PROGRESS REPORT ON
SEED PRODUCTIN AND REARING TRIAL ON
Sparus sarba (Local name: HARABT)

AQUACULTURE RESEARCH CENTER

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C O N T E N T

1. INTRODUCTION

The purpose of this report is to discribe the seed production and rearing trial on Sparus sarba which tried in 1989 and started on 2nd February 1991.

2. Brooders (Parent fish)

Fifty nine pieces of Sparas sarba were collected from the sea during the period from 26th October to 29th November 1989. Twenty pieces were selected as a parent fish and transfered to KD-4 Tank(7 m in diameter, 60 to 80 cm in depth, 24 hours running water). This tank was covered and surounded by sunshade net to let them relax and easier to get used to a new environment. Moist pellet (Fish:Fish meal:Flour:Vitamix = 55:35:8:2) and cuttle fish, shrimps were fed twice a day.

On 3rd January, two pieces died and many parasite (Lernothoropus S.P) were observed in their gill rakers (see photo A3-30.34). So that took them into a medical bath with 50 ppm of formalin for three hours and after that no parasite were observed. A few eggs were observed during the period from 8th January to 21st February. But those were not enough amount for this trial.

Three reasons were considered for this result. Firstly they had trouble with parasite. Secondly the period from collection to spawning season was too short for them to get used to a new enviroment. And some people who visited our center disturbed and frightened them.

On the trial in 1990 thirteen pieces of male and 15 pieces of female (Average body weight; about one kilo gram) were selected as a parent fish from NP-3 pond on 4th December. Moist pellet and cuttle fish, clam meat were fed twice a day.

One piece died on 31st December, the same parasite and another parasite (Gyrodactylus S.P. See photo M1-4, 5) were observed in the gill raker. So t at took them into a medical bath with 50 ppm of formalin for 135 minutes. But 6 pieces of female and one piece of male died so another 8 pieces of female (Average body weight: 700 g) were transfered to KD-4. The maturation of dead females were not yet riped at this time.

3. Spawning

Every evening fine mesh net(200 μm)was set at outlet pipe and checked every an hour. At 19:30 on 2nd February, some eggs were observed and collected every an hour up to the next morning. About 110 g of floating eggs were collected and transfered to hatchery tank.

Seed production trial was started with this egg. This spawning season started on 28th January and ended on 16 March. About 840g of eggs were collected during this period(Table 1, Figure 1). They spawned at around 19:00 o'clock. The size of egg is about 0.9 mm in diameter and it float in the water while it is alive.

4. Hatchery

Floating eggs which spawned on 2nd February were put in the hatchery tank(500 ℓ plastic, round tank)and slightly aerated. To count their number the density of egg were equalized by aeration then picked up 500ml of water and counted the number of eggs. After three times of this operation the caluculated total number was 176,000 pieces. They hatched out 24 - 26 hours after spawned at the water temperature ranged from 24 to 26 ℃ and 29 - 31 hours after spawned at the water temperature ranged from 23.5 to 24.5℃ (Photo:M3-20 ~ M8-28).

About 144,000 pieces of larvae hatched out(Hatch out rate was 81.8 %.)

5. Larval rearing management

5-1. Rearing tank : At first 500 ℓ and 1000 ℓ plastic tank were used for rearing tank. Both plastic tanks were weakly aerated.

On 4th February About 28000 pieces of larvae were transfered into 1000 ℓ plastic tank(Tank-A) and about 14000 pieces of larvae were transfered into 500 ℓ plastic tank (Tank-B).

On 7th April Tank-B was changed to vinyl tank(2.5m in diameter, Depth 70cm). On 21st April Tank-B was drained and fingerings were transfered to Tank-B.

5-2. Rearing water : Seawater was pumped up from intake pipe which located 500m from the sea shore and passed sand filter. This water was filtered by 1 μm filter pipe before use in the first 31 days. Then this water was used directly.

At first the amount of water in Tank-A was 1000ℓ and reduced to 500 ℓ on 20th February.

At first the amount of water in Tank-B was 500 ℓ and reduced to 300 ℓ on 23rd February.

5-3. Water temperature : Water temperature was taken by thermometer which indicate minimum and maximum temperature. Every 8:00 o'clock in the morning take out it and recorded minimum and maximum temperature during 24 hours.

a) Tank-A: Ranged from 25.0 ℃ to 32.0℃; Period 5 Feb. ~ 21 Apr. (Fig - 2).

b) Tank-B: Ranged from 24.0 ℃ to 34.0℃; Period 5 Feb. ~ 26 May. (Fig - 3).

5-4. Salinity

a) Tank-A: Ranged from 35 ‰ to 38‰; Period 5 Feb. ~ 21 Apr.

b) Tank-B: Ranged from 35 ‰ to 38‰; Period 5 Feb. ~ 26 May.

5-5. Water exchange

Rearing water was exchanged every evening. Forty percent of rearing water was exchanged in the first 10 days and 50% exchanged in the next 21 days. Then changed to running water. This started at 9:00 o'clock and stopped at 17:00 o'clock in the first 15 days then changed to whole day. The amount of running water was increased from 2 to 12ℓ/min according to their growth.

The density of nitrous acid (NO_2^-) was checked every morning and if it is more than 0.1 ppm, rearing water was exchanged immediately.

5-6. Feeding : Feeding record is shown in Table-2. Their mouth opened about 36 hours after hatch out, so feeding started on 5th February.

Eight types of food were used in this trial.

a) Live food.

1. Oyster larva : Fertilized in the evening. Size 120 ~ 140μm (Photo: M1-16)

2. Rotifer : Cultured by chlorella water. Size 200 ~ 250μm (Photo: M2-36)

3. Artemia nauplius: Cultured by rotifer. Size 400 ~ 700μm

b) Artificial food.

4. B.P : Artificial plankton. grain size : 30 ~ 100 μm. 7-8 million pcs/g
5. A 2 : Artificial plankton. grain size : 250 ~ 400 μm.
6. B 2 : Artificial plankton. grain size : 400 ~ 700 μm.
7 C 2 : Crumble pellet grain size : 700 ~ 1,700 μm.
8. Moist pellet; Fish: Fish meal: flour: vita ix=55:35:8:2 (Vitamix; Complexed vitamin powder).

At first B.P was fed to both tanks. At the same time rotifer was fed to Tank-B and fertilized oyster egg was fed in the evening to Tank-A for four days. This egg hatch out about 10 hours after fertilized.

Rotifer is the most suitable food in this stage but it was not cultured enough to feed daily because of the trouble in chlorella culture, so fed A 2 which was developed as a artificial plankton at the size of rotifer, to both tanks 6 days after hatch out.

B 2 was developed as a artificial plankton at the size of artemia nauplius and used after A 2.

Food was changed according to their growth and when change food to another food, both foods were fed at the same time for several days.

Moist pellet was fed after feeding C 2. This moist pellet is the same one which feed to parent fish.

5-7. Cleaning : Dirties on the bottom such as dead pieces of fish, excrement was taken away by syphon and floating dirties such as oil from artificial food, dead pieces of rotifer were taken away by beaker and scoup net. The wall of the tank was wiped with cloth when rearing water drained for exchange.

6. Result

Because of gulf war I left Yemen during the period from 18th February to 25th April. So this trial was continued by three of staff by refering advise paper which I wrote before leave.

There were troubles in chlorella and rotifer culture so most of larvae died in the first three weeks but their mortality became low after this period. At the date of 25th May about 600 pieces grew up to the size from 30 to 65 mm in total length and the rearing trial is still continue.

7. Discussion

a) Reason for electricity failure and contamination of chlorella water, chlorella was not continuously and constantly cultured. Because of this reason rotifer was not cultured enough, so we fed mostly artificial plankton and most of larvae died in the first three weeks (Fig-4, 5).

If chlorella was cultured continuously and constantly more rotifer cultured and more larvae would have survived. So the way of chlorella culture should be improved by the next trial. For example change the roof to transparent plastic sheet to take in more sun light and culture chlorella by natural sun light. Use more acurate filter to get lid of another algae and plankton. Cover the tank by transparent sheet to prevent from contaminating.

b) This fish is more suitable for fish farming comparered with L. nebulosus (Local name : Ghash Azlak). We had seed production trial on L. nebulosus started on 16th January and ended on 12th March. Most of fry died within the first two weeks. The reason was the trouble with the first stage's food. Egg of Sparus sarba is bigger than that of L. nebulosus and oyster larva is not necessary as a first stage's food. Tank-A was fed oyster larvae for the first four days and Tank-B was not fed but there was no difference between them in survival rate.

c) Because of gulf war I could not advise during the important period and continued by three of staff. They faced some troubles but managed to continue this trial and in spite of the first trial about 600 pieces of fingerings were produced. So if this trial is conducted with JICA Expert in the next season more successfull result will be expected.

Table - 1. Spawning Record of Sparus sarba (Local name :HARABT)

Period: 28, Jan - 16, Mar, 1991.

DATE	Amount (g)	R E M A R K
28. Jan	Few	
29.	Few	
30.	Few	Floating eggs only; 5200 pcs
1. Feb	62	
2.	110	Floating egg only
5.	5	
13.	51	
15.	40	
18.	15	
19.	25	
20.	30	
22.	90	
23.	48	
24.	94	
25.	63	
26.	90	
27.	23	
28.	45	
1. Mar	20	
16.	20	

Table - 2 (1). Feeding Record of Tank-A and Tank-B

DATE	T A N K - A	T A N K - B
5 Feb	B.P 1.2g 12:00,13:00,15:00,17:00 Oyst r egg 25 pcs/ml 19:00	B.P 0.6g 12:00,13:00,15:00,17:00 Rotifer 5 pcs/ml 12:00
6	B.P 1.2g 7:00, 9:00,11:00,13:00,15:00,17:00 Oyster egg 22 pcs/ml 19:30	B.P 0.6g 7:00, 9:00,11:00,13:00,15:00,17:00
7	B.P 1.2g 7:00, 9:00,11:00,13:00,15:00,17:00 Oyster egg 22 pcs/ml 19:30	B.P 0.6g 7:00, 9:00,11:00,13:00,15:00,17:00 Rotifer 10 pcs/ml 16:00
8	B.P 1.2g 7:00, 9:00,11:00,13:00,15:00,17:00 Rotifer 2 pcs/ml 16:00 Oyster egg 25 pcs/ml 19:30	B.P 0.6g 7:00, 9:00,11:00,13:00,15:00,17:00 Rotifer 5 pcs/ml 16:00
9	B.P 1.2g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.5g 7:00, 9:00,11:00,13:00,15:00,17:00 Oyster egg 109 pcs/ml 19:30	B.P 0.6g 8:00,10:00,12:00,14:00,16:00 A 2 0.3g 7:00, 9:00,11:00,13:00,15:00,17:00
10	B.P 1.0g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.5g 7:00, 9:00,11:00,13:00,15:00,17:00	B.P 0.6g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.3g 7:00, 9:00,11:00,13:00,15:00,17:00
11	B.P 0.9g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.5g 7:00, 9:00,11:00,13:00,15:00,17:00	B.P 0.4g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.3g 7:00, 9:00,11:00,13:00,15:00,17:00
12	B.P 0.7g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.7g 7:00, 9:00,11:00,13:00,15:00,17:00	B.P 0.3g 8:00,10:00,12:00,14:00,16:00,18:0 A 2 0.4g 7:00, 9:00,11:00,13:00,15:00,17:0
13	B.P 0.7g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.7g 7:00, 9:00,11:00,13:00,15:00,17:00	B.P 0.3g 8:00,10:00,12:00,14:00,16:00,18:0 A 2 0.4g 7:00, 9:00,11:00,13:00,15:00,17:0
14	B.P 0.7g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.7g 7:00, 9:00,11:00,13:00,15:00,17:00	B.P 0.3g 8:00,10:00,12:00,14:00,16:00,18:0 A 2 0.4g 7:00, 9:00,11:00,13:00,15:00,17:0
15	B.P 0.6g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 0.9g 7:00, 9:00,11:00,13:00,15:00,17:00	B.P 0.3g 8:00,10:00,12:00,14:00,16:00,18: A 2 0.5g 7:00, 9:00,11:00,13:00,15:00,17:
16	B.P 0.6g 8:00,10:00,12:00,14:00,16:00,18:00 A 2 1.0g 7:00, 9:00,11:00,13:00,15:00,17:00	B.P 0.3g 8:00,10:00,12:00,14:00 A 2 0.6g 7:00, 9:00,11:00,13:00,15:00,17: Rotifer 20 pcs/ml 16:00
17	A 2 0.7g 7:00 ~ 17:00 Every an hour B.P 1.2g 18:00	A 2 0.3g 7:00 ~ 17:00 Every an hour B.P 0.5g 18:00
18	A 2 0.7g 7:00 ~ 17:00 Every an hour B.P 1.2g 18:00	A 2 0.4g 7:00 ~ 17:00 Every an hour B.P 0.5g 18:00

* Oyster egg :Fertilized before feed.
* B.P : Artificial plankton - Grain size 30 ~ 100μm,7 ~ 8 million pcs/g
* A 2 : Artificial plankton - Grain size 250 ~ 400 μm

Table - 2 (2). Feeding Record of Tank-A and Tank-B

DATE	TANK - A	TANK - B
19 Feb	A 2 0.8g 7:00 ~ 17:00 Every an hour B.P 1.2g 18:00	A 2 0.4g 7:00 ~ 17:00 Every an hour B.P 0.5g 18:00
20	A 2 0.9g 7:00 ~ 17:00 Every an hour B.P 1.2g 18:00	A 2 0.5g 7:00 ~ 17:00 Every an hour B.P 0.5g 18:00
21	A 2 0.6g 7:00 ~ 17:00 Every an hour	A 2 0.7g 7:00 ~ 17:00 Every an hour
22	A 2 0.6g 7:00 ~ 17:00 Every an hour	A 2 0.8g 7:00 ~ 17:00 Every an hour
23	A 2 0.5g 7:00 ~ 17:00 Every an hour	A 2 0.9g 7:00 ~ 17:00 Every an hour
24	A 2 0.5g 7:00 ~ 17:00 Every an hour	A 2 1.0g 7:00 ~ 17:00 Every an hour
25	A 2 0.3g 7:00 ~ 17:00 Every an hour	A 2 0.3g 7:00 ~ 17:00 Every an hour
26	A 2 0.3g 7:00 ~ 17:00 Every an hour	A 2 0.3g 7:00 ~ 17:00 Every an hour
27	A 2 0.3g 7:00 ~ 17:00 Every an hour	A 2 0.4g 7:00 ~ 17:00 Every an hour
28	A 2 0.3g 7:00 ~ 17:00 Every an hour	A 2 0.6g 7:00 ~ 17:00 Every an hour
Mar	A 2 0.4g 7:00 ~ 17:00 Every an hour	A 2 0.7g 7:00 ~ 17:00 Every an hour
	A 2 0.4g 7:00 ~ 17:00 Every an hour	A 2 0.7g 7:00 ~ 17:00 Every an hour
	A 2 0.5g 7:00 ~ 17:00 Every an hour	A 2 0.8g 7:00 ~ 17:00 Every an hour
	A 2 0.6g 7:00 ~ 17:00 Every an hour	A 2 0.9g 7:00 ~ 17:00 Every an hour
	A 2 0.6g 8:00 ~ 17:00 Every an hour	A 2 0.9g 8:00 ~ 17:00 Every an hour
	B 2 8:00,10:00,12:00,14:00,16:00 A 2 9:00,11:00,13:00,15:00,17:00	B 2 8:00,10:00,12:00,14:00,16:00 A 2 9:00,11:00,13:00,15:00,17:00
	B 2 8:00,10:00,12:00,14:00,16:00 A 2 9:00,11:00,13:00,15:00,17:00	B 2 8:00,10:00,12:00,14:00,16:00 A 2 9:00,11:00,13:00,15:00,17:00
	B 2 0.4g 8:00,10:00,12:00,14:00,16:00 A 2 0.7g 9:00,11:00,13:00,15:00,17:00	B 2 0.5g 8:00,10:00,12:00,14:00,16:00 A 2 0.9g 9:00,11:00,13:00,15:00,17:00
	B 2 0.5g 8:00,10:00,12:00,14:00,16:00 A 2 0.7g 9:00,11:00,13:00,15:00,17:00	B 2 0.5g 8:00,10:00,12:00,14:00,16:00 A 2 0.7g 9:00,11:00,13:00,15:00,17:00
	A 2 0.8g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 0.3g 8:00,10:00,12:00,14:00,16:00 A 2 1.0g 9:00,11:00,13:00,15:00,17:00

: Artificial plankton - Grain size 30 ~ 100 μm, 7 ~ 8 million pcs/g
: Artificial plankton - Grain size 250 ~ 400 μm

Table - 2 (3). Feeding Record of Tank-A and Tank-B

TE	TANK - A	TANK - B
Mar	A 2 0.8g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 0.5g 8:00,10:00,12:00,14:00,16:00 A 2 1.1g 9:00,11:00,13:00,15:00,17:00
	A 2 0.5g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 0.5g 8:00,10:00,12:00,14:00,16:00 A 2 1.0g 9:00,11:00,13:00,15:00,17:00
	A 2 0.5g 7:00, 9:00,11:00,13:00,15:00,17:00 Rotifer 17:00	B 2 1.0g 8:00,10:00,12:00,14:00,16:00 Rotifer 17:00 Artemia 11:00,17:00
	A 2 0.5g 8:00,10:00,12:00,14:00,16:00,17:00 Rotifer 13:00,18:00	A 2 1.1g 8:00,10:00,12:00,14:00,16:00,18:00 B 2 9:00,11:00,13:00,15:00,17:00 Rotifer & Artemia 13:00,18:00
	A 2 0.6g 8:00,10:00,12:00,14:00,16:00,17:00 Rotifer 13:00,18:00	A 2 1.2g 9:00,11:00,13:00,15:00,17:00 B 2 8:00,10:00,12:00,14:00,16:00 Rotifer & Artemia 13:00,18:00
	A 2 0.7g 7:00, 9:00,11:00,13:00,15:00,17:00 Rotifer 17:00	A 2 1.2g 9:00,11:00,13:00,15:00,17:00 B 2 1.0g 8:00,10:00,12:00,14:00,16:00,18:00 Rotifer 17:00
	A 2 0.7g 8:00,10:00,12:00,14:00,16:00,17:00	A 2 1.2g 9:00,11:00,13:00,15:00,17:00 B 2 8:00,10:00,12:00,14:00,16:00,18:00
	A 2 0.7g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 0.5g 8:00, 9:00,10:00,14:00,15:00,16:0 Artemia 11:00,17:00
	A 2 0.7g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 8:00, 9:00,10:00,14:00,15:00,16:0 Artemia 11:00,17:00
	A 2 0.7g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 8:00, 9:00,10:00,14:00,15:00,16:0 Artemia 11:00,17:00
	A 2 0.7g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 8:00, 9:00,10:00,14:00,15:00,16: Artemia 11:00
	A 2 0.7g 8:00,10:00,12:00,14:00,16:00,17:00	B 2 8:00, 9:00,10:00,14:00,15:00,16: Artemia 11:00
	A 2 9:00,15:00 B 2 8:00,10:00,14:00,16:00 Rotifer&Artemia 11:30,17:00	B 2 9:00,15:00 C 2 8:00,10:00,14:00,16:00 Artemia 11:00,17:00

2 : Artificial plankton - Grain size 250 ~ 400 μm
2 : Artificial plankton - Grain size 400 ~ 700 μm
2 : Artificial food - Grain size 700 ~ 1100 μm

Table - 2 (4). Feeding Record of Tank-A and Tank-B

ATE	TANK - A		TANK - B	
Mar	A 2 0.5g	9:00,15:00	B 2 1.0g	9:00,15:00
	B 2 0.5g	8:00,10:00,14:00,16:00	C 2 1.0g	8:00,10:00,14:00,16:00
	Rotifer	11:00,17:00	Rotifer	11:00
	Artemia	11:00	Artemia	11:00,17:00
	A 2 0.5g	9:00,15:00	B 2 1.0g	9:00,14:00,16:00
	B 2 0.5g	8:00,10:00,14:00,16:00	C 2 1.0g	8:00,10:00,15:00
	Rotifer	17:00	Artemia	11:00,17:00
	Artemia	11:00		
	A 2 0.5g	9:00,15:00	B 2 1.0g	9:00
	B 2 0.5g	8:00,10:00,14:00,16:00	C 2 1.0g	8:00,10:00
	Rotifer	11:00,17:00		
	Artemia	11:00		
	A 2	9:00,14:00,16:00	B 2	9:00,14:00,16:00
	B 2	8:00,10:00,15:00	C 2	8:00,10:00,15:00
	Rotifer	11:00,17:00	Rotifer	11:00,17:00
	Artemia	11:00,17:00	Artemia	11:00,17:00
	A 2	9:00,14:00,16:00	B 2	9:00,14:00,16:00
	B 2	8:00,10:00,15:00	C 2	8:00,10:00,15:00
	Rotifer	17:00	Rotifer	17:00
	Artemia	11:00,17:00	Artemia	11:00,17:00
	A 2	9:00,14:00,16:00	B 2	9:00,14:00,16:00
	B 2	8:00,10:00,15:00	C 2	8:00,10:00,15:00
	Rotifer	17:00	Rotifer	17:00
	Artemia	11:00,17:00	Artemia	11:00,17:00
	A 2	9:00,14:00,16:00	B 2 2.0g	9:00,14:00,16:00
	B 2	8:00,10:00,15:00	C 2 2.0g	8:00,10:00,15:00
	Rotifer	11:00,17:00	Rotifer	11:00,17:00
	Artemia	11:00,17:00	Artemia	11:00,17:00
	B 2 0.5g	8:00,9:00,10:00,14:00,15:00,16:00	B 2 2.0g	9:00,14:00,16:00
	Rotifer	11:00,17:00	C 2 2.0g	8:00,10:00,15:00
	Artemia	11:00,17:00	Rotifer	11:00,17:00
			Artemia	11:00,17:00
Apr	B 2 0.5g	8:00,9:00,10:00,13:00,14:00,15:00	C 2 2.0g	8:00,9:00,10:00,13:00,14:00
	Artemia	11:00,16:00	Artemia	11:00,16:00
	B 2 0.5g	8:00,9:00,10:00,14:00,15:00,16:00	C 2 2.0g	8:00,9:00,10:00,14:00,15:00,16:00
	Artemia	11:00,16:00	Artemia	11:00,16:00

2 : Artificial plankton - Grain size 250 ~ 400 μm
2 : Artificial plankton - Grain size 400 ~ 700 μm
2 : Artificial food - Grain size 700 ~ 1100 μm

Table - 2 (5). Feeding Record of Tank-A and Tank-B

DATE	TANK - A	TANK - B
3 Apr	B 2 0.5g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia & Rotifer 11:00,17:00	C 2 2.0g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia 11:00,17:00
4	B 2 0.5g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia & Rotifer 11:00,17:00	C 2 2.0g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia 11:00,17:00
5	B 2 0.5g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia & Rotifer 11:00,17:00	C 2 2.0g 8:00,9:00,10:00 Artemia 11:00,17:00
6	B 2 0.5g 8:00,9:00,10:00,14:00,15:00,16:00 Rotifer 11:00,17:00 Artemia 11:00,17:00	C 2 2.0g 8:00,9:00,10:00,14:00,15:00,16:00 Rotifer 11:00,17:00 Artemia 11:00,17:00
7	B 2 0.5g 9:00,14:00,16:00 C 2 0.5g 8:00,10:00,15:00 Artemia 11:00,17:00	C 2 2.0g 8:00,9:00,10:00 M.Plt. 3 g 14:00, 6 g 17:00
8	B 2 0.5g 9:00,14:00,16:00 C 2 0.5g 8:00,10:00,15:00 Artemia 11:00,17:00	C 2 4.0g 11:00,15:00 M.Plt. 3 g 8:00,13:00,17:00
9	B 2 0.5g 9:00,14:00,16:00 C 2 0.5g 8:00,10:00,15:00 Artemia 11:00,17:00	M.Plt. 3 g 8:00,13:00,17:00 4 g 11:00,15:00
10	B 2 0.5g 9:00,14:00,16:00 C 2 0.5g 8:00,10:00,15:00 Artemia 11:00,17:00	M.Plt. 4 g 8:00,14:00 5 g 11:00,17:00
11	C 2 0.5g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia 11:00,17:00	M.Plt. 4 g 8:00,14:00 5 g 11:00,17:00
12	C 2 0.5g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia 11:00,17:00	M.Plt. 6 g 8:00,11:00,14:00,17:00
13	C 2 1.0g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia 11:00,17:00	M.Plt. 8 g 8:00,11:00,14:00,17:00
14	C 2 1.0g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia 11:00,17:00	M.Plt. 8 g 8:00,11:00,14:00,17:00
15	C 2 1.0g 8:00,9:00,10:00,14:00,15:00,16:00 Artemia 11:00,17:00	M.Plt. 9 g 8:00,11:00,14:00,17:00

* B 2 : Artificial plankton - Grain size 400 ~ 700 μm
* C 2 : Artificial food - Grain size 700 ~ 1100 μm
* M.Plt.: Moist pellet; Fish : Fish meal : Flour : Vitamix = 55 : 35 : 8 : 2
* On 7th April, Fingering in Tank-B transfered to Vinyl tank(ϕ2.5m Depth 70cm)

Table - 2 (6). Feeding Record of Tank-A and Tank-B

DATE	TANK - A	TANK - B
16 Apr	M.Plt. 1 g 8:00,10:00,12:00,14:00,16:00	M.Plt. 9 g 8:00,11:00,14:00,17:00
17	M.Plt. 1 g 8:00,10:00,12:00,14:00,16:00	M.Plt. 10 g 8:00,11:00,14:00,17:00
18	M.Plt. 1 g 8:00,10:00,12:00,14:00,16:00	M.Plt. 12 g 8:00,11:00,14:00,17:00
19	M.Plt. 1.5g 8:00,11:00,14:00,17:00	M.Plt. 14 g 8:00,11:00,14:00,17:00
20	M.Plt. 1.5g 8:00,11:00,14:00,17:00	M.Plt. 16 g 8:00,11:00,14:00,17:00

* On 21st April,75 pcs of fingerings in Tank - A were transfered to Tank-B(φ2.5m Depth 70cm)

DATE		
21 Apr		M.Plt. 16 g 10:00,13:00,17:00
22		M.Plt. 16 g 9:00,12:00,15:00,18:00
23		M.Plt. 16 g 9:00,12:00,15:00,18:00
24		M.Plt. 18 g 9:00,12:00,15:00,18:00
25		M.Plt. 20 g 9:00,12:00,15:00,18:00
26		M.Plt. 20 g 8:00
27		M.Plt. 20 g 8:00
28		M.Plt. 25 g 8:00
29		M.Plt. 25 g 9:30,12:30,15:30,18:30
30		M.Plt. 25 g
1 May		M.Plt. 25 g

*On nd May,Selected small size and released to vinyl tank(φ2.0m Depth 40cm); S - Group:372 pcs
TANK - B(φ2.5m Depth 70cm); L - Group:220 pcs

M.Plt.:Moist pellet; Fish : Fish meal : Flour : Vitamix = 55 : 35 : 8 : 2

Table - 2 (7). Feeding Record of Tank-A and Tank-B

DATE	S - G R O U P	L - G R O U P
2 May	M.Plt. 10 g 12:30,13:30,17:30	M.Plt. 30 g 9:30, 20 g 12:30,13:30
3	M.Plt. 15 g 9:30,12:30,15:30, 17:30	M.Plt. 30 g 9:30,12:30,15:30,17:30
4	M.Plt. 15 g 8:30,11:30,14:30, 17:30	M.Plt. 30 g 8:30,12:30,15:30,17:30
5	M.Plt. 15 g 8:30,11:30,14:30, 17:30	M.Plt. 30 g 8:30,12:30,15:30,17:30
6	M.Plt. 15 g 8:30,11:30,14:30, 17:30	M.Plt. 30 g 8:30,12:30,15:30,17:30
7	M.Plt. 15 g 9:00,12:00,15:00, 17:00	M.Plt. 30 g 9:00,12:00,15:00,17:00
8	M.Plt. 15 g 9:30,12:30,15:30, 17:30	M.Plt. 30 g 9:30,12:30,15:30,17:30
9	M.Plt. 15 g 9:30,12:30,15:30, 17:30	M.Plt. 30 g 9:30,12:30,15:30,17:30
10	M.Plt. 15 g 9:30,12:30,15:30, 17:30	M.Plt. 30 g 9:30,12:30,15:30,17:30
11	M.Plt. 15 g 9:30, 20 g 12:30,15:30, 17:30	M.Plt. 35 g 9:30,12:30,15:30,18:30
12	M.Plt. 25 g 9:30,12:30,17:00,20:00	M.Plt. 35 g 9:30,12:30,17:00,20:00
13	M.Plt. 30 g 9:30,12:30	M.Plt. 40 g 7:30,12:30
14	M.Plt. 30 g 9:30,12:30	M.Plt. 40 g 9:30,12:30
15	M.Plt. 20 g 8:00,11:00,14:00,18:00	M.Plt. 30 g 8:00,11:00,14:00,18:00
16	M.Plt. 30 g 6:00,9:30,12:30,17:30	M.Plt. 40 g 6:00,9:30,12:30,17:30
17	M.Plt. 30 g 6:00,9:00,12:00,15:00,18:00	M.Plt. 40 g 6:00,9:00,12:00,15:00,18:00
18	M.Plt. 30 g 6:00,9:30,12:30,17:00	M.Plt. 40 g 6:00,9:30,12:30,17:00
19	M.Plt. 30 g 6:00,9:00,12:00,15:00,17:00	M.Plt. 40 g 6:00,9:00,12:00,15:00,17:00
20	M.Plt. 30 g 6:00,9:30,13:00,17:30	M.Plt. 40 g 6:00,9:30,13:30,17:30
21	M.Plt. 30 g 8:00,10:30,14:30,17:30	M.Plt. 40 g 8:00,10:30,14:30,17:30
22	M.Plt. 30 g 6:00,10:00,14:00,18:00	M.Plt. 40 g 6:00,10:00,14:00,18:00
23	M.Plt. 35 g 6:00, 9:00,13:00,17:00	M.Plt. 45 g 6:00, 9:00,13:00,17:00
24	M.Plt. 40 g 6:00, 9:00,12:30,15:30,18:00	M.Plt. 50 g 6:00, 9:00,12:30,15:30,18:00

* M.Plt.: Moist Pellet : Fish : Fish meal : Flour : Vitamix = 55 : 35 : 8 : 2

Fig- 1. Spawning of Sparus sarba

Period:28.Jan - 16.Mar 1991.

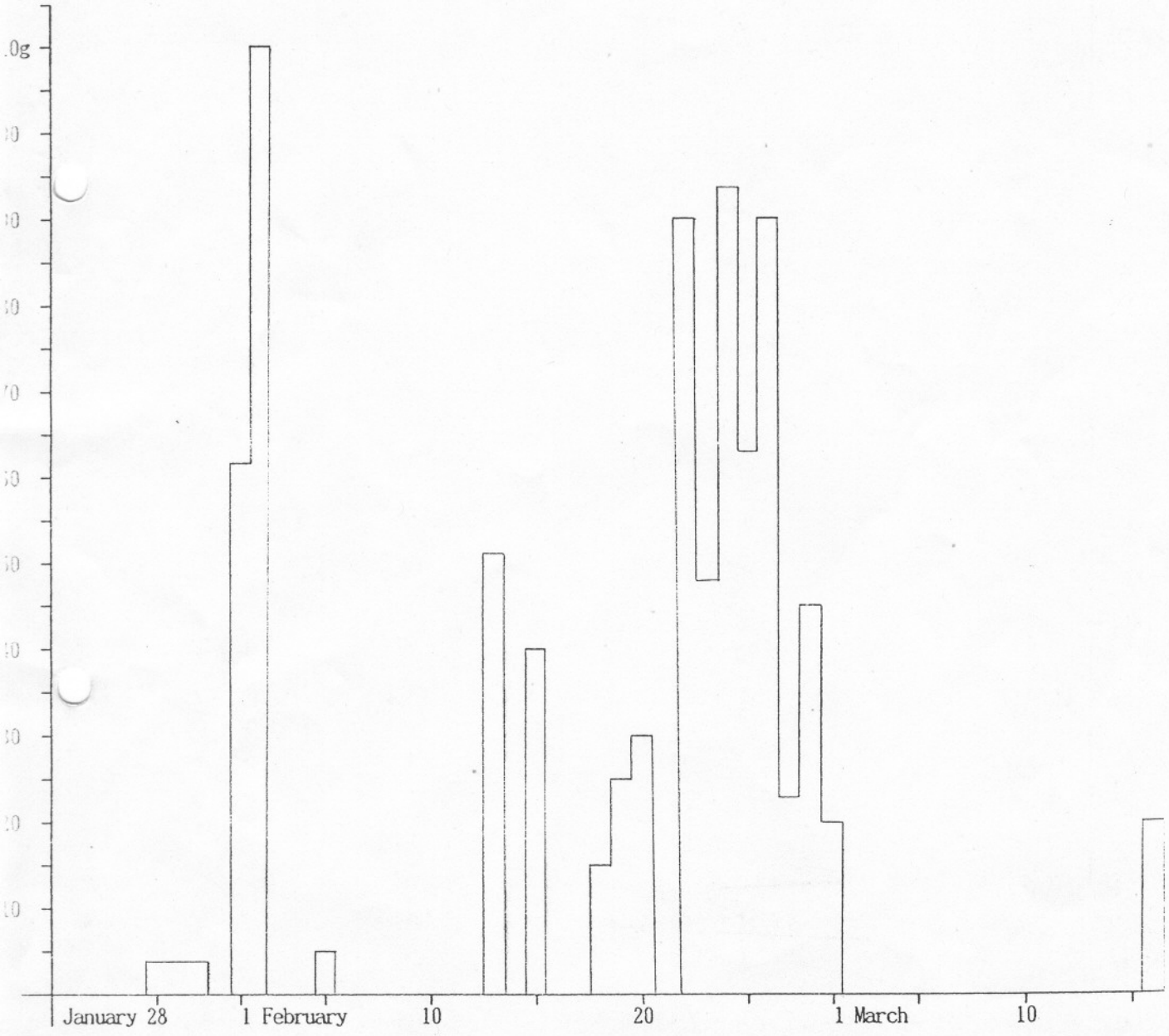

Fig-2. Water Temperature of TANK-A

Period:5 Feb.~ 21 Apr.1991