

## Research on Coastal Finfish Aquaculture in Florida and Australia

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### ABSTRACT

En los últimos tres años, varias especies de peces fueron evaluadas para conocer su potencial como organismos cultivables para la acuicultura. Estos organismos fueron criados en tanques, canaletas y en charcas con el fin primordial de desarrollar técnicas de cultivo y fórmulas alimenticias apropiadas para el cultivo costero de peces en las regiones del Golfo y el Caribe al igual que en el área tropical de Australia.

Los huevos del róbalo común (*Centropomus undecimalis*) y el barramundi (*Lates calcarifer*) se pueden obtener de hembras maduras silvestres o por medio de inducir la ovulación con HCG y luego forzar mecánicamente el desove. Los huevos de la trucha marina moteada (*Cynoscion nebulosus*) se pueden obtener por métodos voluntarios en tanques de desove o induciendo su ovulación con HCG y luego forzando mecánicamente el desove. Los huevos del sargo chopo (*Archosargus probatocephalus*) se pueden obtener de hembras maduras silvestres, induciendo el desove en tanques utilizando HCG o induciendo la ovulación con HCG y forzando mecánicamente el desove.

Estas especies son alimentadas con rotíferos (*Brachionus plicatilis*) y Artemia hasta la etapa de su metamorfosis, luego de lo cual se utiliza alimento seco. En un período de 8 a 12 meses estas especies alcanzan un peso de 500g. Las variaciones en crecimiento diario y la tasa de conversión (FCR) para el alimento seco son los siguientes: para un róbalo (de 16-230g) 2.1-0.85% y 0.7-1.1 FCR; para un barramundi (de 9-153g) 2.5- 1.7% y 0.9-1.1 FCR; para la trucha marina moteada (de 24-110g) 3.1-1.2% y 0.8-1.5 FCR.

Todas estas especies exceptuando la trucha marina pueden ser criadas en agua dulce o salada hasta que se convierten en juveniles.

### INTRODUCTION

Four species of coastal finfish, three carnivorous and one omnivorous (sheepshead), were spawned and reared under experimental aquaculture conditions to evaluate their potential. Common snook (*Centropomus undecimalis*) and barramundi (*Lates calcarifer*) are in the tropical fish family Centropomidae. Common snook normally occur from central Florida southward along the east coasts of Mexico and Central and South America to Brazil, including Caribbean islands with coastal freshwater streams (Rivas, 1986). Barramundi are found in the Indian and tropical west Pacific Oceans from the Persian Gulf to Amoy, China and throughout northern Australia. Sheepshead (*Archosargus probatocephalus*), a member of the porgy or sea bream family Sparidae, which includes many cultured species, ranges from Nova Scotia to Brazil in mainland coastal waters (Johnson, 1978). Spotted seatrout (*Cynoscion nebulosus*), a member of the drum family Sciaenidae, ranges from Cape Cod,

Massachusetts to the lower Gulf of Campeche, Mexico, usually in estuaries (Mercer, 1984). All four species are valuable in sport and commercial fisheries.

### Spawning

Spawning seasons are moderately long (Table 1). Common snook (Tucker and Campbell, submitted) and barramundi (Davis, 1985) spawn in the summer, sheepshead in late winter and early spring (Johnson, 1978; Tucker and Barbera, submitted), and spotted seatrout during spring and summer (Mercer, 1984; Tucker and Faulkner, 1987). All four species have been spawned in the laboratory by stripping females that have ovulated naturally before capture and others that have ovulated after injection with human chorionic gonadotropin (HCG). All except snook have voluntarily spawned in captivity. Eggs are small, floating, have single oil globules, and hatch quickly.

Table 1. Spawning and egg characteristics of four coastal finfish species.

	Common Snook	Barramundi	Sheepshead	Spotted Seatrout
Spawning season length (months)	5	5	3	5
Artificial spawning <sup>a</sup>	1,2	1,2,3,4	1,2,3	1,2,3,4
Egg diameter (mm)	0.7	0.7	0.8	0.7
Hatching time (hours)	17	17	28	14

- <sup>a</sup>1. Naturally ovulated and strip-spawned  
 2. Injected with HCG and strip-spawned  
 3. Injected with HCG and voluntarily spawned  
 4. Voluntarily spawned

### Development

Early development is fast, and larvae feed soon after hatching (Table 2). Energy reserves are soon used up. Age at which *Artemia* can be eaten depends on mouth size as well as growth rate; sheepshead have the smallest mouths. By the time fish have transformed into juveniles and are eating dry feed, all except spotted seatrout can be reared in fresh water.

### Temperature and Growth

Optimal water temperatures for these species are found in the tropics, but temperature tolerance is wide (Table 3). Feeding and growth rates tend to decrease sharply at suboptimal temperatures. Growth on pellets was very good over the size ranges studied. Feed conversion ratio was exceptionally good for snook and barramundi and good for seatrout.

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**Table 2. Development of four coastal finfish species**

	<b>Common Snook</b>	<b>Barramundi</b>	<b>Sheepshead</b>	<b>Spotted Seatrout</b>
First feed (days after hatch)	2.5	3	3	1.5
End yolk and oil (days after hatch)	5	5	4	3
Eat <i>Artemia</i> (days after hatch)	10	10	14	7
To fresh water (days after hatch)	15	15	<35	No
Transform (days after hatch)	35	25	30	35
Converted to dry feed (days after hatch/mm TL)	38/43	26/17	30/11	37/38

**Table 3. Culture temperature and growth of four coastal finfish species.**

	<b>Common Snook</b>	<b>Barramundi</b>	<b>Sheepshead</b>	<b>Spotted Seatrout</b>
Optimal temperature (C)	27-28	27-28	mid 20's	28
Temperature range (C)	10-35+	12-43	10-35	10-34
Growth on pellets (grams/days)	726/435	153/191	573/390	110/150
Feed conversion ratio (largest fish)	1.10	1.09		1.55

A major goal of research on these species is the development of dry pelleted feeds suitable for marine fish. Five commercial diets, 12 experimental diets, and fresh foods have been tested on various stages of the four species. The experimental diets were inexpensive and simple, containing fish meal, poultry/meat meal, textured vegetable protein, wheat flour, fish oil, vitamins, and minerals. Two of these (Table 4) outperformed all other diets tested in terms of growth and conversion.

**Table 4.** Two good dry feeds for marine fish (Tucker *et al.*, submitted)

1986 price(USD/tonne)	\$522	\$557
Fish meal (%)	27	20
Crude protein (%)	54	48
Crude fat (%)	13	13
Carbohydrate (%)	16	10
Fiber (%)	5	6
Ash (%)	12	23

### Common Snook

These were easily raised up to a weight of 1.6 kg in small tanks, large tanks, and ponds. Snook were spawned 12 times during 1983, 1984, and 1985. Feeding trials with pellets were conducted over the size range 16-725 g; daily growth ranged from 2.1 to 0.67% and feed conversion ratios (FCR) from 0.7 to 1.10 (Tucker, 1987a). Snook reached a weight of 110 g in six months. They are sedentary and do not waste energy through excessive activity. They also are gregarious and tolerate crowding. At temperatures of 26–30° C, they can be reared to a mean weight of 450 g in one year or less with a feed cost of less than US\$0.30 per fish. The high food value of snook has been documented (Tucker *et al.*, 1985).

### Barramundi

Barramundi were reared from four spawns during 1985–1986. Feeding trials with pellets were conducted over the size range 9–153 g; daily growth ranged from 2.5 to 1.7% and FCR from 0.9 to 1.09 (Tucker *et al.*, submitted). Barramundi reached a weight of 110 g in less than six months. Early juveniles grew at least as fast as common snook, and feed conversion ratios were only slightly higher.

### Sheepshead

This mainland species was easily raised up to a weight of 1.0 kg in large tanks and ponds. Its smaller relative, the sea bream (*A. rhomboidalis*), is more common around Caribbean islands and may also have potential for aquaculture. Sheepshead were spawned four times in 1984 and 1986 (Tucker and Barbera, submitted). They accepted and grew well on a variety of feeds and had survival and growth rates that compared favorably with those of red sea bream (McCormick, 1983; Tucker, 1987b). They reached a weight of 110 g in five months and 570 g in 13 months. Aggression can be more of a problem with this omnivore than with the three carnivores, but can be minimized by good management.

### Spotted Seatrout

Seatrout were raised in tanks and ponds up to a weight of 350 g. They were spawned 79 times in 1985 and 1986, 4 times with HCG and 75 times voluntarily (Tucker and Faulkner, 1987). Feeding trials with pellets were conducted over the size range 24—110 g; daily growth rate ranged from 3.1 to 1.2% and FCR from 0.8 to 1.55 (Tucker, 1987c). Feed conversion ratios were higher than for the centropomids but still acceptable.

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