

## AQUACULTURE OF RED DRUM (*Sciaenops ocellatus*) AND OTHER SCIAENIDS

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### Introduction

Recent refinements in red drum (*Sciaenops ocellatus*) aquaculture have led to a rapid increase in commercial production of these species in southern regions of the United States (1). Major advances in the artificial control of reproduction and rearing of red drum larvae and juveniles in captivity are summarized here. In addition, the potential applications of these technologies to the culture of other sciaenid fishes are discussed.

### Reproduction

#### *Precocious maturation*

The time for red drum to reach sexual maturity can be reduced by more than half by rearing them at summer temperatures (24-28 °C) and a constant photoperiod (12L:12D) and feeding them a high food ration (2, 3). Red drum, which normally mature at 4-5 years of age, can be induced to undergo sexual maturation and begin spawning before they are two years old by this technique.

#### *Gonadal recrudescence*

Exposure to condensed annual photoperiod and temperature cycles is the preferred method of inducing gonadal recrudescence in all the sciaenid species investigated so far. Environmental manipulation techniques to induce gonadal recrudescence and spawning of sciaenids in captivity were first developed for spotted seatrout (*Cynoscion nebulosus*) and red drum by Arnold and coworkers. Gonadal growth and spawning of spotted seatrout occurred under summer conditions (15L:9D, 26 °C) whereas autumn conditions (9L:15D, 23 °C) were required for red drum spawning (4). Condensed (4-6 months) annual cycles are now routinely used to induce gonadal recrudescence in red drum and orangemouth corvina (*Cynoscion xanthulus*) (5, 6).

#### *Spawning*

Special procedures are not usually required to induce spawning of red drum and spotted seatrout; once the gametes are fully developed, the broodstock are maintained at the temperature and photoperiod conditions at which they spawn naturally. Spawning can usually be induced by gradually lowering and then raising the water temperature if it does not occur naturally (2, 5). Once spawning be-

gins, it will continue indefinitely if the fish are held under optimum environmental conditions for spawning up to 7.5 years for one group of red drum broodstock (2). Hormonal treatments are reliable methods of inducing spawning of orangemouth corvina and other sciaenid species that do not respond predictably to environmental manipulation (7). A single injection of a LHRH analog (20-100 µg/Kg bw) induces spawning of a variety of sciaenid fishes 30-36 h later (8). A hormonal method of spawning seatrout, in which LHRHa is administered in the diet, has been developed to eliminate the stress associated with capture and handling (9). Oral administration of 0.5-1.0 mg LHRHa/Kg bw in the diet (dead shrimp) induced spawning in spotted seatrout 32-38 h later. Spotted seatrout can be induced to spawn repeatedly by oral administration of LHRHa at 20-30 day intervals, the interval required for a new cohort of oocytes to complete their growth. In contrast, oocyte growth and feeding are interrupted for two weeks after each injection of LHRHa resulting in fewer spawns and decreased egg production during the spawning season. Repeated oral administration of a LHRH analog is a valuable method, therefore, for large scale production of spotted seatrout eggs.

### Rearing

#### *Larval culture*

Sciaenid larvae are easily grown on cultured *Brachionus plicatilis* and *Artemia* sp. Microencapsulated diets are readily accepted if they are of appropriate size and can be maintained in the water column, but larvae are unable to obtain sufficient nutrition without the addition of live prey (10). The alimentary canal is simple in first feeding red drum larvae but the digestive glands and measurable concentrations of digestive enzymes are present (11). Larvae can be weaned to dry micro-particulate diets at one week of age with high survival and excellent growth rates (12). Test diets containing 50 % protein and 18-20 % lipid with 2.5-3.5 n-3 HUFA produced the best growth (13). Successful weaning of red drum larvae from live prey after only one week is unique and of great importance in the development of economical, year-round production of juveniles.

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*Juvenile Culture*

Juvenile red drum can be reared in high-density recirculating systems. Fifty-six day old red drum fingerlings (0.66 g mean weight) were stocked at a

density of 307 fish/M<sup>3</sup> into a 38 MT semi-closed recirculation system. After 126 days of culture survival, mean weight and maximum biomass of the system were estimated at 70 %, 73.7 g and 16 Kg/m<sup>3</sup>, respectively.

## EVALUACIÓN DE LA TÉCNICA DE CRIOCONSERVACIÓN PARA PRESERVAR A LARGO PLAZO LOS RECURSOS GENÉTICOS DE LA CAÑA DE AZÚCAR

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### Introducción

Para que un método de conservación *in vitro* sea eficiente, es necesario que cumpla con dos requisitos: mantener la estabilidad genética del material y garantizar altos niveles de recuperación después del almacenamiento (1).

En el presente trabajo se evaluó mediante parámetros agronómicos y bioquímicos la técnica desarrollada para crioconservar los ápices de la caña de azúcar (almacenamiento en nitrógeno líquido, -196 °C) y se comparó este método con la conservación a temperaturas superiores por diferentes periodos de tiempo.

### Materiales y Métodos

Se utilizaron ápice de plantas *in vitro* de cuatro variedades: C. 87-51, C. 26670, B. 34104 y B. 4362.

El protocolo de conservación, contempló el uso de la técnica de encapsulación-deshidratación (2, 3) y el tejido se almacenó a +12, -20, -70 y -196 °C durante 0, 10, 120, 180 y 365 días.

Para las muestras crioconservadas, se evaluaron seis características agrícolas y siete botánicas en condiciones de campo y se aplicaron dos sistemas isoenzimáticos (esterasas y peroxidasas) con materiales *in vitro*.

### Discusión

La respuesta de los ápices en función de la temperatura y el tiempo de conservación, reflejó que solo las muestras crioconservadas mantuvieron la viabilidad del tejido a lo largo del almacenamiento y que los niveles de sobrevivencia dependieron del factor varietal y no de la permanencia en el nitrógeno líquido (C. 87-51: 70 %, C. 26670: 82 %, B. 34104: 67 % y B. 4362: 83 %). A temperaturas superiores por el contrario, la pérdida de la viabilidad se hizo evidente transcurridos los 10 primeros días de la conservación.

No se detectaron diferencias significativas ( $P < 0,05$ ) en los parámetros agronómicos evaluados, entre las muestras controles y las crioconservadas. Los perfiles electroforéticos reflejaron las características de las muestras patrones para los dos sistemas isoenzimáticos empleados.

Todo esto demuestra, que la crioconservación no induce modificaciones genéticas en el material biológico almacenado y que constituye un método seguro para preservar a largo plazo el genoplasma de la caña de azúcar.

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