-rice bran treatment.

5. Survival was 100% in the ground fish-rice bran treatment and only 42% in the IFP feed treatment. Survival in the IFP feed was 73% for large individuals and 10% for smaller ones.

6. Water pollution in all tanks was severe after the 1st week of culture. Pollution appeared greatest in the IFP feed tanks.

11. Effect of Organic and Inorganic Treatments on Pond Turbidity

Introduction

By the end of June 1972, 60 ponds were formed by rough dikes at the Freshwater Station. The ponds were filled with rain water early in July and remained filled until mid-September. The pond waters were muddy or turbid because of the high amount of erosion from the newly formed dikes.

Turbidity reduces fish production and, where turbidity is caused by negatively-charged clay particles, the addition of positively-charged materials like manures or acid-forming fertilizers cause the clay particles to precipitate and the water to clear. This experiment was designed to test the effects of such materials on the Freshwater Station pond waters.

Materials and Methods

The 33 500-m^2 ponds used were divided into 4 categories based on a visual classification of the pond water color. Treatments were assigned randomly, using rice straw, green grass, cow dung and inorganic fertilizer. The color classification, treatment material and level for the different ponds are given in Table 11.01.

Partly composted rice straw was obtained from the San Juan Student Barrio at CLSU while talahib grass, Saccharum spontavenum, was cut from nearby fields. Partly dry cow dung was gathered from the CLSU dairy corral. The inorganic fertilizer used was Atlas 16-20-0-15. The materials were applied on the days indicated in Table 11.01.

Water samples were collected in 300-ml BOD bottles from the pond surfaces every Monday, Wednesday, and Friday mornings, September 21 to November 13, 1972. Turbidity measurements were made with a Hach laboratory turbidimeter. Samples with turbidities in excess of 500 JTU were diluted with tap water to bring them within the range of the meter. Secchi disk readings were made concurrently with water sample collection.

Water pH, amount of water loss, and plant life were noted for possible relationship with turbidity in the ponds. Water pH was taken with a paper color comparator using bromthymol blue indicator. Amount of water loss was measured over a 6-day period using split bamboo stakes placed in the ponds for reference. Rainfall and evaporation rates were obtained from the CLSU weather station and used to correct water level data. Also, color photographs were taken of the ponds before and after the experiment.

Table 11.01 -- Description of pond treatments in turbidity reduction experiment at the Freshwater Station, Sept. to Oct., 1972.

Treatment	Color	Pond no.	Treatment level	Amount applied (kg)	Date started
Control	Iron Red	4B	--	--	Sept. 21
	Milky Rust	4C	--	--	Sept. 21
	Milky Pink	4F	-		Sept. 21
	Milky	4H, 4I, 4J	-	--	Sept. 21
		5B	--	--	Sept. 22
		6D	--	--	Sept. 21
Rice Straw	Iron Red	4A	2 ton/ha	100	Sept. 27
	Milky Pink	5A, 6B	2 ton/ha	100	Sept. 27
	Milky	5I	1 ton/ha	50	Sept. 27
		6I, 5E	2 ton/ha	100	Sept. 27
		6K	3 ton/ha	150	Sept. 27
Grass	Milky Rust	4D	2 ton/ha	100	Sept. 29
	Milky Pink	4E	2 ton/ha	100	Sept. 29
		4G	2 ton/ha	100	Nov. 1
	Milky	5J	1 ton/ha	50	Sept. 28
		6F	2 ton/ha	100	Nov. 1
		5K	3 ton/ha	150	Sept. 28
Dung	Milky Pink	6A, 6C	2 ton/ha	100	Sept. 22
	Milky	5G	1 ton/ha	50	Sept. 22
		4K, 6J	2 ton/ha	100	Sept. 22
		6G	3 ton/ha	150	Sept. 22
Inorganic Fertilizer	Milky	5F	45 kg/ha	2.25	Sept. 22
		5C, 5H	90 kg/ha	4.5	Sept. 22
		6E, 6H	90 kg/ha	4.5	Sept. 22
		5D	180 kg/ha	9.0	Sept. 22

Results

Considerable variability was recorded even between ponds receiving similar treatments. Using the first and last turbidity readings, the percentage reduction in turbidity were calculated (Table 11.02). In the ponds receiving different levels within treatments, no advantage was demonstrated by increasing amounts of treatments (Figure 11.01). Treated ponds at all levels of treatment in the milky colored ponds had greater percentage reduction in turbidity than control ponds (Figure 11.02). However, mean decrease in turbidity in the ponds should not be regarded as statistically significant ($P \leq 0.95$).

The Secchi disk readings were limited by water depth in ponds especially during the later part of the experiment when water clarity was highest. Figure 11.03 shows the relationship between 825 paired Secchi disk and turbidimeter readings.

Water pH of all ponds taken on November 8, was pH 7.2 ± 0.2.

The results of subsoil textural classification are given in a separate work. Generally, most of the study ponds are fine textured having 32 to 57% clay with exception of 5A & 4A ponds having 49 and 92% sand, respectively.

Data for water level observations are shown in Table 11.03. Measurements were corrected for evaporation and rainfall which was 10.6 mm/day for pond series 1, 2, 3, and 7.2 mm/day for pond series 4, 5 and 6. These figures are tentative because ponds are under construction which may alter their water loss characteristics. However, it appeared that some ponds, notably ID, 2A, 2I, 4A, 4B, 5A & 6B have excessive water loss. In contrast, other ponds like 3D to 3I and 4E to 4K actually gained water, possibly from the neighboring water supply canal.

No visible algae growth was observed on ponds 4A, 4B, 4C, 5A, 5B, 6A & 6B. The rest had algae growing in varying quantities: those ponds with low turbidities had relatively better growth, notably Chara and some lab-lab. By late October, a greenish tinge developed in ponds 5C, 5D, 5F, 5G, 5H, 6C, 6D, 6F, 6H, 6I, 6J & 6K attributed to phytoplankton growth.

Grass was observed growing in varying densities on the peripheral dikes of the ponds except for ponds 4A, 4B, 4C, 4D, 4E, 5A, 5B and 5C which were observed to have new grass sprouting on the dikes only by early November.

Table 11.02 – Percentage turbidity reduction with various levels of treatment in ponds at the Freshwater Station from Sept. 21 to Nov. 13, 1972.

Color Classification	Iron Red	Iron Red	Milky Rust	Milky Rust	Milky Pink	Milky Pink	Milky Pink	Milky Pink	Milky Pink	Milky Pink	Milky Pink
Pond No.	4B	4A	4C	4D	4F	5A	6B	4E	4G	6A	6C
Treatment	Control	Straw	Control	Grass	Control	Straw	Straw	Grass	Grass	Dung	Dung
Level	–	2T/ha	–	2T/ha	–	2T/ha	2T/ha	2T/ha	2T/ha	2T/ha	2T/ha
Xi (initial) in JTU	850	470	410	265	205	980	490	220	175	940	210
Xt (terminal) in JTU	280	78	310	90	115	440	300	150	98	720	20
X = Xi–Xt	570	392	100	175	90	540	190	70	77	220	199
Reduction (%)	67%	83%	24%	66%	44%	55%	39%	32%	44%	23%	95%

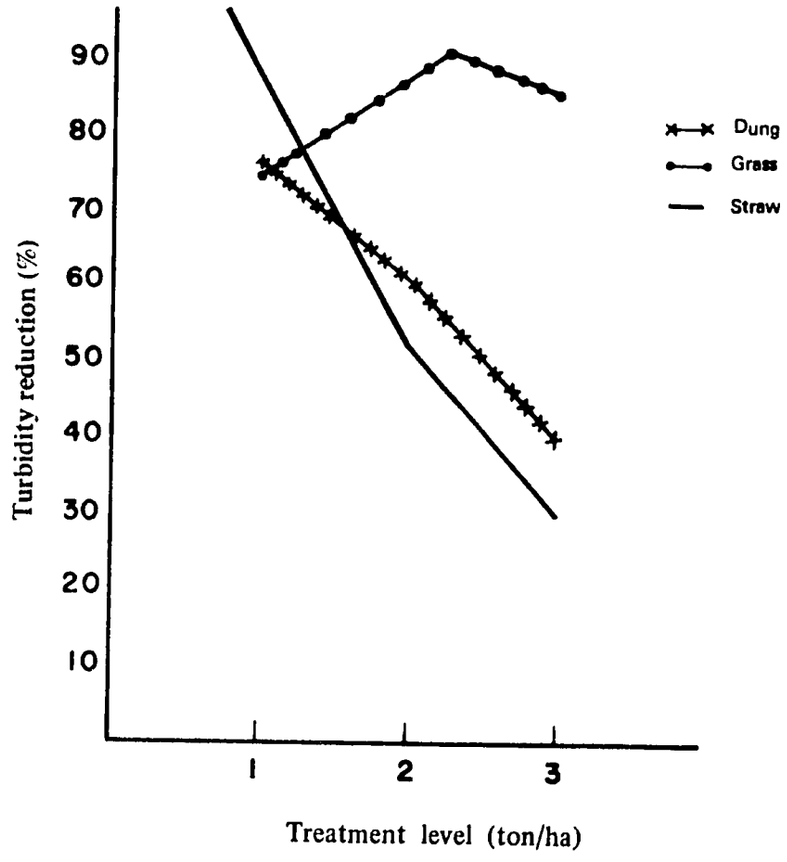
Color Classification	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky
Pond No.	5F	5C	5H	6E	6H	5D	4H	4I	4J	5B	6D
Treatment	*Ferti.	Ferti.	Ferti.	Ferti.	Ferti.	Ferti.	Control	Control	Control	Control	Control
Level	45 kg	90 kg	90 kg	90 kg	90 kg	180 kg	–	–	–	–	–
Xi (initial) in JTU	150	220	170	190	150	135	193	220	170	560	195
Xt (terminal) in JTU	32	75	6	75	110	43	130	150	130	390	12
X = Xi–Xt	118	145	164	125	40	93	63	70	40	170	183
Reduction (%)	79%	66%	96%	66%	27%	69%	33%	32%	24%	30%	94%

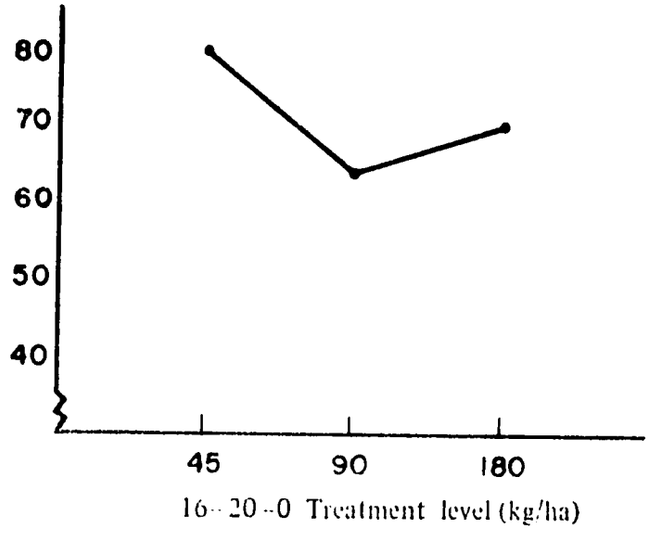
Table 11.02 – continued

Color Classification	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky	Milky
Pond No.	5I	6I	5E	6K	5J	6F	5K	5G	4K	6J	6G
Treatment	Straw	Straw	Straw	Straw	Grass	Grass	Grass	Dung	Dung	Dung	Dung
Level	1T/ha	2T/ha	2T/ha	3T/ha	1T/ha	2T/ha	3T/ha	1T/ha	2T/ha	2T/ha	3T/ha
Xi (initial) in JTU	110	135	195	170	120	195	135	120	190	140	155
Xt (terminal) in JTU	5	67	96	120	32	22	22	30	110	30	95
X = Xi–Xt	105	68	99	50	88	173	113	90	80	110	60
Reduction (%)	95%	50%	51%	29%	73%	89%	84%	75%	42%	79%	39%

*Ferti. means fertilizer 16-20-0-15

Fig. 11.01 – Per cent turbidity reduction in milky-colored ponds receiving different levels within treatments, Freshwater Station, September to November 1972.





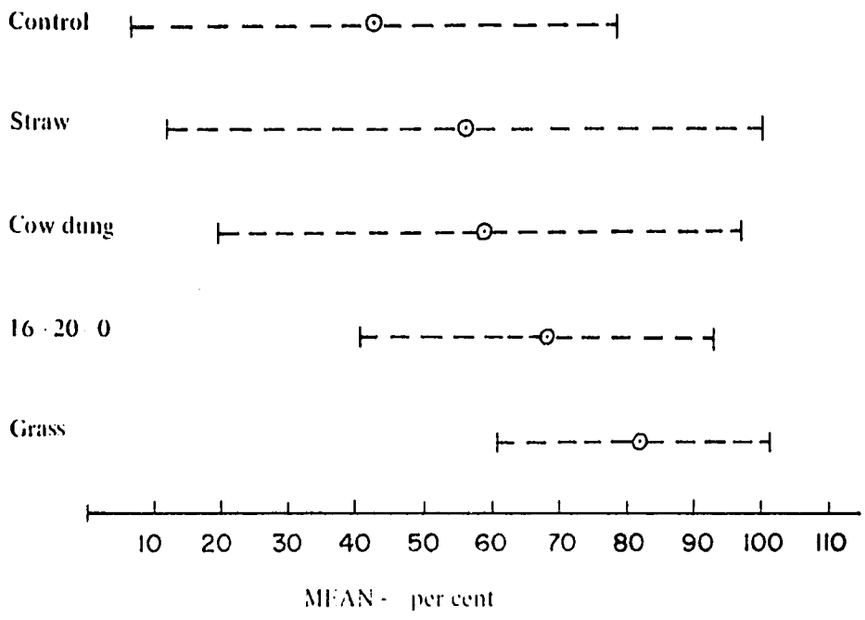


Fig. 11.02 Mean turbidity reduction and 95% confidence intervals for milky colored ponds receiving different fertilizer treatments at the Freshwater Station, September 21 to November 13, 1972.

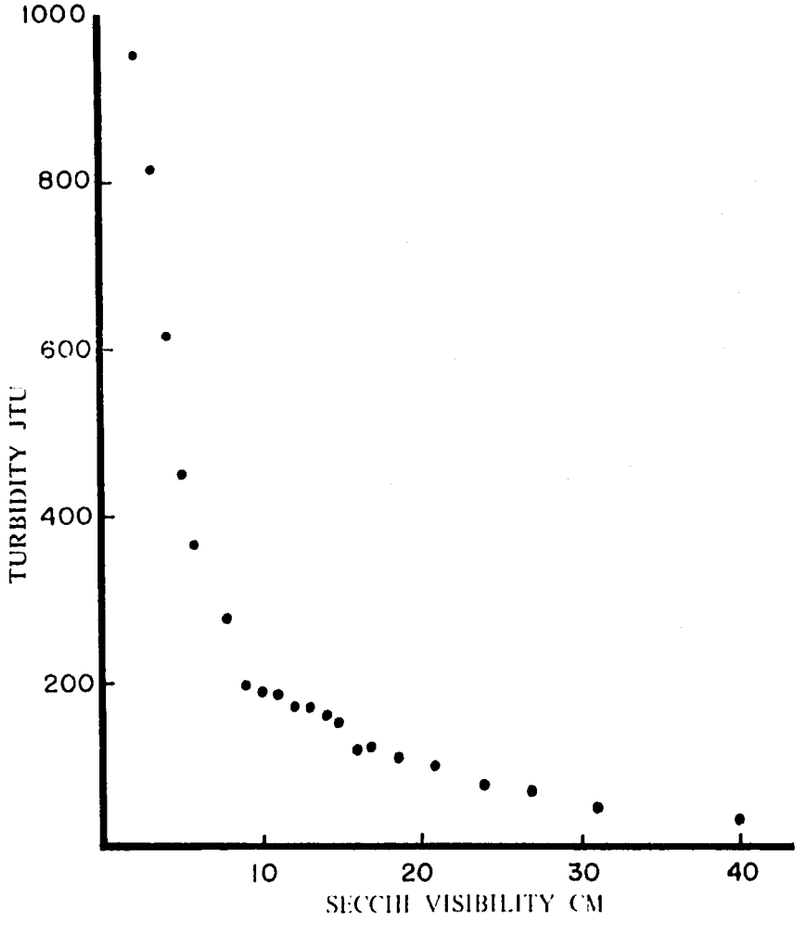


Fig. 11.03 -- Relationship of turbidity readings to Secchi disk visibilities in ponds at the Freshwater Station, September 21 to November 13, 1972. Dots represent mean values at each cm Secchi reading. Total of 825 paired observations.

Table 11.03 - Mean daily water loss corrected for evaporation and rainfall in the Freshwater Station ponds for a five-day period Sept. - Nov., 1972.

Pond no.	Water loss mm/day	Pond no.	Water loss mm/day	Pond no.	Water loss mm/day
1A	+9.0	2A	-23.0	3A	-13.8
B	-21.2	B	+2.4	B	+4.7
C	+1.9	C	-18.5	C	-1.8
D	-23.3	D	-11.6	D	+9.5
E	-2.4	E	+4.5	E	+7.95
F	-1.3	F	-3.3	F	+7.4
G	-12.7	G	-6.2	G	+7.2
H	-3.2	H	-4.7	H	+5.1
I	-0.23	I	-52.37	I	+6.9

Pond no.	Water loss mm/day	Pond no.	Water loss mm/day	Pond no.	Water loss mm/day
4A	-38.8	5A	-22.6	6A	-6.1
B	-25.5	B	-10.9	B	-22.6
C	-7.7	C	-4.9	C	-21.8
D	-10.3	D	-2.6	D	8.7
E	+1.5	E	-3.6	E	-5.8
F	+3.1	F	-4.2	F	-5.8
G	+3.7	G	-	G	-6.8
H	+4.7	H	-	H	+0.5
I	+4.7	I	-5.2	I	-6.1
J	+4.3	J	+0.2	J	-7.1
K	+4.7	K	-5.2	K	-5.2

Conclusions

1. Milky-colored ponds receiving inorganic and organic fertilizer treatments had higher mean percentage turbidity reduction than control ponds, green grass giving the best response. Variability in response was considerable even within treatments.

2. Increasing amounts within treatments of various fertilizers did not help in reduction of turbidity in the study ponds.

3. Water loss or gain was apparent in several ponds in their unfinished condition. Subsequent checks should be done and corrective steps taken following completion of the ponds if conditions warrant

B. Research in Progress

I. Field Trials on Bangus Production with Plankton

Four field trials on bangus production with plankton were initiated in the reporting period in cooperation with two fish producers in Iloilo Province. Two trials (Trials I and IV) were conducted in La Paz, Iloilo City, on the fish farm of Mr. Ernesto Jamandre. The others (Trials II and III) were conducted near Dumangas on the farm of Mr. Tirso Jamandre. Trial I was terminated in October, but the other trials remained in progress at the end of the reporting period. This report gives a complete write-up of Trial I and a progress review through December 31 on the other trials. They will be evaluated collectively after all have been completed.

The single pond trials were designed with the objective of obtaining information on bangus production with plankton, such as relative growth, yields and survival, that will provide an information base for more extensive experiments and trials to be conducted at the Brackishwater Station and in the private sector in the future.

These ponds are now being surveyed and areas used are tentative estimates.

a. Trial I

Materials and Methods

The pond used in this trial was constructed especially for the study by the owner. The pond was formed in the corner of an existing production pond by raising dikes on two sides using the excavated bottom soils from inside the new pond and using the existing pond dikes on the other sides. The pond area was 518 m^2 with a water depth of approximately 75 cm and a dike freeboard of 30 cm. The pond had one gate opening directly into the production pond. The water had to be pumped out to complete draining which was done prior to filling the pond from the production pond on July 6,

The fertilizer used throughout the trial was 18-46-0. The dates and amounts applied are presented in Table 1.01. The first application was made July 6 by applying 39 kg/ha in solution and 39 kg on a platform. Four subsequent applications of 19.5 kg/ha made during the trials were applied on the platform

Table 1.01 - Amounts and dates of 18-46-0 fertilizer applications to 518 m^2 pond in bangus field trial experiment, Iloilo City, 1972. All applications were made on a single platform except for half of the July 6 application which was applied in solution.

Date	Culture day	Fertilizer applied (kg/ha)		
		Total	N	P_2O_5
July 6	4	78.0	14.0	35.9
Aug 9	30	19.5	3.5	9.0
Aug 22	43	19.5	3.5	9.0
Sept 5	57	19.5	3.5	9.0
Sept 19	71	19.5	3.5	9.0
Total	-	156.0	28.0	71.9

Bangus averaging 0.34 g were stocked on July 10 at a rate of 2007/ha (104 fish/pond). Total weight stocked was 6.7 kg/ha. Additional bangus entered the pond about July 24 during flooding, and some of the originally stocked bangus may have also left the pond at the same time. The bangus population after flooding consisted of 3 size groups henceforth referred to as Groups A, B and C. Group A, containing the original stock, was the largest in number but smallest in size. In addition to the bangus, other fishes such as tilapia and mollies were known to be in the pond from the time of stocking. The population was sampled three times between stocking on July 10 and harvesting on October 3. At each sampling the 3 groups were separated before each fish was measured and weighed.

Quantitative measures of plankton were taken on occasions during the trial. Physio-chemical analyses of temperature, dissolved oxygen (D.O.), pH, salinity, water transparency and general weather conditions were made on 12 occasions during the trial.

The trial was terminated on October 3, the 84th day of culture, because of the contamination by the unknown weight and number of bangus during the flooding in July. Termination was premature by original planning but necessitated in part by the contamination.

Results and Discussions

Quantitative measures indicate that the standing crops of plankton fluctuated greatly from as low as 0.26 mg/1 to as high as 5.20 mg/1. (Figure 1.01). The fluctuation did not appear to follow any particular pattern. Applications of fertilizer appeared to have no influence on plankton abundance. From the 4th to the 22nd day of culture, the decline in plankton abundance paralleled a corresponding decline in salinity (Table 1.02). Unfortunately, water visibility (transparency) readings were not taken as a check on plankton abundance until late September. However, on September 26 visibility was 16 cm indicating high plankton abundance, while the quantitative measure gave only 78 mg plankton/1, indicating a very low level of abundance.

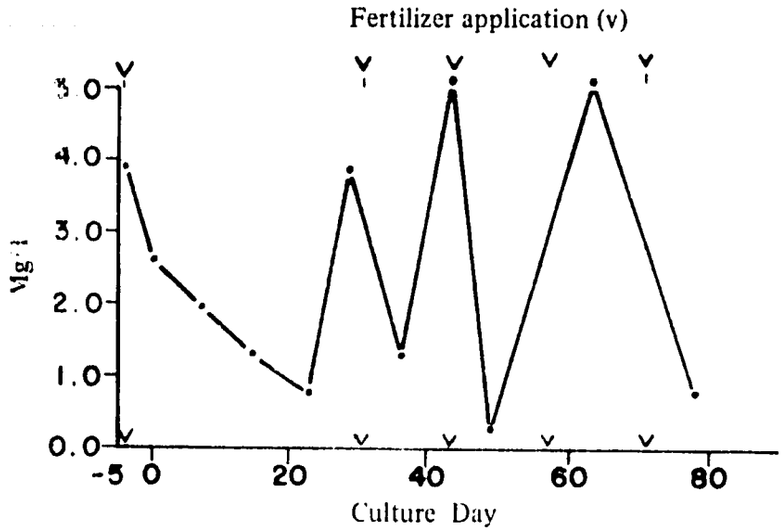


Fig. 1.01 – Standing crops of plankton and fertilizer applications at given culture days during Trial I

Physio-chemical and meteorological observations during the culture are presented in Table 1.02. Other than for the environmental conditions, there does not appear to be any factor that would be adverse to bangus culture. Rapid drops in salinity may have occurred during the period of frequent and rather hard rains in late July, which could have adversely affected the fish. The rainy weather and associated reduced photo period in July and August may have influenced the culture. The turbid water reported in mid-August was an indication of adverse conditions. Also the low water levels in September were not desirable.

Table 1.02 – Conditions in 518 m^2 pond in bangus field trial experiment, Iloilo City, 1972.

Date	Culture day	Time	Temperature Air	Temperature Water	Dissolved oxygen	pH	Salinity	Environmental conditions
July 5	-5	1445	28.0	29.2	7.8	8.8	21.5	cloudy
" 17	7	0930	-	28.6	6.6	8.9	18.3	raining
" 24	14	0945	29.4	28.2	8.2	8.8	12.1	after heavy rain; visibility low
Aug. 1	22	1030	29.1	28.4	7.8	7.0	5.8	raining daily since July 24
" 7	28	0945	28.9	32.5	7.4	8.0	5.7	scattered showers
" 15	36	0940	26.0	26.7	8.0	9.1	6.4	raining; water turbid
" 22	43	1000	26.5	28.6	7.3	8.7	5.2	after raining; water turbid
" 28	49	1030	29.6	30.0	8.7	9.1	5.6	sunny
Sept. 5	56	0900	28.8	29.6	7.1	9.2	5.7	low water level
" 12	63	1440	-	29.3	-	-	4.4	visibility 30-35 cm; low water
" 19	70	0900	26.8	29.1	-	-	4.5	visibility 38 cm; low water
" 26	77	0915	30.8	30.5	8.4	9.4	4.6	visibility 16; low water

Bangus growth was fair through the culture period (Table 1.03 and Figure 1.02). Sampling results indicate that all size groups experienced some repression in growth from the 56th to the 77th days of culture. The period of repressed growth coincides with the reported low water levels from Sept. 5 to 26. Water level after the Sept. 26 sampling was raised from approximately 35 to 60 cm. Growth appeared to be good at the time of harvest on the 84th day.

Determining the growth of the original stock of bangus with relative accuracy was complicated by the accidental introduction of additional bangus of equal and larger sizes during the flooding in July. Only 104 bangus were stocked, but 177 of Group A, supposedly representing the original stock, were recovered at harvest.

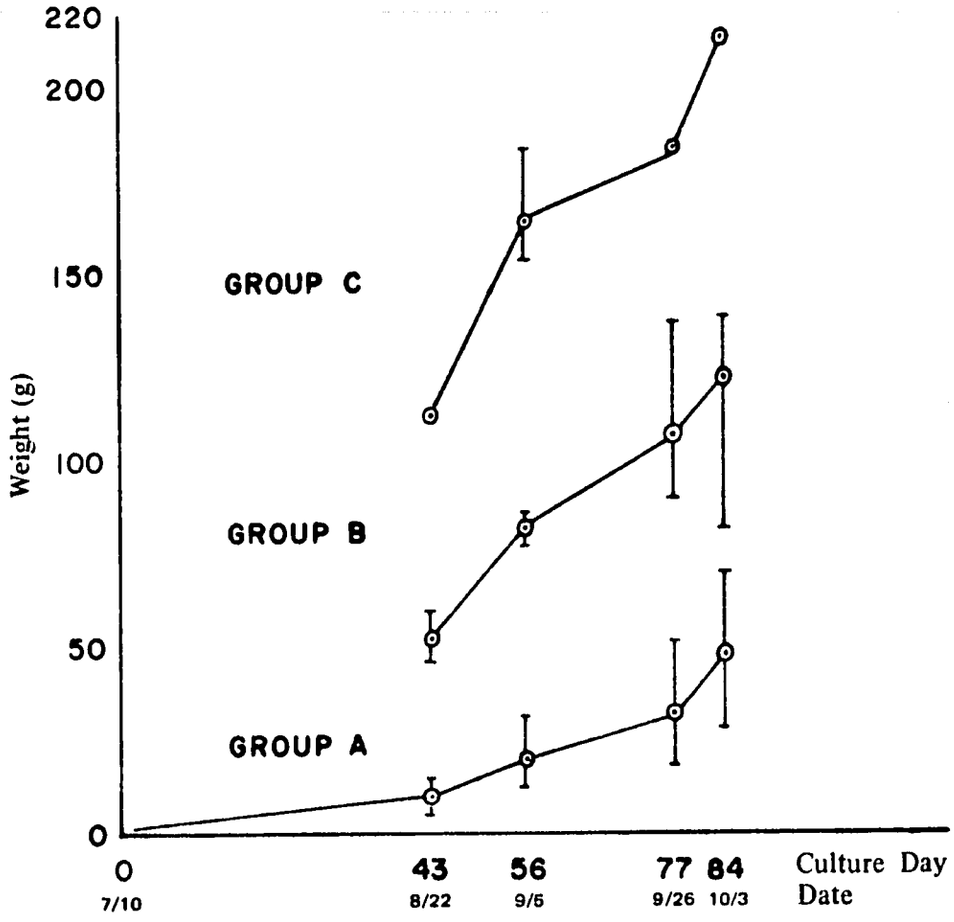


Fig. 1.02 – Empirical growth curves and weight ranges of 3 groups of bangus in Trial I pond.

Table 1.04 - Numbers and weights of fish harvested from the Trial I pond on October 3, 1972.

Group	No/pond	Kg/pond	No/pond	Kg/ha	Mean wt.(g)
A	177	8.6	3416	166.0	49
B	43	8.4	946	123.5	149
C	3	0.7	58	13.5	233

- In addition to the bangus, 32.8 kg/ha (1.7 kg/pond) of other fishes were harvested which included Tilapia, Elops, Megalops, Mugil and Poecilia sp.

A per ha total of 4420 bangus weighing 303 kg was recovered at harvest on Oct. 3, the 84th day of culture. An additional weight of 33 kg/ha or other fishes gave a standing crop at harvest of 33 g kg/ha. The Group A bangus accounted for 166 kg or about 55% of the total weight of bangus. The carrying capacity of the pond had apparently not been reached judging from the slope of the growth curves (Figure 1.02) at the time of harvest

b. Trial II

Materials and Methods

The pond being used in this trial is 9 ha with a maximum water depth of about 75 cm. The pond was dried from July 6 to 10 as part of the preparation for producing lab-lab. On July 10, 50 kg 16-20-0/ha were broadcast and applied in solution. On July 11 the pond was flooded to a depth of about 12 cm allowing lab-lab to develop until July 31. However, lab-lab failed to develop satisfactorily and instead formed into loose floating clumps. The owner had previously been encouraged by the IFP to try plankton as a food source. He made the decision to do so after the lab-lab failed to develop, and in late July the pond was flooded to about 70 cm to induce plankton growth.

The pond was stocked with 70,000 bangus fingerlings (7778/ha) averaging 33 g on July 31, culture day 0 The fingerlings had been purchased as fry on April 20 and cultured in a nursery pond for 26 days and in a transition pond for 76 days prior to stocking in the trial pond. The fish were transferred without counting from the transition pond to the trial pond. The stocking density was estimated based on expected survival.

A complete record of fertilizer used in the trial through Dec. 31 is presented in Table 1.05. A total of 186.2 kg of fertilizer/ha equivalent to 32.5 kg N and 72.7 kg P_2O_5 was applied between July 10 and Dec. 31. All applications except the one made July 10 were made on a single platform positioned in the center of the pond. Fertilizer applications were made when considered necessary to keep water visibility at less than 45 cm. Except for water visibility as measured using a Secchi disk, no physio-chemical measurements were taken during the trial.

Table 1.05 - Amounts and dates of application for fertilizer used in Trial II through Dec. 31, 1972.

Date	Culture day	Fertilizer applied (kg/ha)		
		Total	N	P_2O_5
July 10	-21	50.0	8.0	10.0
Aug. 6	6	27.7	5.0	12.7
Aug. 24	24	16.7	3.0	7.7
Sept. 4	35	13.9	2.5	6.4
Sept. 18	49	11.1	2.0	5.1
Sept. 20	51	5.6	1.0	2.6
Sept. 24	55	11.1	2.0	5.1
Oct. 1	62	11.1	2.0	5.1
Oct. 8	69	11.1	2.0	5.1
Nov. 20	112	11.1	2.0	5.1
Nov. 27	119	5.6	1.0	2.6
Dec. 25	147	5.6	1.0	2.6
Dec. 27	149	5.6	1.0	2.6
Total		186.2	32.5	72.7

- Only fertilizer used was 18-46-0 except that applied on July 10 which was 16-20-0.

- Application made July 10 and Aug. 6 were by broadcasting; all subsequent applications were made on a single platform.

- In addition to the fertilizer, approximately 10 kg rice bran/ha were broadcast on Sept. 13.

The pond population was sampled on 6 occasions through Dec. 28 (Table 1.06). The sample taken Sept. 3 was made by the owner. All others were made by the IFP using the standard technique.

Table 1.06 - Average weights and estimated standing crops of bangus in Trial II pond from stocking on July 31 through Dec. 28.

Date	Culture day	Average wt (g) fish	Estimated standing crop No/ha[1/]	kg/ha
July 31	0	33	7,800	257
Sept. 3	34	111	7,000	777
Sept. 19	50	125	7,000	875
Oct. 13	74	144	7,000	1008
Nov. 24	116	159	5,200	827
Dec. 8	130	187	3,000	561
Dec. 28	150	242	3,000	726

1/ Survival estimated to be 90% after stocking; partial harvest began Oct. 13.

Seines were used to effect partial harvest on Oct. 13, 26 and 27 and Nov. 24. Total harvest is expected in January, 1973.

Results and Discussion

One platform in the center of the pond has been adequate to sustain plankton. Water visibility has ranged from 16 to 60 cm but has usually been less than 30 cm. No fertilization was necessary in the 43-day period from culture day 69 to 112.

The rate of bangus growth is presented in Figure 1.03. A repressed growth was indicated between the 24th and 116th culture days. The pond had an estimating standing crop of 777 kg/ha on the 34th day and over 1000 kg/ha on the 74th. The weight was assumed to be near carrying capacity of the pond, so a partial harvest of 250 kg/ha was recommended to reduce the standing crop to about 750 kg/ha. Between the 74th and 88th day, a total of 261 kg bangus/ha was harvested (Table 1.07). However, sample weights on the 101st day showed that the bangus were not growing as anticipated so an additional partial harvest of 300 kg/ha was recommended. On the 116th day a total of 342 kg bangus/ha was harvested. The estimated standing crop on the 116th day after partial harvest was 485 kg/ha. This was verified by the sample on the 150th day when the estimated standing crop was again up to 725 kg/ha. Results thus far obtained indicate that the maximum carrying capacity in the pond was slightly over 1000 kg/ha and the efficient carrying capacity was around 800 kg/ha

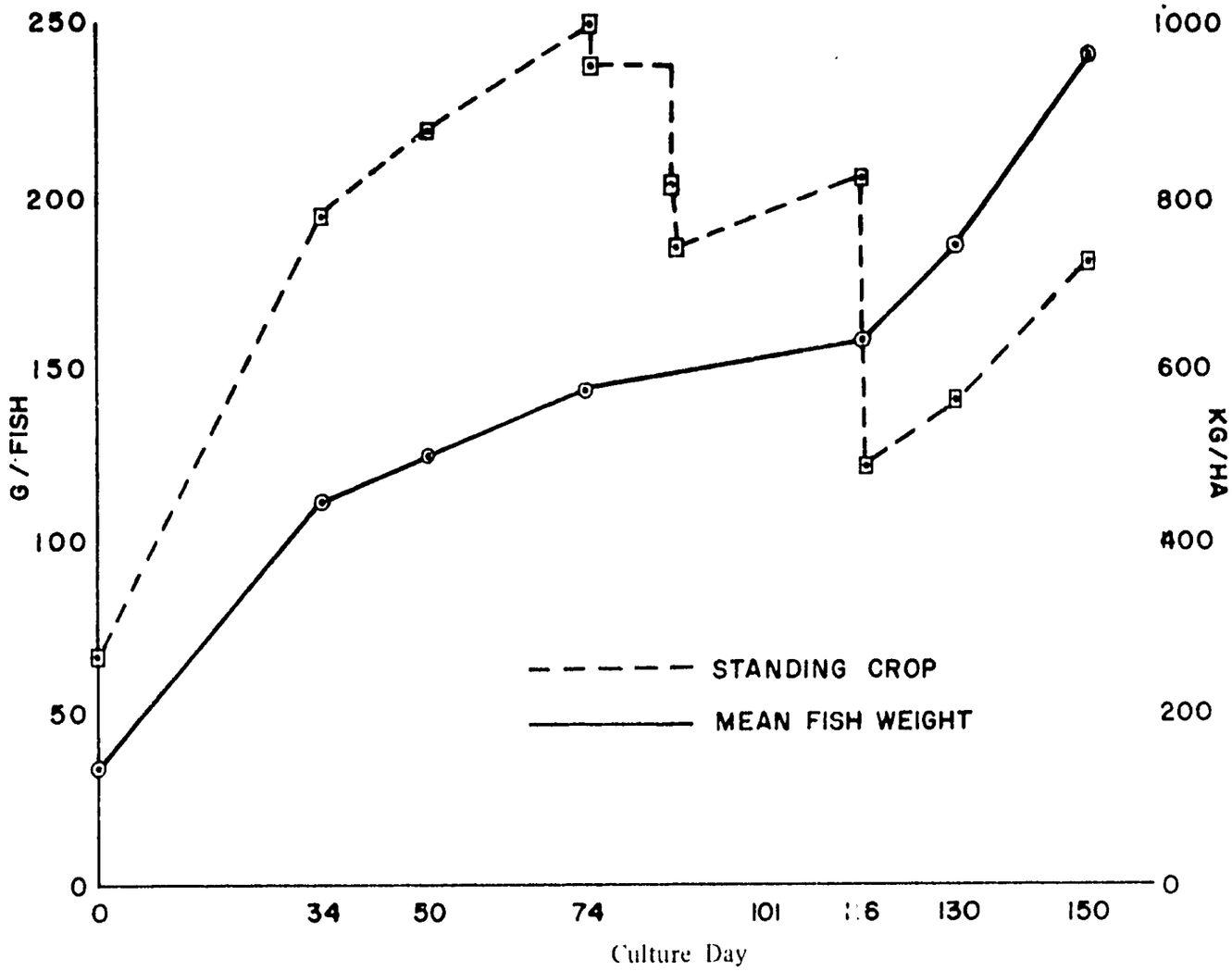


Fig. 1.03 - Empirical growth curve and estimated standing crop of bangus in Trial II from stocking on July 31 through Dec. 28, 1972.

The sample weights obtained on the 101st culture day were taken with a scale of unknown accuracy while all others were taken with a triple beam balance accurate to 0.1 g. The weights obtained on the 101st day were considered high and were discarded when the more reliable weights were taken on the 116th day.

Table 1.07 - Record of partial harvest (cropping) of bangus from Trial II pond during period from stocking on July 31 through December 28, 1972.

Date	No/pond	Kg/pond	No/ha	Kg/ha	Wt/fish (g)
Oct. 13	2430	350	270	39	144
Oct. 26	9170	1320	1020	146	144
Oct. 27	4720	680	520	76	144
Nov. 24	19370	3080	2150	342	159
Total	35690	5430	3960	603	152

c. Trial III

Materials and Methods

The pond being used is 8 ha with a maximum water depth of about 75 cm. The pond is adjacent to the pond used in Trial II. The pond had been drained in early September and refilled to 20-cm depth by rains occurring between Sept. 7 and 16. Pond preparation for the trial began on Sept. 17 with the first fertilizer application in about 20 cm of water. The pond was stocked on Sept. 19, culture day 0, with 8,125 bangus fingerling/ha (65,000/pond). The fish averaged 16.6 g for a stocking weight of 138 kg/ha. The pond level was increased from 20 to 70 cm.

The fertilization record is presented in Table 1.08. All fertilizer used was 18-46-0, and except for those made on Sept. 17 and Oct. 2, all applications were made on a platform. Fertilizer was applied as needed to maintain water visibility of less than 35 cm depth. In addition to the fertilizer approximately 20 kg rice bran/ha was broadcast on Oct. 13.

Population samples were taken on 5 occasions between stocking on Sept. 19 and Dec. 31.

Results and Discussion

The growth curve illustrated in Figure 1.04 indicates that the fish grew at a fair-to-good rate through the 80th culture day. From the 80th to the 100th day growth rate declined. The estimated standing crops on the 80th and 100th days were 869 and 971 kg/ha, respectively (Table 1.09).

Table 1.08 - Amounts and dates of application of fertilizers in Trial III through December 31, 1972.

Date	Culture day	Fertilizer applied (kg/ha) Total	N	P_2O_5
Sept. 17	-2	50.0	9.0	23.0
Oct. 13	13	18.8	3.4	8.6
Oct. 8	19	12.5	2.3	5.8
Oct. 16	27	12.5	2.3	5.8
Nov. 16	57	9.4	1.7	4.3
Nov. 27	69	12.5	2.3	5.8
Total		108.2	23.1	59.0

- All fertilizer used was 18-46-0.
- Applications made Sept. 17 and Oct. 2 were in solution; all others were on platform.
- In addition to the fertilizer, approximately 20 kg rice bran/ha were broadcast on Oct. 13.

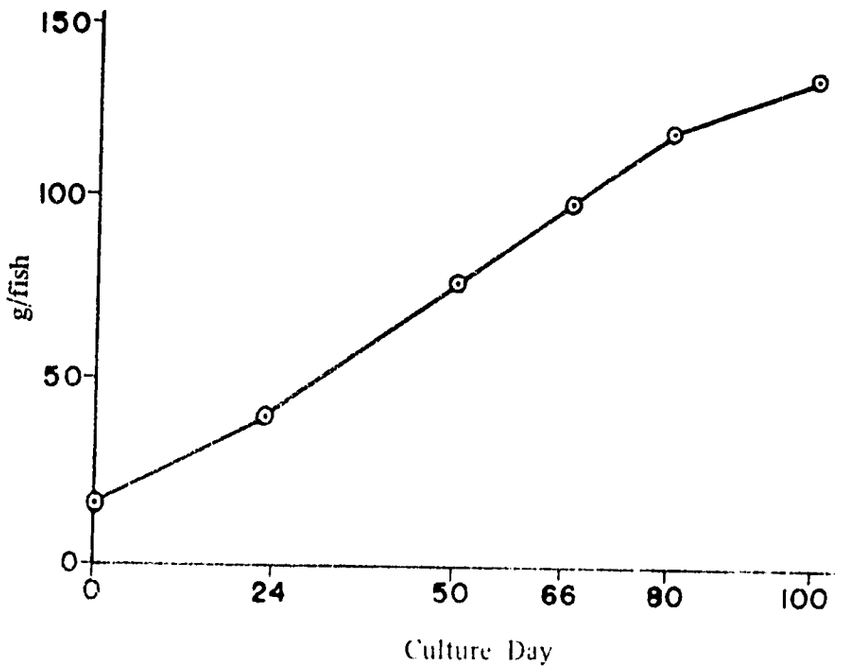


Fig. 1.04 Empirical growth curve of bangus in Trial III from stocking on Sept. 19 through Dec. 28, 1972.

Table 1.09 - Average weights and estimated standing crops of bangus in Trial III pond from stocking on Sept. 19 through Dec. 28, 1972.

Date	Culture day	Average wt (g)/fish	Estimated standing crop No/ha	Kg/ha
Sept. 19	0	17	8,125	138
Oct. 13	24	40	7,300 1/	292
Nov. 9	50	76	7,300	555
Nov. 24	66	99	7,300	723
Dec. 8	80	119	7,300	869
Dec. 28	100	133	7,300	971

1/ To correct for some mortality during the culture a 90% survival was assumed beginning with the first sample on Oct. 13.

The preliminary results suggest that the efficient carrying capacity is about 900 kg/ha under the conditions of this trial. The bangus in this pond will be transferred to an adjacent 10-ha pond in January where the trial will be continued.

d. Trial IV

This trial was begun in November in the same pond as used for Trial 1. Preparation for this trial began on Nov. 3 after the pond had stood with water but without bangus since Oct. 3.

A total of 5,018 bangus fingerlings/ha (260/pond) averaging 5.9 g were stocked on Nov. 8, culture day 0. Sailfin mollies were observed present in the pond when stocked.

The fertilization record is presented in Table 1.10. All fertilizer used was 16-20-0. The first application of 100 kg/ha was made half in solution and half on a platform on Nov. 3, culture day -5 or 5 days before stocking. Total amount applied through Dec. 31 was 300 kg/ha or 48 kg N and 60 kg P_2O_5/ha.

Table 1.10 - Record of fertilization in Trial IV through December 31, 1972.

Date	Culture day	Total	Fertilizer applied (kg/ha) N	P_2O_5
Nov. 3	-5	100	16	20
Nov. 24	16	100	16	20
Dec. 26	48	100	16	20
Total		300	48	60

- All fertilizer used was 16-20-0. The Nov. 3 application was half in solution and half on platform; subsequent applications were on platform.

The pond population was sampled on Dec. 1 and 28. One measurement of salinity was made on Dec. 1. Water visibility was measured with a Secchi disk at intervals throughout the period.

Growth of the bangus was fair through Dec. 28 (Table 1.11; Figure 1.05). From day 0 (Nov. 8) through day 50 (Dec. 28) the fish grew from an average of 5.9 to 29.5 g, an increase of 23.6 g or an average increase of only 0.47 g/day. Relative condition on Dec. 28 was observed to be poor.

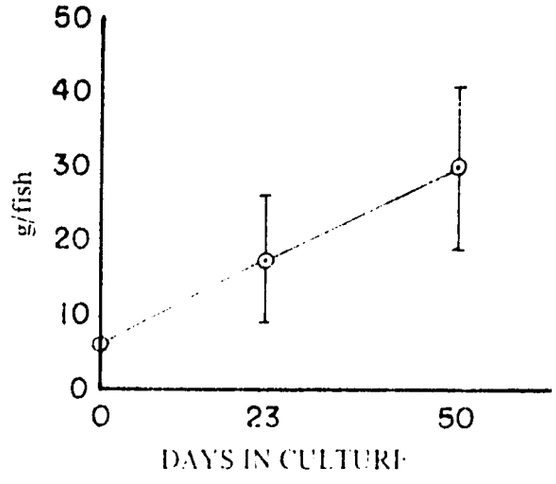


Fig. 1.05 - Empirical growth curve and weight ranges of bangus in the Trial IV pond at intervals.

Table 1.11 - Average weights and weight ranges of bangus in the Trial IV pond at intervals from stocking Nov. 8 through Dec. 28, 1972.

Date	Culture day	Average wt(g)/fish	Wt(g) range	Estimated standing crop No/ha 1/	Estimated standing crop Kg/ha
Nov. 8	0	5.9	3.2- 9.6	5018	30
Dec. 1	23	16.9	9.1-26.2	4516	75
Dec. 28	50	29.5	19.2-40.5	4516	133

1/ Survival of 90% assumed after stocking.

The estimated standing crop on culture day 50 was 133 kg/ha for an approximately net gain of about 100 kg.

Water salinity on Dec. 1 was 15°/oo. Water visibility had fluctuated between 16 and 26 cm in 8 readings between Nov. 16 and Dec. 28.

Elops and Megalops as large as 110 and 193 g, respectively, have been removed from the pond during the culture.

The trial is expected to be terminated in April.

2. Lab-lab and Bangus Production in Ponds Treated with Organic Only Inorganic Only and with Combination Organic and Inorganic Fertilizers.

This study is being undertaken in cooperation with the Iloilo Regional School of Fisheries (IRSOF), Barotac Nuevo, Iloilo. The primary objective is to compare lab-lab and bangus production in ponds treated with chicken manure only, 18-46-0 only and combination 18-46-0 and chicken manure.

The study is being conducted in 12 ponds within the IRSOF compound. The ponds average 0.01 ha. Fertilizers were applied as follows:

Treatment	Pond no.	Rate of fertilization
No fertilizer (control)	2, 4, 9	None
Chicken manure only	1, 6, 11	2000 kg/ha in 2 half-doses at weekly intervals prior to stocking.
18-46-0 only	3, 7, 8	20 kg P_2O_5/ha in 3 half-doses at weekly intervals prior to stocking.
Chicken manure and 18-46-0	5, 10, 12	2000 kg/ha chicken manure and 20 kg P_2O_5/ha 18-46-0 in 2 and 3 half-doses, respectively, at weekly intervals prior to stocking.

The ponds were stocked with bangus fingerlings averaging 27.4 g on Nov. 21.

Lab-lab and fish are being sampled weekly and bi-weekly, respectively. Weekly measures on salinity, dissolved oxygen, CO_2 and pH are being made.

After 42 days in culture, the mean weights of fish were 63.7 g, 57.9 g and 52.6 g in combination, no fertilizer and 16-46-0 ponds, respectively.

The study will terminate on the 60th day of culture.

3. Backyard Hito Culture

One objective of the IFP is to develop some sort of "backyard" fish culture whereby individual families could raise fish for their own consumption. To facilitate research in this regard, two small backyard ponds have been prepared for experimental work. The ponds are 1.5 x 2.0 m on the sides and 0.5 m deep and required 1-1/2 days labor each to dig. The ponds failed to hold water on initial filing so liners made from plastic upholstery materials were fitted to the ponds at a cost of ₱18 each. A screen fence was placed around the ponds to contain fish and keep children and pests out. Ponds were supplied with well water from a residential hose outlet and drained by bailing.

Prior to stocking, algae and Elodea were seeded into both ponds. A rich plankton growth developed in each pond including an oily-green surface scum of Euglena. A distinct pigpen-like odor was apparent when pond water became polluted. Microscopic examination of water samples on Nov. 3 showed high numbers of rotifiers, Paramecium, Anacystis, Scenedesmus and Pediastrum algae among other organisms. A few Chironomid larvae had attached themselves to the pond sides. On Oct. 31 at 3.00 p.m. temperatures in the ponds were 32.0 and 32.6 C. Pond 1 had a supersaturated oxygen condition with more than 15 ppm. Pond 2 had only 0.5 ppm though both readings were made with a YSI oxygen meter which could not be calibrated for altitude. The difference between the ponds at the time was mostly the number of fish stocked: pond 1 had 48 fish (16 fish/m^2) whereas pond 2 had about 400 fish. (133 fish/m^2)

Pond 1 was stocked with 50 hito fingerlings on October 18. Fish were purchased for ₱5.00 in the San Jose City market. Two dead fish were removed during the next two days. Fish were fed IFP-1b prepared pellets each morning and evening at a daily rate of 3 to 5% of their weight. On November 2 a sample of 35 fish had a mean weight of 39.5 g. On November 29 a sample of 17 had a mean weight of 39.9 g. Water was partially replaced on Nov. 14, Dec. 5 and Dec. 16.

At first sampling, pond 1 fish appeared in excellent condition with bellys distented from feeding. At later samples fish appeared healthy but less full than at first. Fish were frequently observed at the surface actively taking pellets at feeding time. The evening feedings were done after dark because fish appeared to feed more readily then. Following the first sampling and all subsequent disturbances such as sampling or refreshing the water,

fish did not surface for feed for several days. It is not known if fish stopped feeding altogether or just waited for pellets to sink.

Because of the poor growth evidenced by the Dec. 29 sampling it was decided to terminate the experiment in pond 1. The pond was drained and all fish measured on Jan. 2, 1973. A total of 47 fish were recovered meaning only 1 additional fish had died besides the 2 dead fish removed directly after stocking. Mean of the fish was 38.6 g, a decrease of an average 0.9 g from size at first sampling. The fish were returned to Pond 1 and will be used in subsequent experiments.

Pond 2 was used as a holding place for hito fingerlings destined for cage experiments. A total of 427 fish were added to the pond in various lots from Oct. 25 through Nov. 6. On Nov. 9 the pond was drained and 387 fish recovered accounting for 91% of the fish stocked. This was good survival considering not all fish placed in the pond were in good conditions. The overall health of the fish appeared to improve while the fish were in the pond. On Nov. 18 seven tilapia were placed in the pond to see if they would survive and possibly reproduce. Following sampling on Dec. 5, four of the fish died. The remaining 3 fish were given pelleted feed and appeared to thrive under pond conditions. At least 100 small fry were first noticed in the pond Dec. 28. Parent fish will be removed and the progress of the young fish will be observed to see if they will grow and survive in crowded pond conditions. If the fish thrive they will be used as subsequent stock for tilapia experiments.

4. Culture of Hito in Pond Cages

Four cages measuring 93 x 93 x 107 cm made of 5 x 5 cm wooden frame covered with welded wire of 8 mm mesh opening are being used in this experiment. The cages are floating with 0.77 m^3 (1.0 yd^3) in water in a 100-m^2 pond at the "Little Baguio" area on the CLSU compound. The pond has a depth of 1.2 m.

Hito fingerlings for stocking the cages were purchased over 37 days from San Jose City Public Market. Because of the limited supply of hito fingerlings, the projected stocking density of 150 fish (200/m^3) for cages 1 and 3 and 230 (300/m^3) fish for cages 2 and 4 were not attained. Only stocking rates of 102 fish for the first two cages and 166 fish for the other two cages were realized after a period of 37 days collecting (Oct. 25 to Dec. 1).

After the initial stocking on Nov. 9 the fish were given a ration of IFP-1b feed at 5% of body weight per day at one feeding per day. Table 4.01 shows stocking record including the additional fish added to each cage.

On Dec. 18, the accumulated stock were all sampled by taking the length and weight measurements of 40 fish and taking the bulk weight of the remainder from each cage. Table 4.02 shows the result of this sampling.

The designed feeding experiment was started Dec. 19. The feed used since Dec. 19 is made of 10% broken rice, 10% IFP-1b feed and 80% trash fish. The feed is prepared by cooking the broken rice into a consistency of a porridge, then trash fish are added and the subsequent mixture cooked. IFP-1b feed is added after cooking and the whole mash is ground in a meat grinder to form a sticky paste. The feed preparation is weighed and packed in polyethylene bags in amounts enough for a day's ration. Feeding rate is computed at 5% of body weight per day which is given half in the morning and half in the afternoon.

Sampling of fish will be taken at 30 day intervals. Feeding rates will be adjusted following sampling as required by growth of the fish. The experiment will continue as long as appreciable growth is obtained or until the fish have reached marketable size of about 200 g.

Table 4.01 -- Stocking record of hito cage culture experiment at "Little Baguio" CLSU compound.

Cage No.	Nov.	No. Stocked & Stocking Dates				Dec.	Total	Average length	Average weight
	9	14	15	24	29	1		(mm)	(g)
1	96	0	0	0	6	0	103	149.6	25.0
2	97	9	12	33	0	18	172	153.4	27.4
3	97	0	0	0	6	0	103	153.7	26.0
4	96	9	12	33	0	17	169	155.8	28.1

Table 4.02 -- Sampling record of hito cage culture experiment on Dec. 18, 1972, at "Little Baguio" CLSU compound.

Cage No.	Average days of culture	No. of fish recovered	Survival %	Average length (mm)	Average weight (g)	Weight gained/fish (g)	Feed conversion
1	38	101	98	153.4	30.2	5.18	9.17
2	33	153	89	152.8	30.7	3.31	11.39
3	38	100	97	155.5	30.6	4.55	10.55
4	33	147	87	156.8	31.9	3.72	10.55

5. Textural Analysis of Freshwater Station Subsoils

Introduction

The ability of a pond to hold water can be predicted from a knowledge of the soils used in forming the ponds. This study is to check the soils at the Freshwater Station to locate areas where ponds may leak. Soil samples from the various ponds are being checked for their relative proportions of clay, silt and sand.

Materials and Methods

Soil samples are being collected with a soil auger. Where necessary, laboratory analysis will be made to classify soil types. Detailed maps of pond soil distribution at the surface, 0.3 m, 0.6 m and 1.0 m below the surface will be made for the whole pond area. Potential trouble areas resulting from too porous soil will need to be corrected.

Laboratory analysis uses the standard sieve and hydrometer methods to determine the relative proportion of soil grain sizes. If more than 10% of the soil passes through #200 sieve, the standard hydrometer method is also performed in the same sample. In the hydrometer analysis, the soil dispersing agent being used is 0.1 N sodium hydroxide.

Results and Discussions

Results of various laboratory analysis are presented in Table 5.01. Findings todate are tentative because the station is still in construction.

Table 5.01 - Results of subsoil analysis by weight of the Freshwater Station ponds at Munoz, Nueva Ecija, November, 1972. Soils are from 0.6 to 0.9 m into the dike except in pond 4A where the sample was from the center of the pond bottom.

Pond no.	Sand %	Silt %	Clay %	Textural class
1A	23.34	43.44	33.22	Clay loam
1C	22.96	40.52	36.52	Clay loam
IF	16.80	41.56	41.64	Silty clay
1I	18.94	37.08	43.98	Clay
3A*	96.28	-	-	Sandy
3F	32.42	33.28	34.30	Clay loam
4A*	92.17	-	-	Sandy
4E	22.56	32.92	44.52	Clay
4K	41.48	26.40	32.12	Clay loam
5A	48.56	11.12	40.32	Sandy clay
5H	4.5	37.98	57.52	Clay
6A	52.48	14.72	32.80	Sandy clay loam
6D	15.28	30.08	54.64	Clay
6H	17.70	28.84	53.46	Clay
6K	18.94	36.26	44.80	Clay

* Result of sieve analysis only.

6. Determination of Length-weight Relationships of Bangus and other Fishes

The IFP has now accumulated several thousand measurements of length and weight of individual bangus from the experiments conducted by the Project. A computer program has been developed for the purpose of determining L-W relationships of bangus and any other other fish species by combining all the data of one species or by separating data based on desired treatments, experiments, locations, dates, etc. Key punching on IBM cards of all the data is being accomplished.

A standard L-W relationship of bangus and other fishes where the IFP has enough data can be generated by the program and from these information a coefficient of condition of the fish can be determined. Such information can be a useful reference for scientists, students and fish farmers. Hopefully results on this can be reported in the next technical report of the project.

7. Bangus Feeding Behavior on Artificial Feed

This project was reported in progress in the FY 1971-72 report having been initiated in May, 1972. Termination was scheduled for September, but the concluding work was not completed during the reporting period. Completion is anticipated prior to July 1973.

8. Screening of Feed Stuffs and IFP-Special Formula Fish Feed

An aquarium with 70 l capacity is being used to test acceptability and growth response of hito and dalag to various feed stuffs. The aquarium is wooden with epoxy paint covering and a glass front. Aeration and bottom filter are provided in the aquarium which also has plants (Elodea sp.) and a cover. Water in the aquarium is freshened periodically.

Two attempts were made to hold small dalag purchased from the local market. All fish died within 24 hr which leads to the conclusion that dalag are less hardy than would be supposed from the way they stay alive during marketing. Hito purchased and handled in a similar manner as the dalag were able to survive and thrive in the aquarium. Several fingerling sized hito have been maintained since October 20.

The hito were started immediately on a diet of chopped land snails. The snails were the large type locally known as African or Japanese snails. The snails were collected from gardens on the CLSU campus and removed from their shells following 5 to 10 min in boiling water. The bodies were passed through a meat grinder and frozen until given to the fish.

The hito accepted the snail meat readily but did not appear to grow. In the period from Nov. 14 to Dec. 5 the mean weight of 8 fish declined from 18.7 g to 18.0 g. Proximate analysis done by the Bureau of Animal Industry in Manila showed the snail meat to be 77.7% water and 48% protein on a dry weight basis.

Following the Dec. 5 sampling, fish were started on IFP-1b pelleted feed. The fish took the feed readily though they waited for it to sink and sometimes would not immediately swallow a large pellet but would rather bite on the pellet and carry it back to the darkest corner of the aquarium. By Dec. 26 the hito had a mean weight of 22.3 g, and average gain of 4.3 g or 24%. Fish will be continued on the IFP feed for another 3 weeks after which progress will be evaluated and alternative feeds will be considered.

Additional aquaria are being prepared for further trials with other species and materials.

9. Evaluation of Chemicals Used in Aquaculture

The project was begun in May, 1972 and was reported in progress in the FY 1971-72 report. It continues in that capacity. A progress report will be presented in the next report.

10. Physio-chemical Survey of Bangus Ponds and Other Selected Waters

This project remains in progress and is proceeding on schedule. The study was initiated in March, 1972, and will terminate in March, 1973.

11. Biological Survey of Ponds and Natural Water

The study was started in April, 1972. The survey has been involved in a total of five separate studies as of December, 1972. Activities were mostly in connection with periodical qualitative and quantitative assessment of lab-lab, plankton and other food organisms in treatment ponds under varying conditions.

The areas covered were fishponds in Iloilo City and in the neighboring towns of Leganes, Zarraga, Barotac Nuevo and Dumangas. The survey will continue through the end of the current dry season to complete a whole year observations on the composition and occurrence of food organisms in brackishwater ponds and environs.

12. Market Surveys

Table 12.01 - Check list of prices as of December, 1972 (Iloilo).

Lumber		
Lauan	-	₱0.60/bd ft
Apitong	-	0.60/bd ft
Yacal	-	1.50/bd ft
Hardware		
Cement	-	5.20/94 lb bag
G.I. Sheets	-	1.96/ft 26 gauge
G.I. Sheets	-	1.41/ft 31 gauge
Steel Bars (round)		
1/2" x 36'	-	22.00 each
1/4" x 36'	-	6.00 each
3/8" x 36'	-	3.70 each
Sand	-	20.00/3 ft
Gravel	-	27.00/3 ft
Bamboo Trunks	-	2/50 each
Bamboo Piles	-	1.00 each
Others		
18-46-0	-	42.00/50 kg bag
16-20-0	-	30.50/50 kg bag
21-0-0	-	18.50/45 kg bag
0-20-0	-	15.00/45 kg bag
12-12-12-14	-	24.00/45 kg bag
0-0-60	-	25.00/50 kg bag
Urea	-	32.00/50 kg bag
Agricultural Lime	-	5.00/50 kg bag
Rice Bran	-	5.00/25 kg bag
Chicken Manure	-	3.00/bag of 3 cans
Brestan	-	66.00/kg
Gusathion		
32 oz bottle	-	38.00
16 oz bottle	-	[illegible].00
8 oz bottle	-	10.00
4 oz bottle	-	3.40

Table 12.02 – Price index of fry in fishing villages of Iloilo

Date	Item	Buying* price/1000		Selling*** price/1000	
		Oton	Tigbauan	Oton	Tigbauan
June 3, 1973	Bangus	₱13.00	₱13.00	₱18.00	₱18.00
Aug. 4, 1972	Bangus	13.00	none	18.00	none
	Sugpo	30.00	none	35.00	none
	Lukon-lukon	3.00	none	5.00	none
Aug. 8, 1972	Bangus	15.00	none	20.00	none
	Sugpo	35.00	none	40.00	none
Aug. 18, 1972	Mullet			30.00	
Sept. 29, 1972	Bangus	25.00	none	30.00	none
	Sugpo	40.00	none	45.00	none

* Buying price from collectors.

** Selling price to consumers.

Table 12.03 – Price index of fishery products in Iloilo City Market.

Date	Item	Buying* price		Selling** price		Quantity	
		Central	Super	Central	Super	Central	Super
December 1972	Bangus	₱ 6.00	₱ 4.50	₱ 7.00	₱ 5.50	per kg of 3 pcs	per kg
	"Lukon"	16.50	16.50	17.00	18.50	per kg	per kg
	Suaje	5.50	7.00	6.00	8.50	per kg	per kg
	Sea Bass	-	-	6.50	-	per kg	-
	Spade fish	-	-	1.50	-	per piece	-

C - Central Market

S - Supermarket

* - Buying price from fishpond operators.

** - Selling price to consumers.

C. Research Programmed (Jan. 1 to June 30, 1973)

1. Brackishwater Station (Iloilo)

a. Continuation of on-going or in progress research projects.

1. Field trials on bangus production with plankton.
2. Lab-lab and bangus production in ponds treated with organic only, inorganic only and with combination organic and inorganic fertilizers.
3. Bangus feeding behavior or artificial feeds.
4. Evaluation of chemicals used in aquaculture.
5. Physio-chemical survey of bangus ponds and other selected waters.

b. Fertilization experiments and bangus production in 500 m^2 ponds at Leganes if they will become available to the project within the period.

c. Comparative study of bangus production with lab-lab and plankton.

d. Methods of assessing productivity of ponds.

e. Salinity and dissolved oxygen tolerances of bangus.

f. Bangus (Sabalo) spawning.

2. Freshwater Station (Nueva Ecija)

Continuation of on-going research and, as the station becomes functional:

a. Milkfish - 1000 m^2 ponds

1. "Basic Production Level in Freshwater Fishpond"
2. "Different Stocking Rates and Fertilizer Systems"

b. Catfish - 500 m^2 ponds

1. "System of Natural Reproduction and Fingerling Production"
2. "Test of Various Feeds" (mostly aquaria experiments)
3. "Determine Basic Production Levels and Effects of Different Fertilizer"

c. Carps

1. "Basic Production Level Compared to Production with Fertilizer and to Production with Feed and Fertilizer"
2. "Polyculture"
3. "Artificial Breeding of Bighead Carp" (available at CLSU ponds)

d. Others

1. "Mix-Culture of Tilapia and Dalag"
2. "Mix-Culture of Tilapia and Hito"
3. "Techniques of Zooplankton Culture to Produce Food for Young Fish"

III. TRAINING AND EXTENSION ACTIVITIES

A. Consultations

The project has given free consultation to numerous interested parties regarding the technical aspects of aquaculture. Private and public interests were counseled both at the stations or offices and in the field.

B. Demonstrations

Research demonstration work was done with private ponds of Mr. Jose Legarda and Atty. Jose Batungbacal of Bataan, Dr. Saturnino Abesamis of Pangasinan, and Mr. Tirso Jamandre and Mr. Ernesto Jamandre of Iloilo. Reports of these research demonstrations are indicated in this technical report.

C. Lectures and Seminars

Lectures and seminars were given by the project to the private sector and the government sectors, notably to Secretary Arturo Tanco and his party, Chairman Florencio Medina and his staff, President Salvador P. Lopez and his staff, The Philippine Federation of Fishpond Producers, the Rotary Club of Malolos, and many others given by our station staffs at their localities.

D. Training Activities

Some of the staff of the IFP were involved in the Peace Corps Volunteer training program of the Bureau of Fisheries held in Dagupan City and Iloilo City (October and November, 1972). A new course, Introduction to Inland Fisheries, was started at CLSU in the second term which should be the beginning of a fisheries curriculum at that school. The 3-credit elective course is being taught by IFP staff.

IV. PROPOSED TRAINING AND EXTENSION PROGRAM

The Inland Fisheries Committee[1/] created by the Department of Agriculture and Natural Resources in the latter part of 1972 has agreed to implement a training program entitled "Brackishwater Fishpond Fertilization Training Program." This training program aims to train selected extension workers of the Bureau of Fisheries in fertilization of brackishwater ponds and to give them the experience of growing fish through this method with selected privately owned ponds. The IFP staff will be the main core of the training staff. The Committee sees this training program as the start of a permanent linkage between the BF and the IFP wherein the BF extension workers can be continuously provided with technical information which should go to the private sector after the extension workers have transformed the technical information into a layman's language. Extension workers on the other hand, should continuously supply the IFP and the BF with information about the problems of the private sector in aquaculture.

There will be two training centers in the training program - Center I at the Dagat-dagatan Station at Malabon, Rizal, and Center II at Iloilo City. The two centers will be used to train the extension workers for a one-week period (30 hours of lecture-lab demonstration) before the field trials in their respective fields of assignment (12 provinces) which will last about 3 to 4 months. In the field trials the fishpond owners' fertilization method will be compared with that of the IFP fertilization technique under the different conditions of the country.

The last phase of the training program will be done at the IRSOF, Barotac Nuevo, Iloilo, where all the data from the field trials will be pooled together and discussed. It is hoped that in this last phase the trainees can develop their own extension leaflet based on their training. It is also here that some aspects of marketing and marketing problems of the bangus fishpond industry can be injected by the marketing research group of Dr. Lawrence Darrah. (NFAC/ Ford Foundation)

The budgetary requirements of this training program will be approximately ₱90, 000. The BF and the NFAC together with the USAID will shoulder the main bulk of the budgetary requirements.

1/ This Committee is charged with the function of determining and studying policies and programs pertaining to inland fisheries.

V. STATUS OF CONSTRUCTION

A. Freshwater Station (CLSU, Munoz, Nueva Ecija)

Based on the report of Amalgamated Project Management Services, Inc. (APMS), the percentage accomplishment are the following as of December 12, 1972:

1.	Earth work	72%
2.	Total work	75%
3.	Deepwell	100%
4.	Building (lab/administration)	56%
5.	Pumphouse	39%
6.	Outside Development	14%

At the end of December 1972, the water supply pipes to the ponds were still being laid, the big culvert pipes of the main drain canal were being constructed, there still remained some excavation of the ponds and filling of dikes to be done, and the laboratory/administration building was being constructed at a fast pace. Construction of the fishpond system, however, was felt to have been progressing at a slow pace.

B. Brackishwater Station (Leganes, Iloilo)

Based on the report of the APMS, the percentage accomplishment are the following as of December 25, 1972:

1.	Earthwork	63%
2.	Total work	53%
3.	Deepwell	65%
4.	Building (lab/administration)	0%
5.	Pumphouse	0%
6.	Outside Development	0%

Problems of construction at Leganes seem to be mainly concentrated in availability of labor manpower in the locality. Earthwork is done by manual labor but the contractor has started employing high water pressure passing through a nozzle to speed up excavation of canals and ponds. The murky fluid (a combination of water and fine soil) produced by this method is pumped out and conveyed to a place where filling is needed.

The project has appealed to the contractor and the APMS to finish the filling of earth material on the building site so that the building construction can be started.

Construction of main gates of the main drainage canal and the gates of the 500 m^2 ponds has started.