

2. Production Cycle and Productivity

It was found that fingerling of 15-20g are grown for around 8 months to reach over 60g body weight per fish on average. And it takes around 18 months in total to grow to over 60g body weight from fry size. Tilapia grows fast during summer rainy season between December and March, therefore, fish production should be done during these months. Standard production cycle is shown in Figure-2 and model of fattening tilapia in polyculture is shown in Table-2.

Activities from now

1. Evaluation of fish stocking in various season

PDM 2.1.5 Examination on species combination, stocking density, feeding rate, and others necessary for establishment of rearing techniques

Activities and results until now

1. Monoculture and Polyculture

Stocking rate in polyculture should be 3 *O.shiranus*, 1 *T.rendalli*, 1 *C.gariepinus* by harvest weight according to results at NAC. When *T.rendalli* is unavailable, the rate becomes 4 *O.shiranus* and 1 *C.gariepinus*. *O.shiranus* and *T.rendalli* reproduce themselves in fattening pond, while *C.gariepinus* does not in general spawn without hormone injection.

Productivity by polyculture may attain to be higher than that by monoculture because natural feeds which are not utilized by *O.shiranus* are used by other species, *T.rendalli* or *C.gariepinus*. However, *C.gariepinus* which is classified as carnivorous, usually feed on the young of *O.shiranus* and *T.rendalli* and they cannot gain the same weight of the consumed fish. Food conversion rate of tilapia is estimated to be more than 3 for *C.gariepinus*. And it is only natural that *T.rendalli* has low survival rate at harvest.

Therefore polyculture can be recommended to produce larger sized tilapias.

2. Research on integrated fish farming with livestock in Kasinthura fish farm

Construction has completed.

Activities from now

1. Examination of comparative productivity between the pond with goat cage and the pond without goat cage in Kasinthura
2. Examination of fish growth with various fertilizing rate of chicken manure

PDM 2.1.4 Study of production cycle

Activities and results until now

1. Growth Rate

Tilapia grow fast when water temperature is higher than 25°C. This water temperature is expected from the middle of October to the middle of May for 7 months at NAC. Female of *O.shiranus* mature and start spawning at less than 40g of body weight, hence their growth is inferior to males. Their standard growth curve is shown in Figure-1.

Weight gain from stock until harvest proves to be around 350% for 8months in fattening pond on an average. Therefore 20g fingerling reaches 70g at harvest.

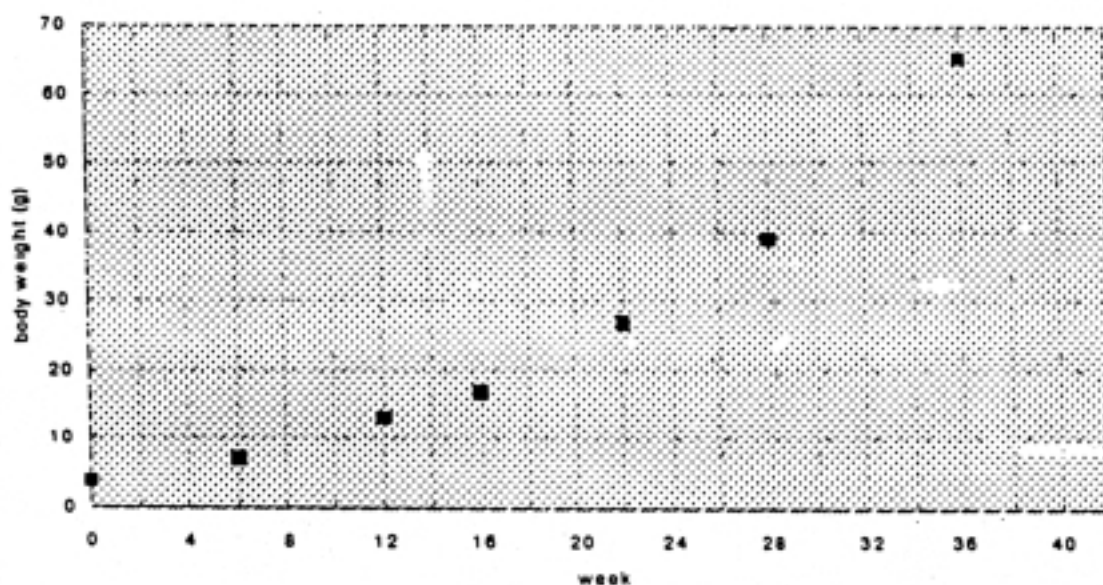


Figure-1: Standard growth curve on *O. shiranus* at NAC

Progress Report on Fish Rearing Section in Phase 2

PDM 2.1.1 Research on fertilization techniques including tests of manure and integration of livestock

Activities and results until now

1. Evaluation of Fertilization of Chicken Manure to Fish Pond

- Results of examination are shown in the Table-1.

O. shiranus showed equal growth rate with *C. gariepinus*, with regard to body weight from 20g to 40g. and water temperature between 16 and 21 °C. *O. shiranus* proved not to be a slow grower *O. shiranus* seemed to eat enough natural feeds of zooplankton and midge especially in Tank B-5 and D-6.

The intensive fertilization of chicken manure did not cause the desired effect to increase productivity on *O. shiranus* and the results were not clear on *C. gariepinus*. Further examination is required to confirm the results of fertilizing chicken manure for tilapia and catfish culture.

Table 1: Effects of Fertilization with Chicken Manure on the Growth of Fish

June 9 ~ July 23, 2000 (45days) Stocked in concrete tank 2 × 2 × 1m

Tank No.	D-3	D-2	B-5	D-6	D-5
Fish species	<i>C. gariepinus</i>	<i>C. gariepinus</i>	<i>O. shiranus</i>	<i>O. shiranus</i>	<i>O. shiranus</i>
Fish Foods	Wheat bran	Wheat bran	Wheat bran	Wheat bran	Wheat bran
Chicken manure	6 kg.	6 kg.		6 kg.	6 kg.
Initial					
Fish no.	12	24	12	12	24
Total Body weight (g)	293.0	560.0	333.0	315.0	694
Average B.W. (g/fish)	24.4	23.3	27.8	26.3	28.9
Final					
Fish no.	12	23	12	12	24
Total Body weight (g)	435	591	480	413	802
Average B.W. (g/fish)	36.3	25.7	40.0	34.4	33.4
Stocking density (g/m ²)	109	148	120	103	201
Total Food Supply /fish (g)	18.8	18.8	21.4	20.2	22.3
Total Weight Gain /fish (g)	11.8	2.4	12.3	8.2	4.5
Food Conversion Rate	1.6	8.0	1.7	2.5	5.0
Daily Feeding Rate (%)	1.4	1.7	1.4	1.5	1.6
Daily Growth Rate (%)	0.9	0.2	0.8	0.6	0.3
Weight gain (%)	148	110	144	131	116
Survival rate (%)	100	96	100	100	100

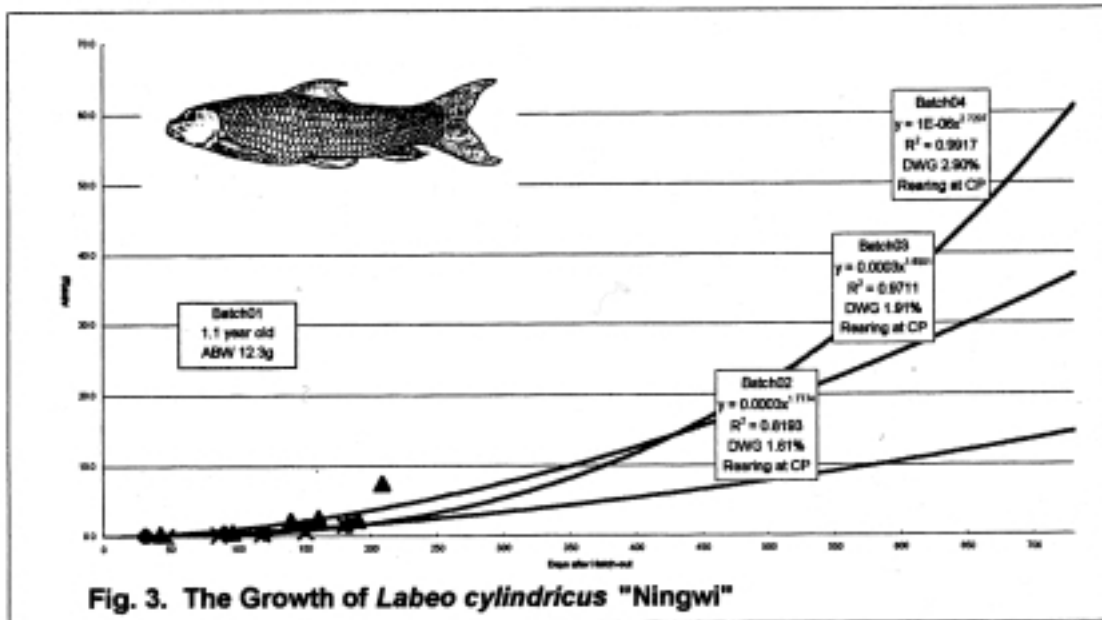
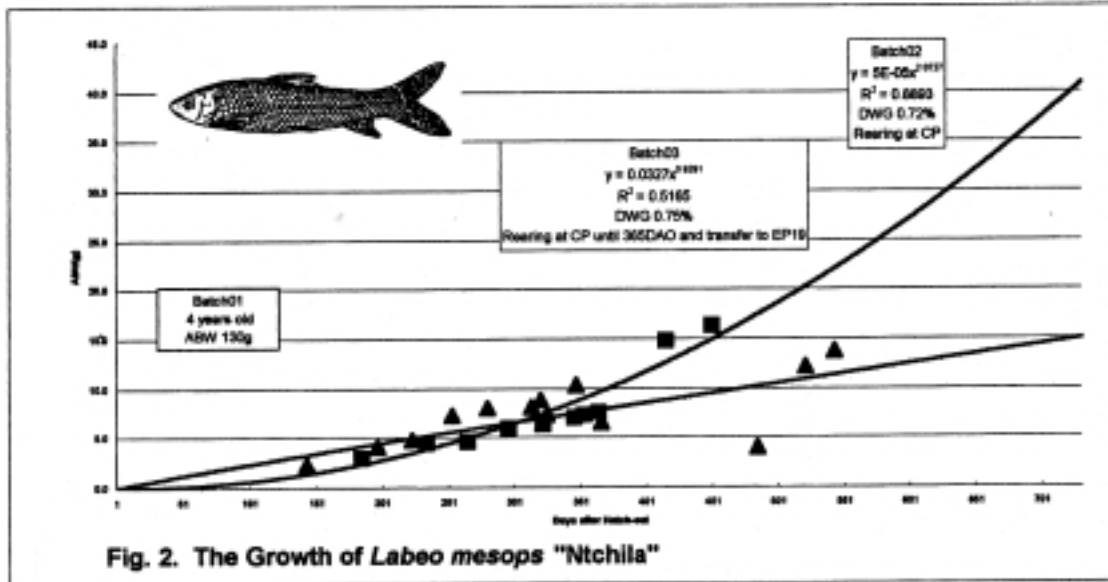
Water temp 16 - 21°C at 8:00 am

We will study more maturation inducement technique.

5.5 Up Grading Techniques

C/Ps needs more fry production training to master techniques in each condition.

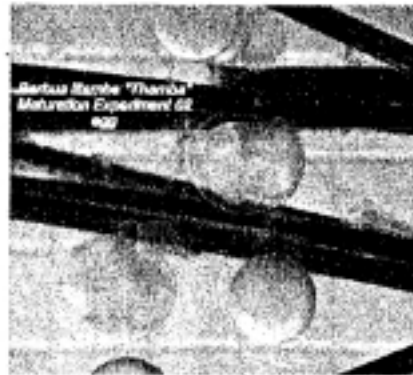
Estimate growth curve of two cyprinids rearing at NAC are given in Fig. 2 and 3.



season by 1KW heater.

Most of Thamba ovulated at 135day culture with 28°C and injected hormone. 50,000 eggs were collected at following day, however, could not get fertilized eggs since there were no available males.

Many Mlamba were dead due to escape from tank and the division decided to stop maturation manipulation for Mlamba.



4.3 Maturation Experiment 03 (ME03)

Ntchila (6ind., sex unknown, 248-414g) has been rearing in maturation tank since July 19, 2001 with same manner of ME02. These fish are accepting feeds and the division is raising water temperature now.

5. Suggestions for Next Half Term

The C/P has skill about maturation inducement by hormone injection if the broodstock are matured and they know how to rear fry, e.g. water management and feeds management at this moment. The JICA expert suggests these following points for next half term.

5.1 Identification of Growth

The sampling result shows our species are growing slow. All species will grow 40 to 60g at 2 years old. The factors for commercial culture are the fish will grow to marketable size with in one year or less and it is easy to culture. In this sense, our species are not ideal for our project.

At first, we make age determination of wild one and compare our data. Moreover, if our fish are very behind it needs investigation to find reasons.

5.2 Selection of Species

The consideration of time remaining of the project, we needs to concentrate two or three species that grow fast and easy to culture. This is the time to think about the tilapias including the target.

5.3 Premium Seed Production

We will produce advance seeds that use techniques of selective breeding or genetic method.

5.4 Maturation Inducement

Generally, the seed are produced based on demand from farmer. Therefore, the manipulation of maturation is very important to catch up demands. In addition to that, the hatchery operates efficiently with scheduling, it relates to fry cost.

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clarify about growth of Ntchila with latest batch. Because Ntchila batch01 to 03 were rearing in concrete tank for a long time and those may stagnate growth due to lack of natural foods.

The records of rearing experiment are given in Table 5.

Table 5. The Record of Rearing Experiment

Corde	Species/ Batch	Date	Days old	Tank/Pond	Feeds	Biomass Ind. (Kg)	TL (mm)	BW (g)	Density Ind/sqm	DWG %	SR %
RE01	Ningwi01	24-Nov-00	284	EP11 Stock		2,500	3.3	1.3	5.0		
RE01	Ningwi01	28-Mar-01	408	EP11 Harvest	Maize	2,684	13.9	87.8	5.2	5.4	1.1 107.4
RE01	Ningwi01	24-Nov-00	284	EP12 Stock		2,500	3.3	1.3	5.0		
RE01	Ningwi01	29-Mar-01	409	EP12 Harvest	Maize	2,446	20.4	95.0	8.3	4.9	1.5 97.8
RE01	Ningwi01	06-Dec-00	296	Kashintaura Stock		2,323	3.0	1.3	4.6		
RE01	Ningwi01	21-May-01	462	Kashintaura Harvest	Maize	2,136	18.3	8.6	4.3	1.1	92.0
RE02	Ningwi01	29-Mar-01	411	EP11 Stock		500	2.6	87.8	5.2	1.0	
RE02	Ningwi01	28-Aug-01	563	EP11	None	489	4.3	96.8	8.9	1.0	0.4 97.8
RE03	Ningwi01	04-Apr-01	415	EP12 Stock		74	1.0	13.3			
RE03	Ningwi01	23-Aug-01	556	EP12	Maize+Pellet	49	0.9	127.2	18.6		0.2 66.2
RE03	Ntchila01	04-Apr-01	1,517	EP12 Stock		19	2.2	115.4			
RE03	Ntchila01	23-Aug-01	1,658	EP12	Maize+Pellet	17	2.2	238.3	127.1		0.1 89.5
RE03	Thamba01	04-Apr-01	436	EP12 Stock		219	3.9	18.0			
RE03	Thamba01	23-Aug-01	577	EP12	Maize+Pellet	153	3.5	137.7	23.2		0.2 69.9
RE04	Ningwi01	26-Apr-01	432	CP1 to EP19 Stock	Maize	2,498	21.5	102.0	8.6	W/ chambo	
RE04	Ningwi01	10-Jul-01	587	EP19		very few	97.2	7.9			-0.1
RE04	Ntchila03	13-Mar-01	365	EP19 Stock		220	1.4	99.9	6.5	W/ chambo	
RE04	Ntchila03	06-Sep-01	542	EP19	Maize		165.2	38.9			1.0
RE05	Ningw05	11-Jun-01	92	CT1-6 Stock		7,650		18.0	0.06	100-500	
RE05	Ningw05	07-Sep-01	179	CT1-6 Harvest	Pellet	5,847		45.8	0.87		3.3 99.4
RE06	Ningwi02	27-Jun-01	139	EP02 Stock		250	0.6	59.7	2.2	1.0	
RE06	Ningwi02	26-Jul-01	168	EP02 Harvest	Pellet	90	0.3	66.1	2.8	0.4	0.8 36.0
RE07	Ntchila06	20-Aug-01	181	EP14 Stock		426	1.0	65.2	2.5	0.9	
RE07	Ntchila06	20-Sep-01	212	EP14	Maize			87.6	6.2	0.9	3.0

4. Broodstock maturation inducement

4.1 Maturation Experiment 01 (ME01)

We prepared two sets of small-scale maturation tank (one ton) that can increase water temperature to induce maturation and two cyprinids; Ningwi (5female and 3mail, 79-219g) and Ntchila (2female and 4mail, 233-410g) were reared from October 29, 2000 to February 8, 2001.



The result showed some broodstock were matured at 28C. However, those were no increase in body weight. In other words, egg quality is not good even it matures. We needed feeds for broodstock that gains body weight.

4.2 Maturation Experiment 02 (ME02)

Thamba (8ind., sex unknown, 100-159g) and Mlamba (2female and 2mail, 409-895g) also were reared by two sets of small-scale maturation tank from April 24, 2001. We fed pellet for fry that contain 50% fishmeal and the fish accepted feeds few weeks later. It is difficult to raise temperature during winter