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Larval rearing of Sea Bass (*Dicentrarchus labrax* (L.) with a high survival(1)

by

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ABSTRACT

An experiment of larval rearing of Sea Bass is described. Larval density ranged from 50/l at the beginning of the experiment, to 1.4 fingerling/l after 3 months. Fingerlings were fed at that time with a pelletized artificial diet. Average weight was 0.8g. Survival from the newly hatched larvae was 38%.

INTRODUCTION

Extensive culture of Sea Bass, with juveniles captured in estuaries, is a common activity in coastal lagoons of some Mediterranean countries. Due to an increasing interest for aquaculture, captures cannot fullfill the demand. For this reason, some Italian and French laboratories initiated, since 1969, spawning induction and larval rearing programs on this species. The various methods used, and the status of present research, were described in a previous note (GIRIN, 1975).

The technique developped at Centre Océanologique de Bretagne is based upon high density, small containers, and daily feeding. 86 000, 1 month old, animals were produced in 1974, out of 364 000 newly hatched larvae, with a best survival up to 37% at that age (GIRIN, in press) ; but a very high mortality, due to the lack of a convenient pellet, occured when trying to change from living food to an artificial diet : only 1 200 pellet feeders survived at the age of 4 months (average weight : 0,9 g).

This problem was solved in 1975, and the rearing season ended with a little more than 20 000, 3 months old, fingerlings (average weight : 1 g) out of 165 000 newly hatched larvae (12% survival).

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This note describes briefly one of the 3 rearing experiments in which survival was over 35% at the age of 3 months.

MATERIAL AND METHODS

7 500 newly hatched larvae were transferred into the culture tank on march 22. They were obtained from hatching in flow-through baskets of eggs, spawned and fertilized naturally by a captive spawning stock, as in previous experiments (GIRIN, in press).

From day 4 to day 51, living food is offered once daily, at noon. 2 species are employed : *Brachionus plicatilis* O.F. Müller (fig. 4 a) and *Artemia salina* Leach (fig. 4 b, c, d). *Brachionus* are produced with living *Tetraselmis suecica* Butcher (GIRIN and DEVAUCHELLE, 1973). *Artemia* are offered as nauplii, or after growing for 2 or 4 days with a powder of *Spirulina maxima* (PERSON, in press). The quality of the food to be offered on a definite day is decided before the experiment. The amount is calculated both from a curve established previously, and from the amount left in the tank, when some is left.

In order to ease the change from living food to pellets, 3 meals a day of frozen *Artemia* are offered from day 51 to day 59 (fig. 4 e, f, g). The amount necessary for each meal is put in a 2 cm inside diameter, 16 cm long polythene tube, which is then filled to the top with ice. It is slid in a 5 cm external diameter expanded polystyrene sheath, hanging vertically over the tank, with a cover on upper end. Defreezed food drops slowly (1/2 to 1 hour) in the tank after 1 to 1 1/2 hour delay. The quality and amount to be offered in a meal are calculated previously from the number of larvae surviving on day 51.

Pelletized food is offered from day 51, continuously, from a small automatic feeder. The quality to be given at a time is decided from previous experiments. The amount is calculated from the number and weight of fingerlings in the tank. The dry pellets used are produced in the laboratory by R. METAILLER. Their formulation is basically the same as P50L12 (ALLIOT and al., 1974). They may incorporate 10% or 30% powder of freeze dryed *Artemia* as an appetizer (fig. 4 h, i, j, k).

Until the age of 51 days, tanks used are the conical 145 l previously described (GIRIN, in press). The whole population was cultured in a single tank until day 32. 2 500 larvae were then transferred to a second tank because

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of overcrowding (fig. 1). Past day 51, trout culture square tanks are preferred : In this case, 400 l ones until day 62 (1 m x 1 m x 50 cm deep), and then a single 2 000 l one (2 m x 2 m x 70 cm deep).

Water temperature is maintained at 18° C $\pm$ 1° C all along the experiment. For safety reasons, water used is partly recirculated, through two successive filters, one with oyster shells (before the pump), the other with sand (after the pump). The various tanks used are connected to different recirculated units, whose flow rate and capacity depend upon the size and number of tanks connected to them. For all of them, the capacity of the oyster shells filter range around 12% of the total capacity of the unit, the capacity of the sand filter around 6%. Water in each unit is usually renewed at a rate of 10% per hour. This rate can be increased up to 20% if necessary. Flow rate in a tank is calculated from previous experiments, in order to maintain oxygen level over 85% of saturation. Because of a general overcrowding in all recirculated units at the time of the experiment, oxygen sometimes happened to drop below this limit in spite of very high flow rates (fig. 1 and 2).

Fluorescent tubes hanged between 40 and 60 cm over water surface provide a continuous illumination, ranging from 2 000 lux below them, to 500 lux near the sides of the tanks.

On days 10 and 20, survival is estimated from 3 samples of 1 l each. After day 30, dead animals are removed and numbered daily (fig. 3). 10 fishes are sampled every 5 days in neutralized 5% formaline and used later for length (fig. 5) and weight (fig. 6) measurements.

RESULTS

The 7 500 newly-hatched larvae used in this experiment came from a small (13 500 eggs) early spawning, and were the largest of the season (1.31 mm in diameter). Hatching percentage was not very good (73%).

The stocking density choosen (51.7 larvae/l) was lower than the average value of 1974, but much higher than in others author's experiments on this species. Survival was very good at day 20 (85%), but consistently reduced on day 30 (53%). Among others possible reasons, there is an evidence that mortality may be related to an underestimation of food requirements from days 20 to 25 ; since there was practically no *Artemia* left 2 to 6 hours before daily feeding. Survival at 30 days was anyway better than in all previous experiments, except one (batch 3 a, 1974).

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Three days before the transfer of the larvae to the square tanks, some of them began to loose their good physical condition, and mortality increased. In addition to this, the environmental change, and the forced adaptation to frozen *Artemia* and pelletized food increased the stress. This resulted in the loss of 17% of the survivors between days 48 and 58. The unexpected mortality increase on day 48 can be explained on one hand by an unsuitability of the conical 145 l tank at that age, on another hand by the fact that the large amounts of 2 and 4 days old *Artemia* needed at that time could not be produced and were replaced unsatisfactorily by nauplii.

Past Day 70, mortality was neglectable, and 2 898 juveniles (38.6 survival) were transferred out of the larval rearing unit of the laboratory at the age of 94 days.

Oxygen (fig. 2) dropped often below 80% during the experiment, and even once below 70%. There is no evidence of any effect on survival.

Growth curves (fig. 5 and 6) are plotted from very small samples (10 animals). Hence the analysis must be restricted to their general figure. Their no evidence for a significant effect of oxygen depletion or of the numerous food changes on growth. The results obtained are in the range of our best results of 1974, and apparently a little better than the ones published by other authors (BARNABE and RENE, 1972 ; LUMARE and VILLANI, 1973). But no precise comparizon can be made, due to the lack of information on confidence limits in these author's papers. Average weight of the whole population weighed alive at the time of the transfer out of the unit (day 94) was 1.02 g.

Maximum population density and load in each type of tank used were 24.4 larvae/l (0.23 g/l) at day 30, 11,9larvae/l (0.46 g/l) at day 60 (average value), 3.95 juveniles/l (0.39 g/l) at day 60 (average value), and 1.5 larva/l (1.01 g/l) at day 90.

CONCLUSIONS

The result of this experiment is not an exception : it was repeated twice during the rearing season, on similar batches, once with a better growth. It points out the possibility for a confident, high survival, larval rearing technique of this species.

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The culture conditions are still far from optimal : food requirements were underestimated for some days, oxygen level was often very low, quality of food and feeding technology were not the best.

Anyway, Sea Bass can now be considered as a species easy to rear in large quantities. The production technique can still be widely improved, and has to be made economically worthwhile.

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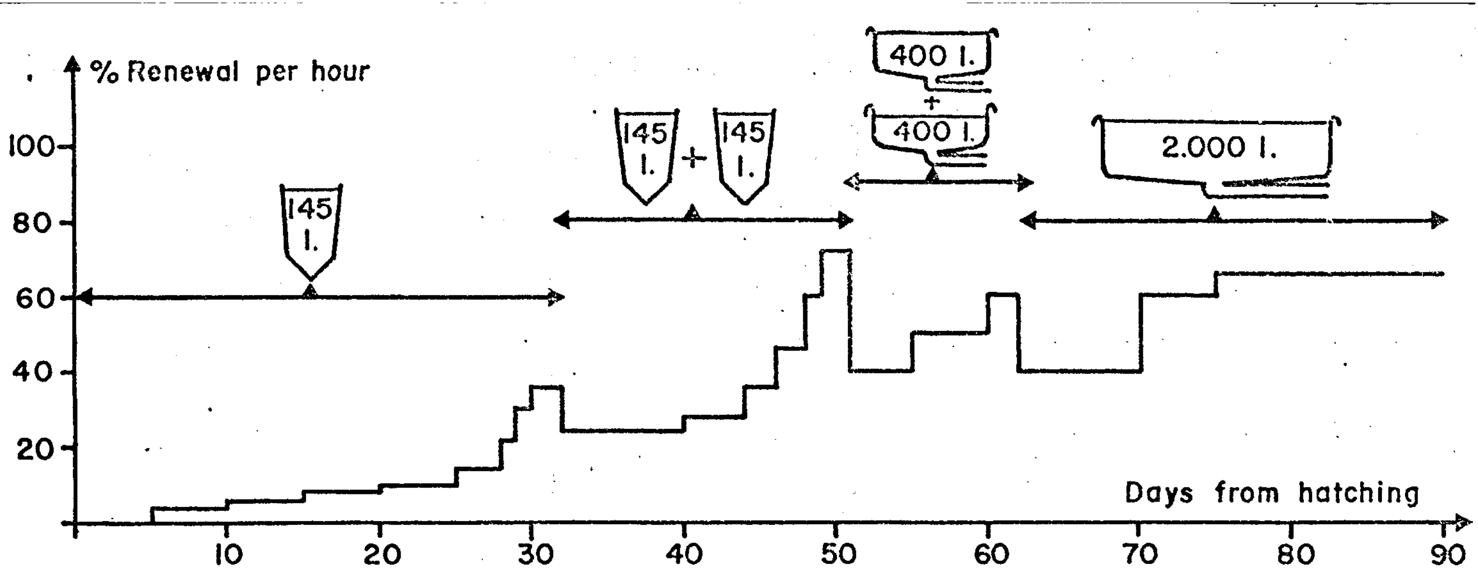

FIG. I. Tanks used and water flow as percentage of tank volume per hour.

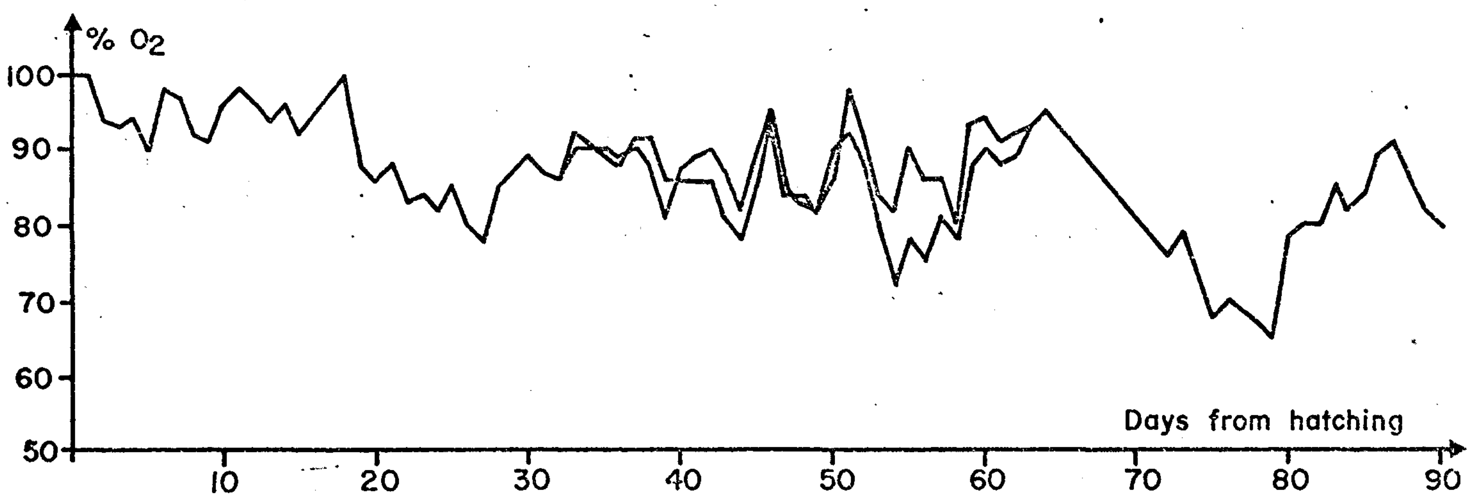

FIG. 2. Oxygen as a percentage of saturation

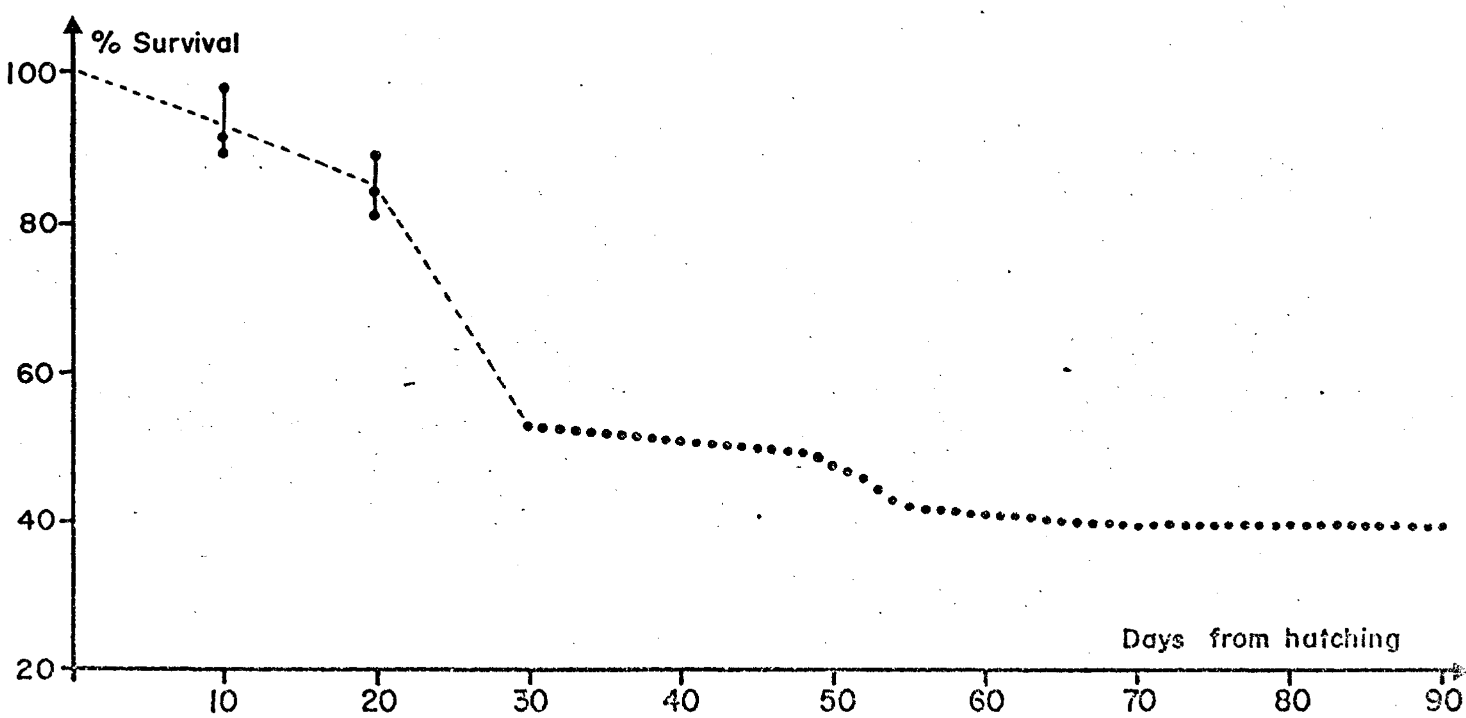

FIG. 3 Percentage of survival

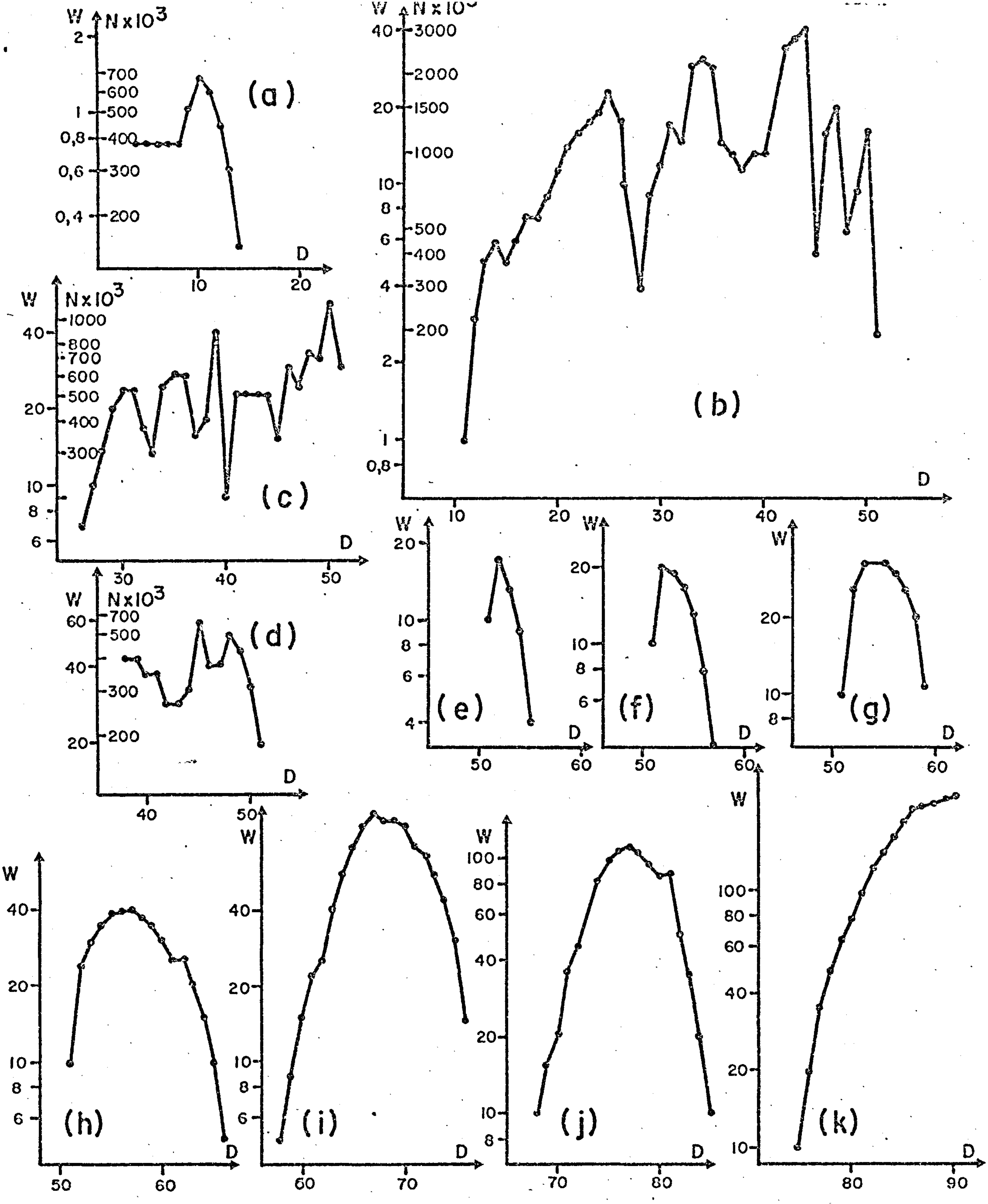

Fig 4 : **Total amount of food offered daily.** W = weight (g) ; N = number of living organisms ; D = days from hatching.

(a) : *Brachionus*. (b) : Living nauplii of *Artemia*. (c) : Living 2 days old *Artemia*. (d) Living 4 days old *Artemia*. (e) : frozen nauplii of *Artemia*. (f) : frozen 2 days old *Artemia*. (g) : frozen 4 days old *Artemia*. (h) 400/630 µ pellet (30% Artemia powder). (i) : 400/630 µ pellet(10% Artemia powder). (j) : 630/800 µ pellet (10% Artemia powder). (k) : 630/800 µ pellet.

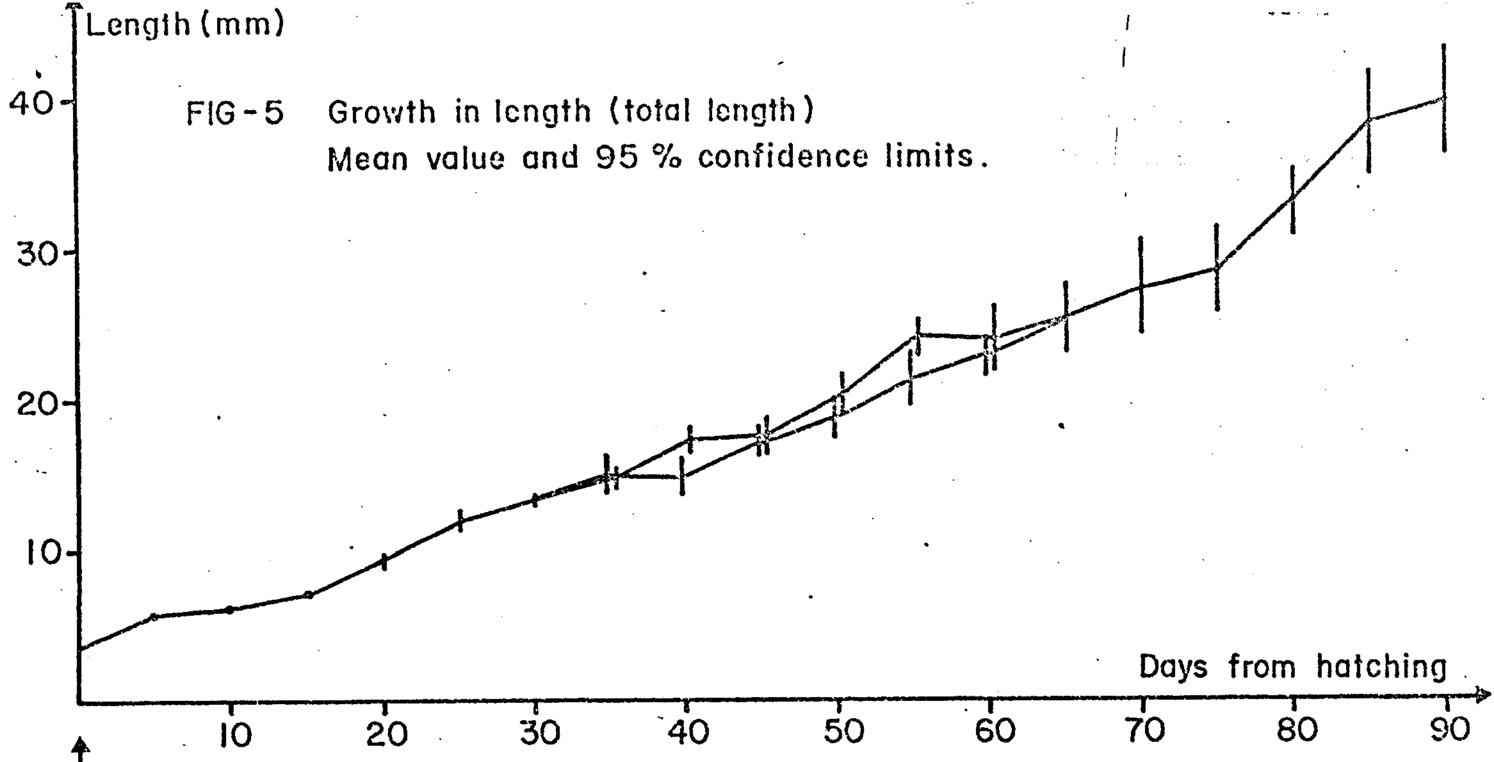

FIG - 5 Growth in length (total length)
Mean value and 95 % confidence limits.

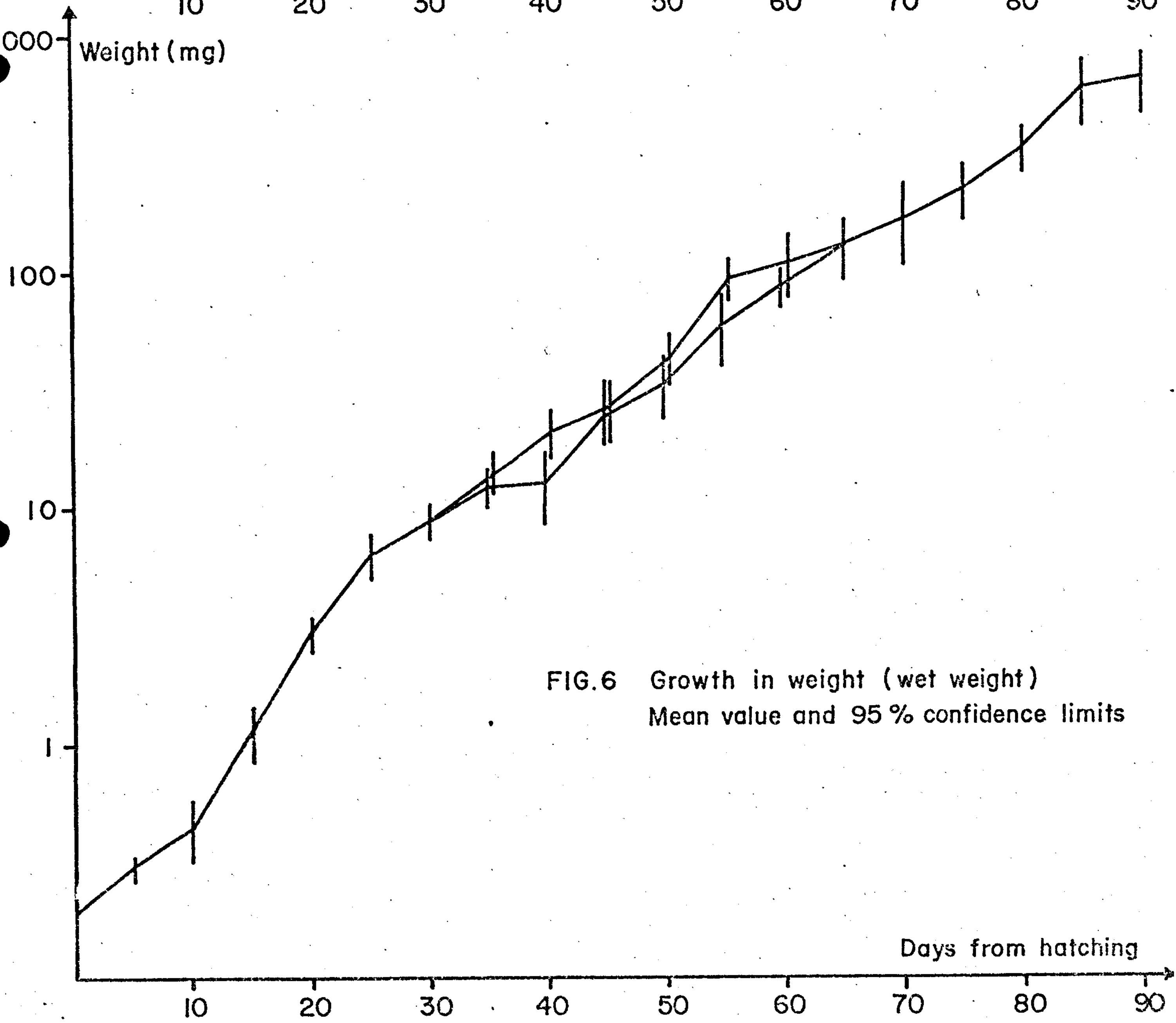

FIG. 6 Growth in weight (wet weight)
Mean value and 95 % confidence limits