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FIRST EXPERIMENTS ON THE REARING OF TROPICAL CARANGIDAE IN FLOATING CAGES

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ABSTRACT

In order to determine the feasibility of fish culture in French Polynesia's lagoons, preliminary tests were performed in 1973 and 1974. Juveniles (7 to 10 g) of three Carangidae species (Caranx melampygus, C. elacate, C. ignobilis) were caught in the wild and transported to the laboratory; three lots were dispatched among two small tanks (500 liters) with 10 animals each and a floating cage (6 x 6 x 4 m; 1.5 cm mesh) with 900 animals.

The range of water temperature was 25 to 27 C, salinity was about 34.5 ppt, and pH was 8.2. Food was given in the form of a moist pellet consisting of 80% dry powder mixed with fresh bonito flesh or troca flesh. Such a diet has a 40% protein content due essentially to fish meal (sun-dried lagoon fish). These moist pellets were well accepted, but dry pellets were spat out.

The time necessary to get a commercial size (300 g) in the tanks or in the floating cage was 6 to 8 months. Mortality rate was under

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5%. The net of the floating cage was kept clean by a herbivorous fish (Siganus sp.) associated with Jack-fish.

Jack-fish culture in lagoons seems promising because of its desirable meat, high market value, and rapid growth rate. Studies are being carried out to demonstrate the economic feasibility of such a culture by reducing the cost of feed and by obtaining reproduction in captivity.

INTRODUCTION

In French Polynesia's territories the great number of available lagoons seems highly promising for fish culture. This tropical area is out of the normal path of the cyclonic depressions or big storms. Tidal variations are negligible (30 cm). The water temperature is around 25 C throughout the year, and most of the parts of the lagoons are protected from heavy swell action by a reef barrier.

Floating cage culture techniques developed in Japan seem to be easily adaptable to such an environment. The tourist industry developing in this country is looking for a reliable supply of "plate fish," i.e. those weighing 300 to 400 g.

Carangids are generally highly esteemed as a food fish and have been studied in other countries with interesting results. Seriola quinqueradiata is now cultivated on a commercial scale in Japan. Over 20,000 metric tons per year (Egusa, 1968) are produced from wild caught juveniles, and experiments on reproduction in captivity are in progress. Tests on the rearing feasibility of Trachinotus sp. (pompano) have been conducted in the USA, and recent works have been done on Caranx mate in Hawaii (Struhsaker et al., 1973).

The following experiments on culture of the different species of Carangidae existing in Polynesian waters have been conducted at the Pacific Oceanologic Center in Vairao, Tahiti, which was created by the National Center for the Exploitation of the Oceans (CNEXO), a French Government Agency.

MATERIALS AND METHODS

Fingerlings, from 7 to 10 g, were easily caught in December and January while swimming up streams into brackish or fresh water. They were caught with a small mesh beach seine. Twenty animals were collected in 1973 and about 1,500 in 1974. Fish were transported alive in 500 liter tanks with aerated sea water.

During the initial trials, a high mortality rate occurred when fingerlings were put directly into sea water (34.5 ppt). It was found necessary to adjust the salinity level in the tank as close as possible to that in the wild. Two days were required to acclimate the animals to sea water. Using this procedure, mortality rate

was below 20%.

In 1973, growth rate experiments were conducted in 500-liter Ewos tanks; in 1974 fingerlings were kept 10 days in tanks, then transferred to the floating cage. Young were acclimatized first in a 3 x 3 x 3 m cage of 0.6 cm mesh; adults were raised in a 6 x 6 x 4 m cage of 1.5 cm mesh.

Two types of net cages were tested. One had a wooden frame with floats and bamboo cane; the top of the cage rested 50 cm above the water. The frame can be used to remove the net. The other had no rigid frame at all; the upper rims of the net were fitted with buoyant floats every 20 cm. A jump proof barrier was braced by four sticks. The cage weathered easily the effects of surge and wind in the lagoon.

The fish were weighed monthly; they were anaesthetized with the drug MS 222 so as to guard them from wounds and recovered at once after immersion in clear sea water. They were fed twice a day at 10% live weight. The diet consisted mainly of a mixed paste of meals with a small percentage of fresh bonito flesh. Vitamins given under premix form at the beginning of the experiment were progressively diminished and brewer's yeast was added in larger amounts to supply B vitamins to the diet and to maintain a prophyllactic condition. Bonito flesh was used as an appetizer.

RESULTS

First attempts were conducted in Ewos tanks to determine the acceptability of different types of food. In one tank, five fish (C. melampygus) fed bonito had a fast growth rate (Figure 1 - curve 2). A second and simultaneous test was set up with 12 animals (C. melampygus) in a similar tank. Dry pelletized food (Table 1) was refused even after 3 weeks of acclimatization. The same diet moistened with 15% fresh bonito flesh gave a good level of consumption and the growth promotion after 10 months with this mixture was similar to that with bonito flesh only (Figure 1 - curve 1).

The results of these experiments can be summed up as follows: 1) A diet with 40% protein content promoted fast growth and good survival. 2) Food must be presented as a paste or a wet pellet (30-40% moisture). 3) An appetizer is needed to permit a rapid ingestion. The best is chopped bonito meat; bonito juice or shrimp hydrolysates are less successful. 4) A rhythm of two meals a day at 10% body weight is desirable.

In 1974, the same diet was used to rear Carangids in the floating cage. The test used three species, C. ignobilis, C. melampygus, and C. elacate. After an initial loss of 100 fish due to the acclimatization period, the survival rate in June was 95%, and the resulting growth was excellent. A total of 66 animals

(mainly C. ignobilis) attained a mean weight of 420 g in 180 days (Figure 2 - curve 1), while the mean weight of the principal lot was 220 g (Figure 2 - curve 2). At the end of June the estimated biomass was 200 kg and the mean weight of the whole lot was 235 g (Table 2). The food conversion ratio was equal to 3.5.

Specimens harvested in June for human consumption were taste tested; there was no unnatural flavoring in the sample, and they were as palatable as wild samples.

The two types of cages withstood the lagoon weather conditions without any trouble. Fouling on the floating cage nets stayed at a low level due to the behavior of siganids mixed with carangids. They ate most of the algae inside the cage as did other reef fish on the outside. After 6 months of culture there were only young oysters (Crassostrea sp.) attached to the net.

It appeared after many sea water quality tests that hydrologic conditions were very stable: 35 ppt salinity, 29 C in January to 26 C in July, saturated in dissolved oxygen, and very little turbidity or pollution. These constant parameters were the result of strong water renewal in the Vairao lagoon. There is also an additional effect in the cage caused by the swimming movements of the animals establishing convection currents.

DISCUSSION

The results of growing Carangids in floating cages indicates that these fish can be raised from young to adults (250 - 300 g) in 180 to 230 days. A slight lowering in sea water temperature did not create a significant decrease in growth. Conditions of temperature and oxygen inside are close to those outside allowing one to work with high densities at low cost (Inoue, 1972). A 6 x 6 x 4 m cage net can probably carry a production of 500 kg.

Parasitism and disease did not occur during the experiment but the fish seemed to be affected by overfeeding or inadequacy of diet. Mortality occurred after collection in the wild; solving the problem of reproduction in captivity will permit the fish to get used to the tank or floating net earlier and perhaps to accept a dry pellet.

A routine operation in trout or catfish farming consists of a periodic harvest of marketable fish thus maintaining an adequate population size and a better utilization of food. This method of management is efficacious for carangids and should have been applied earlier during the 1974 experiment to eliminate the fast growing group.

Presently the cost of the wet pellet is high; the food budget is 50% of the total expenditure. After a precise estimation of nutrient requirements of jack, a commercial pelletized food could be elaborated with local products (sun dried fish meal, a yeast...)

and imports which would mainly consist of some premixes.

The technique for cultivating carangids in lagoons appears rather simple. There are vast, protected areas available with constant hydrologic conditions and low rate of fouling on nets. The future Polynesian culturists have a possibility to institute fish farming operations if they can procure cheap, quality feed. A demonstration of the economic feasibility is in progress; problems of an insular situation are high freight costs, few cultivable lands, and lack of low price food and energy. Maturing and spawning in captivity have not yet been achieved, but work is being carried out to that end. It is important to supply juveniles for experiments and to select the best species.

These encouraging results lead us to believe that this technique could be applied to the cultivation of the tunas which are of great commercial importance.

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Struhsaker, J. W., D. Y. Hashimoto, S. M. Girard, F. T. Prior, and T. D. Cooney. 1973. Effects of antibiotics on survival of carangid fish larvae (Caranx mate) reared in the laboratory. Aquaculture 2(1):58-88.

Table 1. - Composition of the dry part of the diet used to rear carangids

Ingredients	% dry matter
Tuamotu fish meal	45
Ground whole wheat	23
Powdered milk	4
Brewer's yeast	2
Soybean meal 50	15
Cod liver oil	2
Linseed oil	3
Vitamin premix*	2
Mineral mix	2
Guar	2
	100

*Vitamin fortification mixture, Nutritional Biochemical Company, Cleveland, Ohio

Table 2. - Survival rate and growth of Carangids reared in the floating cage

	Number of fish		Mean weight (g)		Total biomass (kg)
Stocked January 1974	900		10		8
Harvested June 1974	66 784	850	420 220	235	200

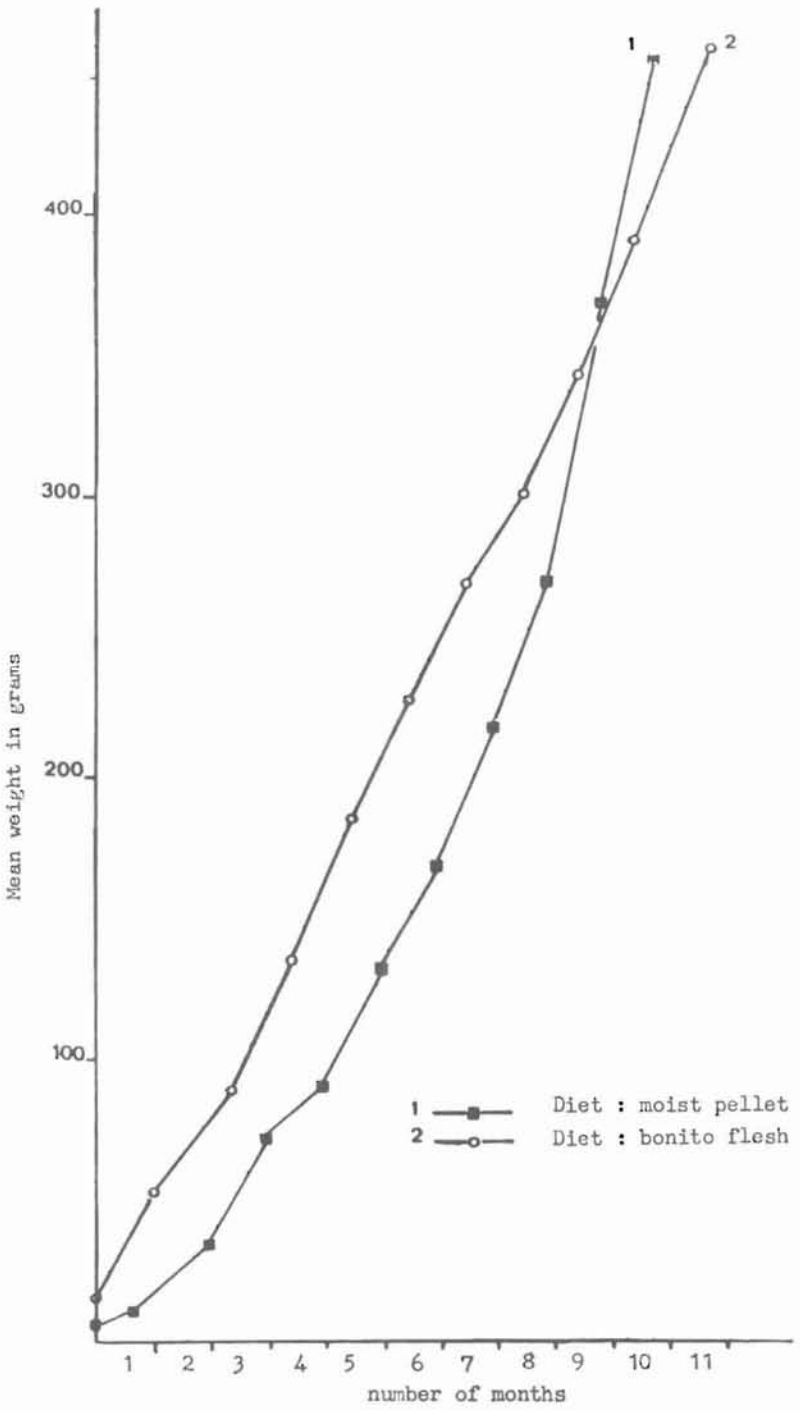
1
2
400
300
200
100
Mean weight in grams
1 Diet : moist pellet
2 Diet : bonito flesh
1 2 3 4 5 6 7 8 9 10 11
number of months

Figure 1.

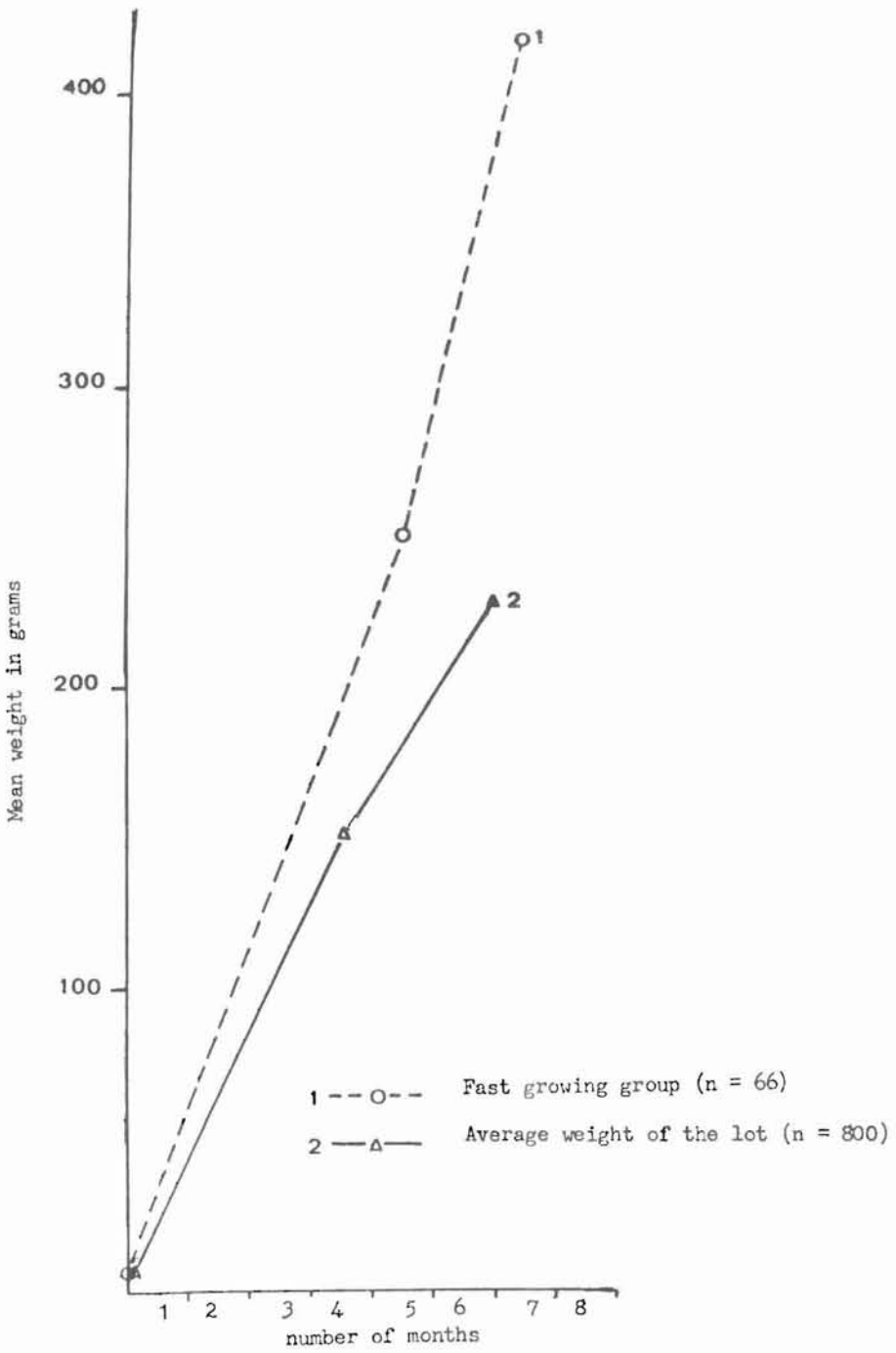
Mean weight in grams
400
300
200
100
1
2
1 2 3 4 5 6 7 8
number of months
1 - - O - - Fast growing group (n = 66)
2 —Δ— Average weight of the lot (n = 800)

Figure 2.