Etat d'avancement des travaux sur les poissons tropicaux en Martinique

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Document scientifique n° 18
Septembre 1988.

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P R E F A C E

Ce document n° 18 se compose de 3 publications :

- Overview of the studies conducted on the finfish, Palometa (Trachinotus goodei), in Martinique, F.W.I

- Spawning of palometa (Trachinotus goodei), in captivity.

- Spawning of yellowtail snapper (Ocyurus chrysurus ; BLOCH, 1791) in captivity.

Cette dernière publication, résume l'essentiel des informations obtenues sur la sarde et présentées d'une façon exhaustive dans le document scientifique n°9 (1).

Les 2 premières publications de ce document, consacrées à la carangue, font état des derniers résultats acquis sur cette espèce.

(1) Synthèse des données acquises sur l'élevage de deux poissons tropicaux : la sarde queue jaune (Ocyurus chrysurus), et la carangue aile ronde (Trachinotus goodei).

OVERVIEW OF THE STUDIES CONDUCTED ON THE FINFISH, PALOMETA (*Trachinotus goodei*) IN MARTINIQUE, FRENCH WEST INDIES.

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ABSTRACT

This paper presents the results obtained in Martinique (F.W.I) since 1985, in rearing the palometa, Trachinotus goodei.

Palometa had been chosen from few other species to develop aquaculture of a local finfish. The study on maturation conducted on fishes caught from the wild, showed the weight at first sexual maturity was about 350g.In cages, a long spawning season was observed, including two periods of high sexual activity (February and August). 50 hormonal injections had been tried and had induced 19 spawns. No eggs had reached the hatching stage. In 1987, studies showed that feeding quality and the use of two different hormones (HCG or LHRH) did not improve the viability rate.

Growth performances were recorded on fishes fed on trash fish. After seven months, average weight was about 400g from 17g fingerlings.

RESUMEN

Este estudio presenta los resultados obtenidos desde 1985 en Martinica acerca de la cría de la palometa (Trachinotus goodei).

Las primeras experiencias permiten una opción para un desarrollo de la acuicultura. El estudio de la maduracion, efectuado sobre unos animales capturados en el medio natural ensena que el peso de primera madurez sexual es aproximadamente de 350 g. En jaulas, una larga estación de desovamiento ha sido evidenciada con dos periodos de intensa actividad sexual, en febrero y en agosto. 50 inyecciones hormonales permiten conseguir unos 19 desovamientos. Ningún huevo llegó hasta la salida.En 1987, las investigaciones efectuadas ensenan que el mejoramiento de la calidad de la comida y la utilizacion de dos variedades de hormonas (HCG-LHRH) no llega a mejorar la tasa de viabilidad de los desovamientos.

Después de 7 meses de crecimiento elevado a cabo con juveniles de 17 g., el peso medio de los animales acercaba los 400 g.

INTRODUCTION

In Martinique (F.W.I) an important fish consumption (30kg/person/year), the scarcity of sea food products from fishermen and, so, the great amount of imported fish, justify aquacultural research.

A lot of well-protected and non-polluted areas and high sea water temperature (Martinet et al, 1976) confirm the ability of this island to develop such an activity.

Pompano aquaculture began in Florida, where Trachinotus carolinus is a very appreciate species. Since 1957, researches on pompano culture were founded by government agencies, universities and private corporations (Bardach et al, 1972). A pompano farm was initialy constructed in 1963 (Moe et al, 1968). Juveniles were caught from the wild and reared in ponds. Then works had been conducted on reproduction (Hoff et al, 1972, 1978 a and b), and growing out (Smith,1973 ; Anonymous, 1980). Since 1977, experimental culture of Trachinotus species had been conducted in south America (Gaspar, 1977 ; Gomez and Cervigon,1984).

In Martinique, first trials of rearing palometa (Trachinotus goodei) had started in 1981. They showed a good adaptation to rearing conditions, a fast growth, a good resistance to pathological events and an early sexual maturity (René and Haffner,

1982; Bachelier and Thouard, 1983 ; Dropsy, 1985 ; Loyau, 1985 ; Gallet de Saint Aurin et al, 1986).

This paper summarizes the works conducted in 1986 and 1987 on rearing this species.

FISHING OF JUVENILES FROM THE WILD

Fishing took place in shallow water with a beach seine(35 x 2 m ; mesh size 15 x 15 mm).Due to the low density, fishes were transported to the laboratory in two 50 l tanks without aeration. 170 juveniles of palometa were fished in 109 trials, with an average yield of 1,6 fish per trial. Table 1 summarizes the results of fishing in different biotops. The main effort took place on sandy coast in the surf where this fish is more common. Mortality during the first month did not exceed 7,5%.

GROWING OUT

120 palometas, 17g. mean weight, were placed in a 15m3 cylindro-conical floating cage. Fishes were fed ad libitum with mixed trash fish (barracuda, sparling, sardine) twice a day and six days a week. As for all experiments described below, a vitamin and mineral complement was added in the food once a week (Table 2). Fishes were monthly sampled to follow average growth of the population (n = 100). Survival was determined at the end of the experiment.

Figure 1 presents the growth curve of the population. An average weight of 400g was reached in 218 days. The survival rate was high (91%). The conversion rate (food dry weight/biomass increase) did not exceed 2%.

FIRST SEXUAL MATURATION AND SPAWNING SEASON.

A group of 15 fishes, 420g.mean weight, was set in a floating cage and fed with trash fish, sparling, sardine, squid and shrimp. Controls were regularly carried out in order to determine the spawning season (abdominal stripping for males and biopsy for females). Ripening stage was characterized by presence of milt or by a modal diameter of the greatest class of oocytes, superior to 400 microns. Males reached first sexual maturity at seven months old (300g) and females did at fifteen (350 - 400g).

Vitellogenesis control had pointed out a long spawning season, with two peaks of high sexual activity (August and February).

CONTROL OF REPRODUCTION

The four trials on reproduction control are summarized in Table 3.

Table 1. Fishing results.

Biotops	Number of trials	Number of fish	Yield (number of fish/trial)
Sandy beach (no waves)	2	0	0
Sea grass bed, sand and silt	11	6	0,5
Rocky bed	8	8	1
Sandy beach (surf)	88	156	1,8

Table 2. Vitamin and mineral complement.

Autolysat of proteins (g/kg body weight)		: 0,60
Mixed vitamins component	(id)	: 0,50
C. vitamin	(id)	: 0,50
E. vitamin	(id)	: 0,15
B_1 vitamin	(id)	: 0,03

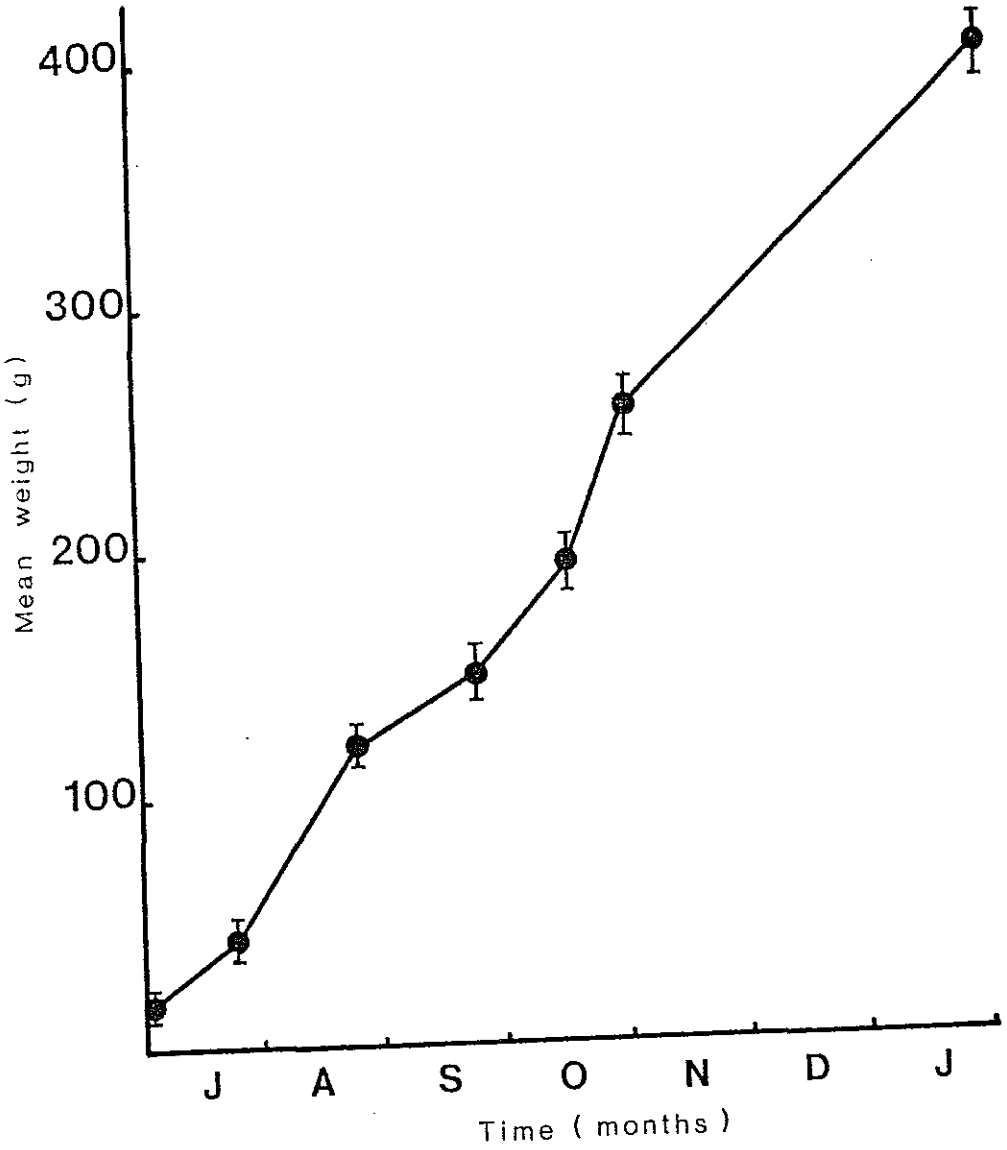

Fig. 1. Evolution of growth

Table 3. Control of reproduction.

Experiments	Broodstok feeding	Hormone injected	Dose per kg	Number of trials	Number of spawns	Viability rate (%)
1	Fresh food	-	-	-	1	70
2	Trash fish	HCG	2x50 to 600 UI	10	6	0
3	Trash fish + fresh food + pellet	HCG	2x500 IU	10	3	0
	Idem	LHRHa	10 micro g.	10	3	0
4	Pellets	HCG	2x500 IU	10	4	0
	Fresh food	HCG	2x500 IU	10	3	0

Experiment 1

A group of 13 fishes, average weight 470g, fed with fish squid and shrimp, were placed in a 14m3 tank for a seven months period. Only one spawn occured during this time without hormonal treatment. Viability rate was 70%.

Experiment 2

40 fishes, average weight 400g, fed with trash fish, were placed in a floating cage. HCG (2 x 500 I.U./kg) was injected in animals showing a ripening stage. Six spawns occured in ten trials. Viability rate was null.

Experiment 3

HCG and an analog of LH-RH (2 x 10 micro g./kg) were injected in females (average weight 470g). Whatever the hormone used, getting eggs was difficult (30% response). Average fecundity was 15.000 eggs/kg of female. No viable eggs were obtained.

Experiment 4

Injections of HCG were carried out in two groups animals (average weight 400g). In the first batch, fishes were fed only with commercial pellets and in the second one with fish, squid and shrimp. Whatever the food distributed, it was not possible to get any viable eggs.

PATHOLOGY

All the rearing stages described above have suffered pathological events, due to parasitical infestation by Neobenedenia melleni (Mac Callum,1927).

Its very wide repartition area and the various fish species it attacks (Jahn and Kuhn, 1932 ; Nigrelli and Breder, 1934; Nigrelli, 1935 ; Loyau, 1985 ; Conroy, pers. com.) make this parasite a real danger for many tropical fish cultures. Wild juveniles of Trachinotus goodei have never been caught with the parasite on them. Adults from fishing often have some parasites on their sides (Baker, pers. com.). In rearing conditions, the infestation can become epidemic, when favoured by :

- high density of fish : in tanks, or in small mesh net cages.
- low quality of food : the comparison between different foods in maturation process, pointed out that the average infestation rate could reach 106 parasites per animal if the only food was dry pellets. The year-round mortality was 41%. If fresh food was given (fish, squid, shrimp), it never exceeded 12 parasites per animal and the mortality remained low (6%).
- season : two peaks of high infestation were reavaled: March to May and August to October (Loyau, 1985).

Neobenedenia melleni is a Plathelminthus from Monogenea

class and Capsalidae family. The adult is egg-shaped and can reach 5mm length. The parasitical cycle lasts three to six days (Fig. 2)

The first symptom is an abnormal behaviour of fishes. They rub against net or tank ("flashing") and jump out of the water. Anorexia and hyperproduction of skin mucus are also observed.Then appear haemorrhagic ulcers on the sides, fin rot (mainly on anal and caudal fin), thickening and opacification of the eye cornea. At this stage, it is easy to see many parasites on eyes, skin and fins. Ulcers are very quickly invaded by bacteria (Vibrio, Aeromonas, Pseudomonas) and mortality increases.

In cages, an early treatment, before anorexia, is possible with Trichlorfon in the food (50mg/kg, four times each 72 h).
In tanks, a five minutes dip in freshwater allows unhooking of the parasites. This must be followed by an antiseptic bath (30 mn furaltadone chlorhydrate, 50mg/l or quaternary ammonia, 2ppm) in order to fight against bacteria proliferation and favour cicatrization of wounds.

In cages, good nutrition and sanitary management are able to keep the parasitical infestation at a low level. In tanks, a quarantine (with sequential freshwater dips) must be imposed before rearing.

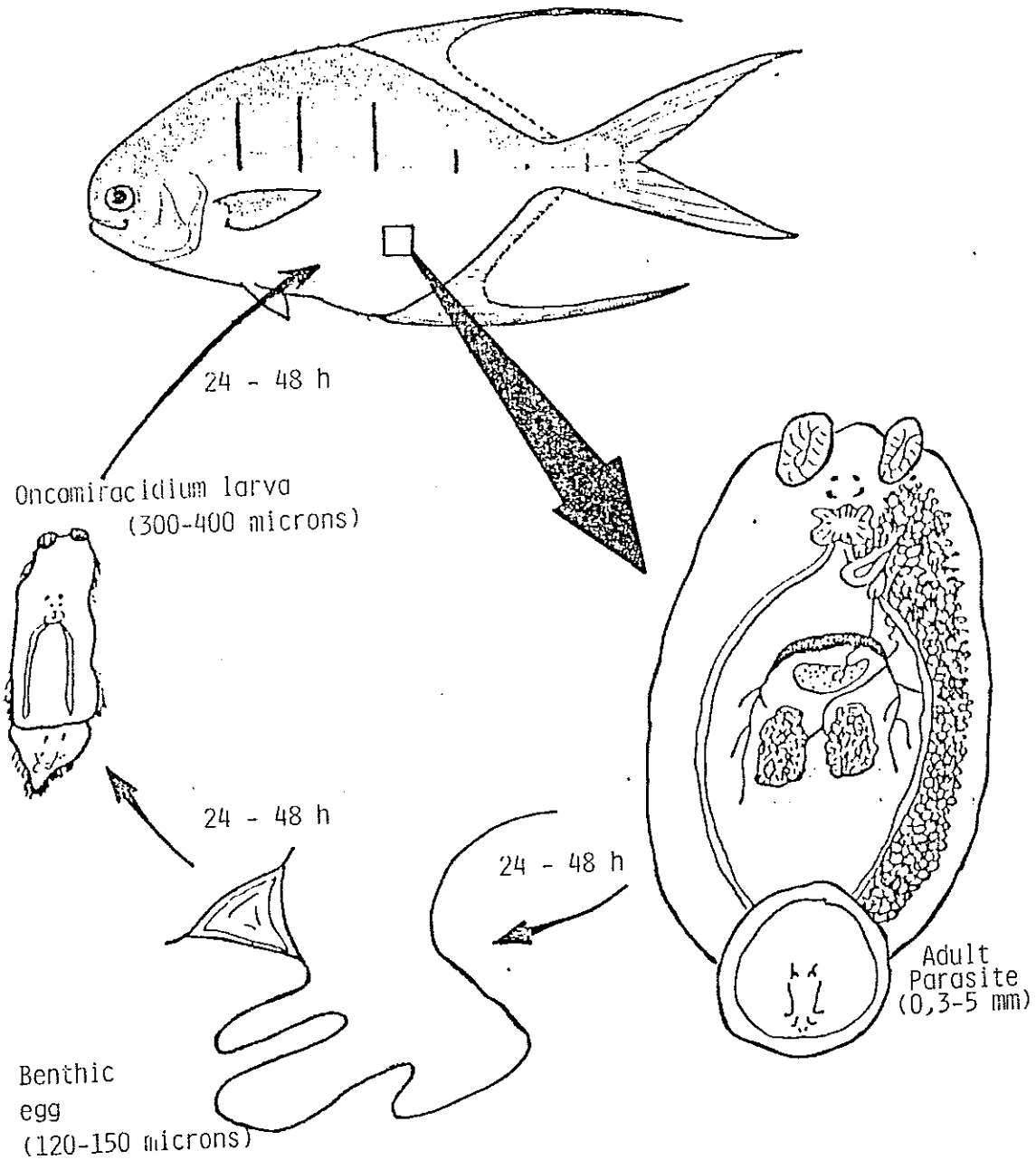

Fig. 2 - Neobenedenia melleni parasitical cycle on Trachinotus goodei (from Loyau, 1985)

DISCUSSION

Beach seine had presented a poor efficiency in catching juveniles of Trachinotus goodei. It seems difficult to catch juveniles or adults with traps or hooks (Blanc, 1984). Compared to the results in Venezuelan water (Gaspar, 1977), this species is less abundant in Martinique. As observed with Trachinotus carolinus (Gunter, 1958 ; Bellinger and Avault, 1971) juveniles are more frequent in the surf, near sandy beach (F.A.O., 1978 ; present data). Most of mortality, following fishing,had affected smallest fishes, suffering feed competition and cannibalism (Gaspar, 1977). Stress induced by fishing, handling and adaptation to cages led to 2% mortality. This low percentage confirms the ability of that species to cage rearing and its good resistance (Bachelier and Thouard, 1983 ; Grebert, 1983). Mortality affecting the whole rearing remained low (9%) as already observed by René and Haffner (1982).

Table 4 presents some growth data of Trachinotus goodei and a comparison with two other species, Trachinotus falcatus and Trachinotus carolinus. If Trachinotus goodei was fed with fresh of frozen fish, mean daily growth ranged from 0,76 to 1,77 depending on authors. Dry commercial pellets, completed with vitamins and mineral seemed well accepted. It allowed a good growth, close to the best results got with trash fish (Bachelier and Thouard,

Table. 4 Growth comparison between three species of Trachinotus.

Species	Rearing conditions		Initial weight	Final weight	Rearing period	Daily growth	References
	Structure (m3)	Feeding	(g)	(g)	(days)	(g/day)	
T. goodei	Ponds(28)	Engraulidae	15	455	400	1,10	Gaspar (1977)
T. goodei	Cages(30)	Pellet	15	439	255	1,66	Bachelier and Thouard (1983)
T. goodei	Cages(100)	Engraulidae	31	309	365	0,76	Gomez and Cervigon (1984)
T.goodei	Cages(30)	Trash fish	17	403	218	1,77	Present data (1988)
T.falcatus	Cages(100)	Engraulidae	15	414	365	1,09	Gomez and Cervigon (1984)
T.carolinus	Cages(1)	Pelleted trout feed+squid	7	454	287/357	1,55/ 1,25	Smith (1973)
T.carolinus	Cages(100)	Engraulidae	18	186	365	0,46	Gomez and Cervigon (1984)

1983). Smith (1973), working on Trachinotus carolinus had also recorded an important growth with pelleted food completed by squid (17%).

Trachinotus goodei is a small size species, maximal length never exceeds 42cm (F.A.O., 1978). So its growth slows down after 400 grammes. Gomez and Cervigon (1984) have noticed important differences between species. Mean daily growth of palometa takes place between those reached by Trachinotus falcatus and Trachinotus carolinus when they are fed with fresh fish. However, Trachinotus falcatus, which adult weight is highly greater than the others, should have best growth ability. But, its growth rate is rather low for the first 5-6 months (Gomez and Cervigon, 1984; Bachelier and Thouard, 1985). From these three species, Trachinotus goodei has fastest growth to reach marketable size of 250 grammes.

Control of vitellogenesis revealed a long spawning season, as noted by Soletchnik et al (1987). This result is in agreement with asynchronous ovaries development (Gaspar, 1986) characterizing sequential spawners. Maturation frequency was high (2 per female/term) (Soletchnik et al, 1987). Similar results were noted with Trachinotus teraia (Bard and Trebaol, 1987). As Trachinotus carolinus (Moe et al, 1968), Trachinotus goodei mature easily in captivity.

In agreement with these latter authors, spawning without hormonal induction remains uncertain. One only spawn, was observed for seven months in tank.

Whatever the hormone used, spawns were not numerous (32%). Ovules were frequently retained, reaching an over-ripening stage. More, ovarian regression was observed as for Trachinotus carolinus (Hoff et al,1978a). In spite of the quality of food and consequently health, egg viability rate remained null.

Comparisons with Hoff et al (1978a) point out the same difficulties (Table 5).In 25 trials, some hundred fingerlings only were produced. Such a problem might come from the age of broodstock. As a matter of fact, fishes induced during these experiments were only one year old, and might have been too young to provide viable eggs. In support of this hypothesis, viable eggs (70%) were got from a two and half years old animal, injected with HCG (Suquet et al, in press). Moe et al (1968) noticed that Trachinotus carolinus sexual maturity probably occurs after the first year and do not spawn before it is two years old.

Five years experiments in rearing Trachinotus goodei have shown that pathology was not restricive (René and Haffner, 1982 ; Gallet et al, 1986 ; present data). Parasitical infestation by

Neobenedenia mellini does have preventive solutions in tanks and cages, easily appliable and well adapted to the rearing techniques.

All the experiments described in this paper confirm a good growth, a low mortality and an high resistance to disease of palometa, Trachinotus goodei. Fishing juveniles in the wild beeing difficult, the control of reproduction is necessary. The opportunity of Trachinotus goodei as candidate for further aquaculture have still to be demonstrated.

REFERENCES

Anonymous.

1980 Observations on the spawning behavior of captive Florida pompano, Trachinotus carolinus. Copeia, 4 : 884-886.

Bachelier, C. and E. Thouard.

1983 Elevage en cage flottante, à la Martinique, de poisson marins. Diplôme d'Agronomie Approfondie. Ecole Nationale Supérieure Agronomique de Rennes. 89pp.

Bard, F.X. and L. Trebaol.

1987 Recherches en aquaculture sur les principales espèces

de poissons lagunaires en Côte d'Ivoire.ORSTOM. 123pp.

Bardach, J.E., J.H. Ryther and W.D. Mc. Larney.

1972 Culture of pompano. Aquaculture. New York,Interscience: 531-540.

Bellinger, J.W. and W. Avault

1971 Food habits of juveniles pompano,Trachinotus carolinus, in Louisiana. Trans. Americ. Fish. Soc.,100(3):486-494.

Blanc, M.

1984 Recherche et capture de géniteurs de poisson tropicaux en milieu naturel (Lutjanidés, Carangidés). Diplôme d'Agronomie Approfondie. Ecole Nationale Supérieure d'Agronomie de Rennes. 100pp.

Dropsy, B.

1985 Bilan biotechnique des élevages de poissons tropicaux au sein de l'Association pour le Développement de l'Aquaculture en Martinique. Diplôme d'Etudes Supérieures Spécialisées. Université de Caen. 109 pp.

F.A.O.

1978 Species identification sheets for fishery purposes. Western central atlantic (fishering area 31). Vol.II.

Gallet de Saint Aurin,D., A. Picollier and P. Haffner.

1986 Principales pathologies observées dans les élevages marins à la Martinique. Pathology in marine aquaculture. Vivarès C.P., J.-R. Bonami and E. Jasper editors. European Aquaculture Society, special publication n°9, Bredene, Belgium : 61-70.

Gaspar, A.G.

1977 Crecimiento, conversion, efficienca y mortalidad del pompano, Trachinotus goodei, confinado en estanques de concreto. Bol. Inst. Oceanogr. Univ. Oriente, 16(1-2):141-152.

Gaspar, A.G.

1986 Ovogenesis del pampano, Trachinotus goodei, Jordan y Evermann 1896, cultivado en estanques. Contribuciones cientificas,6, Centro de investigationes cientificas, Universitad de Oriente. Porlamar. 28pp.

Gomez, A and F. Cervigon.

1984 Crecimiento de Trachinotus carolinus,T.goodei y T. Falcatus (pisces : Carangidae) en jaulas flotantes de 100m3 en la isla de Margarita, Venezuela. Contribucion

16, Fundacion cientifica Los Roques. Caracas. 42pp.

Grebert, O.

1983 Données sur la croissance, la maturation et la reproduction des espèces tropicales élevées en cages flottantes à la Martinique. Diplôme d'Etudes Supérieures Spécialisées Université de Caen. 83pp.

Gunter, G.

1958 Population studies of the shallow water fishes of an outer beach in south Texas. Publ. Inst. Mar. Sci. Univ. Texas, 5: 186-193

Hoff, F.,C. Rowell and T. Pulver.

1972 Artificially induced spawning of the Florida pompano under controlled conditions. Proc. World. Maric.Soc., 3:53-64.

Hoff, F. J. Mountain, T. Frakes and K. Halcott.

1978a Spawning, oocyte development and larvae rearing of the Florida pompano (Trachinotus carolinus). Proc. World Maric. Soc., 9:279-297.

Hoff, F., T. Pulver and J. Mountain.

1978b Conditioning Florida pompano (Trachinotus carolinus)

for continous spawning. Proc. World. Maric. Soc., 9: 299-309.

Jahn,L.R. and C.R.Kuhn.

1932 The life history of Epibdella melleni,Mac Callum 1927 a monogenetic trematod parasitic on marine fishes. Bio. Bull., 62(1) : 89-111.

Loyau, S.

1985 Parasitoses en milieu fermé.Rapport IFREMER.51pp.

Martinet, J., C. Saint Felix and A. Guyard.

1976 Evolution saisonnière de certains paramètres physico-chimiques et planctoniques des eaux du havre du Robert et de la baie de Massy-Massy en Martinique. Bul. Inst. Pêches Marit. 262. 17pp.

Moe, M.A., R.H. Lewis and R.M. Ingle.

1968 Pompano mariculture: preliminary data and basic considerations. Flor. Bd. Conserv. Mar. Lab. Techn. Series 55. 65pp.

Nigrelli, R.F.

1935 Experiments on the control of Epibdella mellini, Mac Callum 1927, a monogenetic trematode of marine fishes. J. Parasitol.21(6):438.

Nigrelli, R.F. and C.M Breder.

1934 The susceptibility and immunity of certain marine fishes to E. Mellini, a monogenetic trematode.J.Parasitol. 20 (5) : 259-269.

René, F. and P. Haffner.

1982 Premiers résultats expérimentaux obtenus sur l'élevage après capture des alevins de, Trachinotus goodei et Trachinotus falcatus (carangues aile ronde), Lutjanus analis et Lutjanus apodus (sorbes et sardes dent de chien) et Ocyurus chrysurus (sardes queue jaune) à la Martinique. Publication de l'Association pour le Développement de l'Aquaculture en Martinique. 60pp.

Smith, T.I.J.

1973 The commercial feasibility of rearing pompano, Trachinotus carolinus (Linnaeus), in cages. Sea grant technical bulletin n° 26. University of Miami. 62pp.

Soletchnik, P.,E. Thouard and M. Suquet.

1987 Synthèse des données acquises sur l'élevage de deux poissons tropicaux en Martinique : la sarde queue jaune, Ocyurus chrysurus et la carangue aile ronde

Trachinotus goodei. Document scientifique n°9. Pôle de Recherche Oceanologique et Halieutique Caraibe. 69pp.

SPAWNING OF PALOMETA

(*Trachinotus goodei*) IN CAPTIVITY

SPAWNING OF PALOMETA (Trachinotus goodei), IN CAPTIVITY.

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ABSTRACT :

Observation of palometa maturation showed a long spawning season, including two periods of high sexual activity (February and August).

After seven months, only one spawn occured whithout hormonal treatment (viability rate : 70%). 40 hormonal injections had been attempted and had induced 13 spawns. Whatever the hormone used and the quality of food, hatching did not occured.

Keywords : jacks, Trachinotus, reproduction, hormonal treatment.

RESUME

Le suivi de la maturation de la carangue aile ronde met en évidence une longue saison de ponte, entrecoupée de deux périodes de forte activité sexuelle (février et aout).

Après sept mois d'élevage une seule ponte est obtenue en l'absence de traitement hormonal (taux de viabilité : 70%). 40 injections hormonales permettent l'obtention de 13 pontes. Quelque soit l'hormone utilisée ou la qualité de la nourriture distribuée, le taux de viabilité reste nul.

Mots clés : carangues, Trachinotus, reproduction, traitements hormonaux.

INTRODUCTION

Palometa, Trachinotus goodei (Jordan and Everman, 1896) is distinguishable from others Carangidae by long dorsal and anal fins and a few vertical black bars on its upper sides. It is most common from Massachussets to south Brazil (F.A.O., 1978).

Studies conducted on close species as Trachinotus carolinus, Trachinotus falcatus and Trachinotus teraïa have shown fast growth (Smith, 1973; Cervigon, 1983; Gomez and Cervigon, 1984; Bard and Trebaol, 1987). Induced spawning by hormone injections has been reported, but viability rate did not exceed 45% (Hoff et al, 1972; 1978a, b).

First growing out trials carried out with juveniles of palometa from the wild, pointed out a good adaptation to rearing conditions, an high survival and a good resistance to pathologies (Gaspar, 1977 ; René and Haffner, 1982 ; Bachelier and Thouard, 1983 ; Dropsy, 1985). An average weight of 400 g was reached in seven months from 17g juveniles (Soletchnik et al, 1988). This fast growth was confirmed by Hurtaud (1986)

Oogenesis was described by Gaspar (1986). Some spawns were induced by HCG injections. However, their viability was very low and often null (René et al, 1983 ; Soletchnik et al, 1987).

This paper presents the spawning cycle of palometa in captivity. It also summarizes reproduction control trials conducted to increase viability rate of spawns.

MATERIAL AND METHODS

Experiment 1

15 one year old fishes, mean weight 420 g, were set in a 15 m^3 cylindroconical floating cage. Density was 0,4 kg/m^3. Sex ratio was about 1/2 (males/males and females). Diet was composed of pellets (36%), trash fish complemented with carrots (30%), fish (sardine, sparling : 20%), shrimp (10%) and squid (4%). As for all experiments described below, a vitamin and mineral complement was weekly added (Table 1). Fishes were fed ad libitum five days a week. Daily feeding rate was 2,7% (wet weight/body weight). Survival at the end of the 12 months experiment reached 80%.

To determine the spawning season, sampling were carried out every thirteen days on the whole population, by stripping males and doing biopsies on females (polyethylene catheter, diameter : 1,5mm). Ripening stage was characterized by presence of milt or by a modal diameter of the greatest class of oocytes superior to 400 microns (n = 50).

Experiment 2

13 one or two years old fishes, mean weight 470 g, were set

Table 1. Composition of vitaminic and mineral complement (dose per week).

Autolysat of proteins(g/kg body weight)		0,60
Mixed vitamins component	(id)	0,50
C vitamin	(id)	0,50
E vitamin	(id)	0,15
B1 vitamin	(id)	0,03

in a $14m^3$ cylindroconical tank. Density was 0,5 kg/m^3. Sex ratio was about 1/2. The water change was 1 m^3/h. Water was filtered through a sand filter (20 microns). Light was natural. Diet was composed of fish (sardine, sparling : 50%), squid (40%), and shrimp (10%). Daily feeding rate was 2,7%. Animals received a preventive treatment before their transfer in tank (Loyau,1985). No mortality was observed.

Spawning occured naturally, without hormonal injection. Each spawn was described by its viability rate (viable eggs/total eggs) and diameter of dead and alive eggs (n = 50).

Experiment 3

40 one year old fishes, mean weight 450g, were set in a $15m^3$ floating cage. Density was 1,1 kg/m^3. Sex ratio was about 1/1. Fishes were fed trash fish and carrot (46%), pellets (34%), sardine and sparling (11%), squid (6%) and shrimp (3%). Daily feeding rate was 1,8%. Mortality rate was 33% during 10 months experiment.

Fishes showing a ripening stage were selected for induced spawning attempts. Two hormones were used, HCG and an analogue of LHRH (des gly ^{10}, D-Ala^6). Dosage levels were respectively 2 x

500 IU/kg and 2 x 10 micro g/kg. Two injections might be applied, the first one having a small effect on the growth of the oocytes. Only female were injected at the posterior base of dorsal fin. Then, two males and one female were set in a 1,8 m^3 race way, isolated with a black cover. Water change was 0,5 to 1 m^3/h. Light and temperature were natural. Density did not exceed 0,8 kg/m^3. The second hormonal treatment was applied twenty hours after the first injection.

Each spawn, collected thirty to fourty hours after the first treatment, was described by the same parameters as in previous experiment. After spawning, an ovarian check allowed observation of remaining oocytes. Spawners were marked with a black indian ink injection, under base of pectoral fin (Coves, 1986). These identification marks were visible during 45 days.

Experiment 4

Two batches of 17 and 18 one year old fishes, mean weight 410 and 370g, were set in two $15m^3$ floating cages. Densities were 0,4 and 0,5 kg/m^3. Sex ratio were between 1/2 and 2/3. In the first batch, animals were fed only with commercial pellets and, in the second one, with sardine and sparling (55%), shrimp (26%) and squid (19%). Daily feeding rate were respectively 2,2% and

4,2%. Mortality rates were 41% and 6% through twelve months.

Seven months after the beginning of the experiment, HCG treatments were applied with the same dosage as in previous experiment.

RESULTS

Experiment 1

Monthly variations of broodstock at ripening stage are presented in Fig.1. They showed a long spawning season, including two peaks of high sexual activity (August and February). Rate of mature males ranged from 30 to 100% of the total population. Female's rate were generally lower than males's.

Experiment 2

Through a seven months period, only one spawn was collected. 14.000 eggs were harvested. Viability rate was 70%. Diameters of alive and dead eggs were 1037 and 1033 microns.

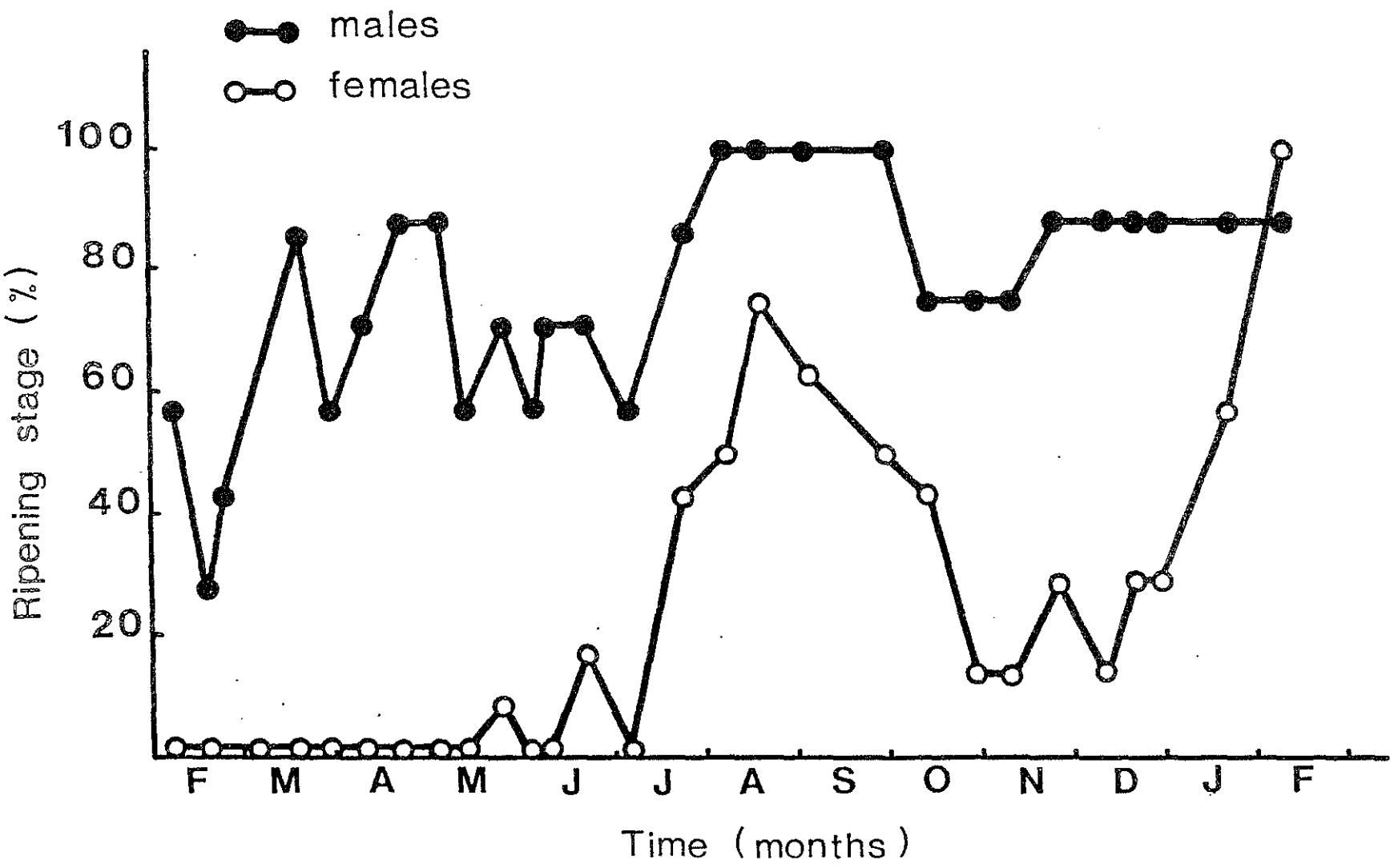

Fig. 1. Rate of broodstock at the ripening stage

Experiment 3.

Results recorded after injections with two different hormones are summarized in Table 2. Whatever the treatment, spawns were not frequent and viability rate remained null. Diameter of dead eggs ranged from 594 to 1058 microns (mean : 937).Ovarian samples few hours after spawning, reavaled no more ripening oocytes.

Experiment 4

Results are summarized in Table 3. Whatever the food distributed eggs were not viable.

DISCUSSION

As for many tropical fishes, the monitoring of vitellogenesis in palometa pointed out a long spawning season. This result, in agreement with asynchronous ovaries developpment (Gaspar, 1986), characterizes sequential spawners. During the first samplings (February to May), the absence of ripening female can be explained by their weight, close to the weight of first sexual maturity, determined by Soletchnik et al (1987). In support of this hypothesis, ripening females were observed one year later at

Table 2. Injection of two different hormones trials

Hormone	Initial oocyte diameter (microns)	Number of eggs collected (no.x10^3)	Viability rate (%)	Fecundity (no.x10^3/kg)
HCG	520	11	0	31
HCG	460	2	0	5
HCG	590	-		
HCH	490	-		
HCG	460	-		
HCG	460	-		
HCG	490	-		
HCG	520	4	0	11
HCG	530	-		
HCG	460	-		
LHRH	440	-		
LHRH	520	-		
LHRH	460	-		
LHRH	560	-		
LHRH	590	17	0	47
LHRH	460	-		
LHRH	520	7	0	16
LHRH	460	-		
LHRH	520	-		
LHRH	490	5	0	12

Table 3. Effect of food quality on viability rate

Food(*)	Initial oocyte diameter (microns)	Number of eggs collected (no.x10^3)	Viability rate (%)	Fecundity (no.x10^3/kg)
1	620	21	0	45
1	590	-		
1	550	19	0	43
1	550	-		
1	590	12	0	28
1	620	-		
1	490	-		
1	430	-		
1	590	-		
1	550	18	0	39
2	460	-		
2	520	-		
2	620	-		
2	620	6	0	14
2	590	-		
2	550	3	0	8
2	460	-		
2	550	11	0	24
2	590	-		
2	620	-		

(*) 1: Pellet, 2 : sardine +sparling+shrimp+squid

the same period (Soletchnik et al, in press). However, some peaks of high sexual activity were detected, as for most of the tropical species. The first one, in February, is common to many Caribbean fishes (Johannes, 1978). Then temperature is low, preceding phytoplancton blooms (Munro et al, 1973).

15 days delay was imposed between two samplings. More frequent handling decreased number of females showing a ripening sta ge. Stress may prevent the normal vitellogenesis process (Billard et al, 1981).

Getting eggs whithout hormonal treatment do not seem adapted to rearing conditions. After seven months, 14.000 eggs, from a unique spawn, were collected from nine females. Ripening stage was easily observed in captivity. But ovary development did not progress (Gaspar, 1986). The same problem was also noticed in mullet, Mugil cephalus (Nash and Shehadeh, 1980) and in milkfish, Chanos chanos (Chaudhuri and Juario, 1977).

After HCG injections, spawning occured for 33% of the trials. Ovulated eggs were not always realased (40% of the attemps). They reached rapidly an over-ripening stage. Such a phenomen is often the cause of a poor quality of the gametes (Riley and Thacker, 1969 ; Jones, 1970). In palometa, packing of over-ripening

eggs near the genital orifice and preventing spawning, was never observed as for some coldwater species (Devauchelle, 1980). However, HCG injection often induced the final maturation process : 73% of the fishes, with an initial oocyte diameter ranged from 430 to 620 microns, responded to the treatment. Regressions were also observed on females at ripening stage. As for many teleostean fishes, it might be the result of excessive handling (Nagahama, 1983). Same phenomen was noted in pompano, Trachinotus carolinus (Hoff et al, 1978a). Attemps to reverse process were futile.

In european sea bass (Dicentrarchus labrax) the use of LHRH analogue hormone increased spontaneous spawning (Suquet, 1987). With palometa, this hormone did not improve the results.

Whatever the hormone or the quality of the food used, the viability rate remained zero per cent. Embryon did not develop itself over the morula stage. In pompano, the best results were associated with high initial diameter, ranging between 580 and 718 microns (Hoff et al, 1978a). This value was then 60 to 75% of the egg diameter, measured a few hours after spawning. The initial oocyte diameter of injected palometa was only 430 to 620 microns, i.e. 45 to 65% of the egg diameter. Even with high sampling frequency, fishes with higher value were never met. The

completion of vitellogenesis was not also observed by Gaspar (1986).

At the beginning of the experiment, fishes were only one year old and might be old enough to mature but too young for good breeding. Moe et al (1968) have noticed pompano probably do not spawn until their second year. In support of this hypothesis, viable eggs (70%) were collected from a two and half years old animal, after HCG injections (2 x 500 IU/kg). At last, samplings carried out on fishes in exp. 2. pointed out that the only one spontaneous spawn, without hormonal treatment, was realased by a same age animal.

Fecundity was quite low and did not exceed 45.000 eggs per kilogram of female (average : 26.000). The use of LHRH analogue did not seem to improve the fecundity as for the temperate sea bass (Suquet, 1987). High frequency of spawning (Soletchnik et al, 1987) could compensate this low fecundity.

In spite of food quality increase and test of two hormones, results were similar. Others hormonal treatments as implants and osmotic pumps, successfully used on stressful fish as milkfish, Chanos chanos (Lee et al, 1986 a, b; Marte et al, 1987) have to be studied. Further investigations have also to be carried out on

older animals.

REFERENCES

Bachelier C., E. Thouard, 1983. Elevage en cage flottante, à la Martinique, de poissons marins. Diplôme d'Agronomie Approfondie. Ecole Nationale Supérieure Agronomique, Rennes, 89p.

Bard F.X., L. Trebaol, 1987. Recherches en aquaculture sur les principales espèces de poissons lagunaires en Côte d'Ivoire. Rapport O.R.S.T.O.M., 123p.

Billard R.C., C. Bry and C. Gillet, 1981. Stress, environment and reproduction in teleost fish. In : Stress and Fish, A.P. Pickering Ed., Academic Press, New York, 185-208.

Cervigon F., 1983. La aquicultura en Venezuela. F. Cervigon Ed., Caracas, Venezuela, 121p.

Chaudhuri H., J.V. Juario, 1977. Use of hormones in breeding cultivated warm-water fishes with special reference to milkfish, Chanos chanos (Forskal). Fisheries Research Journal of the Philippines, 2, 1-6.

Coves D., 1986. Present zootechnical knowledge on sea bass, Dicentrarchus labrax and sea bream, Sparus auratus, broodstocks management and spawning planning. Symposium Franco-Israélien, 10-12 novembre 1986, Tel-Aviv, Israël.

Devauchelle N., 1980. Etude expérimentale sur la reproduction, les oeufs et les larves de bar, Dicentrarchus labrax, daurade, Sparus auratus, mullet, Liza ramada, rouget, Mullus surmuletus, sole, Solea solea, turbot, Scophtalmus maximus. Thèse Doct. 3ème cycle, U.B.O., Brest, 177p.

Dropsy B., 1985. Bilan biotechnique des élevages de poissons tropicaux au sein de l'Association pour le Développement de l'Aquaculture en Martinique. Diplôme d'Etude Supérieures Spécialisées, Caen, 109p.

FAO., 1978. Species identification sheets for fishery purposes. Western central atlantic (fishering area 31). Vol.2.

Gaspar A.G., 1977. Crecimiento, conversion, efficiencia y mortalidad del pompano, Trachinotus goodei, confinado en estanques de concreto. Bol. Inst. Oceanogr. Univ. Oriente, 16 (1-2), 141-152.

Gaspar A.G., 1986. Ovogenesis del pampano, Trachinotus goodei Jordan y Evermann 1896, cultivado en estanques. Contribuciónes cientificas, Universidad de Oriente, Porlamar, 6, 28p.

Gomez A., F. Cervigon, 1984. Crecimiento de Trachinotus carolinus, T. goodei y T. falcatus (pisces : Carangidae) en jaulas flotantes de 100 m^3 en la isla de Margarita, Venezuela. Contribución Fundacion Cientifica Los Roques, Caracas, 16, 42p.

Hickling C.F., E. Rutenberg, 1936. The ovary as an indicator of the spawning period in fishes. Journ. Mar. Biol. Assoc. U.K, 21, 311-317.

Hoff F., C. Rowell and T. Pulver, 1972. Artificially induced spawning of the Florida pompano under controlled conditions. Proc. World Maric. Soc. 3, 53-64.

Hoff F., J. Mountain, T. Frakes and K. Halcott, 1978a. Spawning, oocyte development and larvae rearing of the Florida pompano (Trachinotus carolinus). Proc. World Maric. Soc., 9, 279-297.

Hoff F., T. Pulver and J.Mountain, 1978b. Conditionning Florida pompano (Trachinotus carolinus) for continuous spawning Proc. World Maric. Soc. 9, 299-309.

Hurtaud P., 1986. Quelques aspects du prégrossissement et gros sissement de deux espèces de poissons tropicaux : la sarde queue jaune, Ocyurus chrysurus et la carangue aile ronde, Trachinotus goodei. Diplôme d'Agronomie Approfondie. Ecole Nationale Supérieure Agronomique, Rennes, 50p.

Johannes R.E., 1978. Reproductive strategies of coastal marine fishes in the tropics. Environmental Biology of Fishes, 3, 65-84.

Jones A., 1970. Some aspects of the biology of the turbot (Scophtalmus maximus L.) with special reference to feeding and growth in the juvenile stage. Ph.D. Thesis, University of East Anglia, 145p.

Lee C.S., C.S. Tamaru, J.E. Banno, C.D. Kelley, A. Bocek and J.A. Wyban, 1986a. Induced maturation and spawning of milkfish, Chanos chanos Forsskal, by hormone implantation. Aquaculture 52, 199-205.

Lee C.S., C.S., Tamaru, C.D. Kelley and J.E. Banno, 1986. Induced spawning of milkfish, Chanos chanos, by a single application of LHRH-analogue. Aquaculture, 58, 87-98.

Marte C.L., N.M. Sherwood, L.W. Crim and B. Harvey, 1987. Induced spawning of maturing milkfish (Chanos chanos, Forsskal) with gonadotropin-realasing hormone (GnRH) analogues administered in various ways. Aquaculture, 60, 303-310.

Moe M.A., R.H. Lewis and R.M. Ingle, 1968. Pompano mariculture : preliminary data and basic considerations. Fla. Bd. Conserv. Mar. Lab. Techn., 55, 65p.

Munro J.L, V.C. Gaut, R. Thompson and H. Reeson, 1973. The spawning seasons of Caribbean reef fishes. J.Fish Biol., 5, 69-84.

Nagahama Y., 1983. The functional morphology of teleost gonads. In: Fish Physiology, G.W. Hoar, D.J.Randall and E.M. Donaldson Ed., Academic Press, Orlando, 9, 223-275.

Nash C.E., Z.H. Shehadeh, 1980. Review of breeding and propagation techniques for grey mullet, Mugil cephalus L.,

I.C.L.A.R.M. Studies and Reviews, 3, 87p.

René F., P. Haffner, 1982. Premiers résultats expérimentaux obtenus sur l'élevage après capture des alevins de Trachinotus goodei et Trachinotus falcatus (carangues aile-ronde), Lutjanus analis et Lujanus apodus (sorbes et sardes dents de chien) et Ocyurus chrysurus (sardes queue jaune) à la Martinique. Publication de l'Association pour le Développement de l'Aquaculture en Martinique, 60p.

René F., P. Haffner, C. Bachelier, O. Grebert and E. Thouard, 1983. Elevage des carangues ailes rondes en cages. Rapport interne, I.F.R.E.M.E.R., 7p.

Riley J.D., G.T. Thacker, 1969. New intergenic cross within the pleuronectidae, dab x flounder. Nature, 221, 484-486.

Smith T.I.J., 1973. The commercial feasability of rearing pompano, Trachinotus carolinus (Linnaeus), in cages. Sea Grant. Technical Bulletin, University of Miami, 26, 62p.

Soletchnik P., E. Thouard and M. Suquet, 1987. Synthèse des données acquises sur l'élevage de deux poissons tropicaux en Martinique : la sarde queue jaune, Ocyurus chrysurus et la

Scientifique, Pôle de Recherche Océanologique et Halieutique Caraibe, 9, 69p.

Soletchnik P., E. Thouard, D. Gallet de Saint Aurin, M. Suquet, P. Hurtaud and J.P. Mesdouze, 1988. Overview of the studies conducted on the finfish, palometa (Trachinotus goodei), in Martinique, French West Indies. Presented at Congreso Iberoamericano y del Caribe, 8 - 14 May 1988, Margarita, Venezuela.

Suquet M., 1987. Gestion de populations de reproducteurs de loup (Dicentrarchus labrax), placées en conditions de pontes naturelles ou décalées. Diplôme d'Associé aux Recherches, Université Claude Bernard, Lyon I, 102p.

SPAWNING OF YELLOWTAIL SNAPPER

(*OCYURUS CHRYSURUS*, BLOCH, 1791)

IN CAPTIVITY

SPAWNING OF YELLOWTAIL SNAPPER (Ocyurus chrysurus ; Bloch, 1791) IN CAPTIVITY.

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ABSTRACT

Soletchnik P., Suquet M., Thouard E. and Mesdouze J.P., 1988. Spawning of yellowtail snapper (Ocyurus chrysurus, Bloch 1791) in captivity.

Observations on yellowtail snapper maturation pointed out a long spawning season (March to October), including two periods of high sexual activity (March and July). 21 batches of good quality eggs (mean viability rate :85%) were recorded whithout hormonal treatment. Spawning was also induced by HCG injection. Fecundity was high (172.000 eggs/kg), but the viability rate remained low (31%).

INTRODUCTION

Yellowtail snapper is a well appreciated species in Caribbean Islands. Growing out trials, with juveniles from the wild, have pointed out good adaptation to breeding conditions, fast weaning and high survival rates (René and Haffner, 1982; Hurtaud, 1986; Thouard, 1986).

Some spawnings occured through hormonal treatments. Useful methods with two injections of human chorionic gonadotropin (HCG) was used. Larval rearing trials were conducted, but survival did not exceed 15 or 20 days (Thouard, 1986 ; Soletchnik et al,

1987). This paper presents the reproduction control attemps carried out in 1986 and 1987 in Martinique, to confirm first results previously recorded.

MATERIEL AND METHODS

Experiment 1

31 fishes, mean body weight 620g, were set in a $14m^3$ cylindrical tank. Diet was composed of fish, squid and shrimp. A vitamin and mineral complement, was weekly added. Spawning occured spontaneously, whithout hormonal treatment.

Experiment 2.

120 fishes, with an average weight of 400g, were distributed in a $14m^3$ cylindrical tank and two cylindro-conical floating cages ($15m^3$). Diet was composed of trash fish complemented with 10% carrots. As in previous experiment, a vitamin and mineral complement was weekly added. Sampling allowed the control of maturation by stripping males and doing biopsies on females. Ripening stage was determined by the observation of an average diameter greater than 300 microns in females and by the presence of milt in males. Fishes at ripening stage were selected for induced spawning trials. Broodstock was injected with HCG (2x600 IU/kg). Each spawn was collected thirty to fourty hours after the first injection.

RESULTS AND DISCUSSION

Experiment 1

537 000 eggs in 21 spontaneous spawns have been collected. Average fecundity was 67.000 eggs/kg. Mean viability rate was 85%, ranging from 0 to 98%. However, spawnings were not predictable and average of 27.000 eggs per spawn was not in keeping with needs for rearing.

Table 1. First spawning after hormonal treatment

Initial oocyte diameter (microns)	Viable eggs (no.x10^3)	Dead eggs (no.x10^3)	Viability rate (%)	Fecundity (no.x10^3/kg)
482	38	39	49	154
484	1	12	8	27
455	89	146	38	343
491	0	211	0	301
436	5	24	17	64
482	1	67	1	213
418	74	20	79	171
363	0	0	0	0
427	0	30	0	120
382	0	4	0	12
436	77	28	73	223
436	0	0	0	0

Experiment 2

Ripening stage was observed on fishes which weight was at least 200g. In agreement with Claro (1983), a long maturation season was pointed out (March to October), interrupted by two perods of high sexual activity (March and July).

Table 1 summarizes results recorded on hormonal injections attemps. Spawning was frequent. Average fecundity was 172.000 eggs/kg. Mean viability rate was 31%, ranging from 0 to 79%. This low value remains the main problem. Feeding broodstock with an unappropriate diet may affect this rate (Watanabe et al, 1984). Exclusive distribution of trash fish could not be adapted. By sampling, big size oocytes have been observed on second spawn animals, proving a new maturation one to three months after the first one. Two hormonal injections attempted to these four females (HCG : 2x600 IU/kg) led to the spawning of 73.000 additional eggs per kg (mean viability rate :22%).

REFERENCES

Claro R., 1983. Ecologia y cyclo de vida de la rabirubia, Ocyurus chrysurus (Bloch), en la plataforma cubana. I. Identidad, distribucion, habitat, reproduccion y alimentacion. Rep. Invest. Instit. Oceanol., 1. Ac. Cienc. ed., Cuba : 34pp.

Hurtaud, P., 1986. Quelques aspects du prégrossissement et grossissement de deux espèces de poissons tropicaux : la sarde queue jaune, Ocyurus chrysurus et la carangue aile ronde, Trachinotus goodei. Diplôme d'Agronomie Approfondie. Ecole Nationale Supérieure Agronomique, Rennes :50pp.

René, F. and Haffner P., 1982. Premiers résultats expérimentaux obtenus sur l'élevage après capture des alevins de Trachinotus goodei, Trachinotus falcatus (carangues aile ronde), Lutjanus analis et Lutjanus apodus (sorbes et sardes dent de chien) et Ocyurus chrysurus (sardes queue jaune) à la Martinique. Association pour le Développement de l'Aquacul-

ture en Martinique : 60 pp.

Soletchnik, P., Thouard, E. and Suquet M., 1987. Synthèse des donnnées acquises sur l'élevage de deux poissons tropicaux en Martinique : la sarde queue jaune, Ocyurus chrysurus, et la carangue aile ronde, Trachinotus goodei. Document scientifique, Pôle de Recherche Océanologique et Halieutique Caraïbe, 9 : 69 pp.

Thouard, E., 1986. L'élevage d'Ocyurus chrysurus. Synthèse des données biotechnologiques acquises sur l'élevage de la sarde queue jaune à la Martinique en croissance, maturation et élevage larvaire. Thèse. Ecole Nationale Supérieure Agronomique, Rennes :122pp.

Watanabé, T., Arakawa, T., Kitajima, C. and Fujita, S., 1984. Effects of nutritional quality of broodstock diets on reproduction of read sea bream. Bull. Japan. Soc. of Sci. Fish., 50(3) : 495-501.

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