

**LONG-TERM GROWTH OF  
SOUTH CAROLINA AND TEXAS RED DRUM  
1986-1988**

by

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## ABSTRACT

South Carolina and Texas red drum (Sciaenops ocellatus) were compared to evaluate long-term growth characteristics of the two geographic populations; this paper summarizes the first 2 years of a 4-year study. Red drum from each group were spawned in spring 1986, and fry were held in either outdoor earthen ponds (summers) or indoor recirculating tanks (winters) through spring 1988. No consistent difference in growth was found between the two groups over the 2-year test period. By April 1988, mean ( $\pm$  SD) standard length and weight of Texas fish were  $422 \pm 21.4$  mm and  $1,612 \pm 237.8$  g, respectively; South Carolina fish averaged  $440 \pm 20.0$  mm and  $1,641 \pm 311.1$  g.

## INTRODUCTION

Red drum (*Sciaenops ocellatus*) is an important sport fish along the Gulf of Mexico and Atlantic coasts of the United States (Matlock 1984). The development of controlled spawning techniques (Arnold et al. 1977), hatchery scale fingerling production (Colura et al. 1976, McCarty et al. 1986), and the overfishing of Texas red drum populations (Matlock 1982) has resulted in the implementation of red drum stocking programs in Texas (Dailey and Matlock 1987).

Red drum from different geographic locations may possess different phenotypic or genotypic traits which make them more or less suited to the goals of a particular stocking program. Atlantic coast red drum apparently reach a larger maximum size than Gulf coast red drum (Matlock 1987), possibly due to faster growth rates or longer life spans. The Texas Parks and Wildlife Department (TPWD) currently maintains adult red drum from the Gulf of Mexico (Texas) and Atlantic (South Carolina) coasts in controlled tank systems at the Gulf Coast Conservation Association/Central Power and Light/TPWD Marine Development Center (MDC), Corpus Christi, Texas.

Efforts were initiated by TPWD to identify potentially faster-growing red drum which could contribute to stocking programs used for population enhancement of red drum. The objective of this study was to evaluate long-term growth of red drum from South Carolina and Texas; this paper summarizes the first 2 years of growth.

## MATERIALS AND METHODS

Red drum used in this study were spawned at MDC 2 May 1986 (South Carolina fish), and 28 April to 1 May 1986 (Texas fish). Fish were reared in outdoor earthen ponds (summers) and indoor fiberglass tanks (winters) from May 1986 to April 1988 at TPWD Marine Fisheries Research Station (MFRS), Palacios, Texas. Red drum required overwintering in indoor tanks to protect them from potentially lethal pond water temperatures. Due to space limitations, progressively fewer fish were overwintered as they grew larger, therefore, selection was required (see below) at the beginning of each overwintering period.

Texas red drum fry were stocked 1 - 3 May 1986 in a 1.6-ha pond at 1,250,000 fry/ha. South Carolina fry were stocked 4 May in a 0.2-ha pond at 1,500,000 fry/ha. Pond culture techniques for both groups during this phase of the study followed the general methods of McCarty et al. (1986). Pond salinity (Model 33, Yellow Springs Instrument Company (YSI), Yellow Springs, Ohio), water temperature and dissolved oxygen (YSI Model 58) were recorded once daily between sunrise and 0900 h.

South Carolina fish were harvested after 37 days (10 June 1986), Texas fish were harvested after 34 days (5 June 1986). Standard length (SL) and weight (W) were obtained from 100 fish of each group at harvest. Total length measurements were not used in this study due to the sometimes poor condition of the caudal fin. The number of fish recovered from each pond at harvest was estimated by dividing the total weight of all fish harvested by the mean

weight of 100 measured fish. Survival and production (kg/ha/day) were determined for each pond. At harvest, 2,000 randomly selected fish from each group were retained.

On 5 and 10 June 1986, respectively, the 2,000 Texas and South Carolina fish were transferred to separate 1.6-ha ponds. Fish were not fed a supplemental feed; natural forage was the only available food source. Ponds were harvested 18 and 19 November 1986; individual fish were sampled as previously described. One hundred randomly selected fish of each group were weighed and measured, and 65 fish (of each group) were retained.

The 65 Texas and 65 South Carolina red drum were transferred to separate 9,500-liter fiberglass tanks (for overwintering) and held from 18-19 November 1986 to 7 April 1987. Tanks were maintained under similar temperature, photoperiod, and light conditions, and were equipped with a rotating contact biological filter, an ultraviolet water sterilization unit and a diatomaceous earth filter. Fish were fed 7% body weight (BW) of frozen shrimp, frozen chopped fish and 35% protein floating pellets (Lone Star Feeds, Nacagdoches, Texas) daily from 18 November to 12 December 1986; feeding rate was reduced to 3% BW from 13 December 1986 to 2 April 1987 as fish were not consuming the entire offered portion. Salinity and water temperature (glass thermometer) were measured once daily, ammonia (Model 501, Orion Research, Cambridge, Massachusetts) and pH (Fisherbrand Model 107, Fisher Scientific, Pittsburgh, Pennsylvania) and were measured three times weekly. Total weight of fish held in tanks was determined monthly and feeding amounts adjusted accordingly. All surviving fish were weighed, measured, and tagged abdominally with internal anchor tags on 23 March 1987.

The fish were transferred to separate 1.6-ha ponds on 7 April 1987. Fish were not fed a supplemental feed while held in ponds; water quality was measured daily as described above. Fish were harvested 9 and 10 November 1987 for laboratory overwintering; all surviving fish were weighed and measured. Twenty-five randomly selected fish of each group were placed in separate 4,000-liter fiberglass tanks at MFRS, remaining fish were transferred (due to space limitations) to separate tanks at MDC. MFRS fish were fed 1% BW frozen shrimp, 1% BW chopped fish, and 0.5% BW floating pellets daily, and were weighed and measured monthly through April 1988. Tank water conditions were monitored as described previously.

All statistical tests were performed using the Statistical Analysis System (SAS Institute 1985) at the 0.05 level of significance. Mean values  $\pm$  SD were calculated for each variable tested. Students' t-test was used to compare SL and W of South Carolina and Texas red drum after each period of residence; pond water temperature, salinity, and dissolved oxygen were compared after each summer season.

## RESULTS

Over a 2-year period, neither South Carolina nor Texas red drum showed consistently greater growth in length or weight when compared to each other (Figure 1). Following the initial summer pond culture (harvested November 1986), Texas fish were significantly longer (but not heavier) than South

Carolina fish (Table 1). However, the two groups were similar in length and weight after the first tank overwintering (March 1987). After the second summer in ponds (November 1987), South Carolina fish were significantly longer and heavier than Texas fish. Following the second overwintering period (April 1988), fish again were not significantly different in weight, but South Carolina fish were significantly longer.

Total weight harvested, production (kg/ha/day) and survival for the three pond trials showed results similar to the growth data (Table 2). Survival was comparable in ponds which were stocked at equal rates (harvested November 1986 and 1987). Production was also similar in these ponds at the November 1986 harvest. However, production appeared higher in the South Carolina-stocked pond at the November 1987 harvest. Water quality was similar between South Carolina and Texas stocked ponds in all trials, with the exception of the 1986 fry culture ponds; salinity was significantly greater (but only by 1 o/oo) in ponds containing Texas fish (Table 3).

#### DISCUSSION

No clear advantage in long-term growth characteristics was found between South Carolina or Texas red drum. Based on mean weights of fish after the second summer pond trial (harvested November 1987) South Carolina red drum may grow faster in ponds than Texas red drum. Compounding the issue is the fact that, although bay water was pumped to the ponds simultaneously, shrimp and crabs were found in the Texas pond following the November 1987 harvest, while no individuals of either group were found in the South Carolina pond. During the periods when the fish were maintained in tanks, Texas fish appeared to gain weight faster. The cause of this disparate growth pattern between the two geographic populations is unknown.

Total length (TL) at 2 years (which is most comparable to the April 1988 tank sample) for wild caught fish in Texas ranged from 483 mm (Wakefield and Colura 1982), to approximately 535 mm (Pearson 1929, Simmons and Breuer 1962); Texas fish averaged 422 mm SL (which would be approximately 510 mm TL using conversion Tables provided by Harrington et al. (1979)). Two-year growth estimates from salt-water impoundments in South Carolina were 521 mm TL (Bearden 1967) and 486 mm SL (Theiling and Loyacano 1976); South Carolina fish averaged 440 mm SL (assuming an equal conversion rate for Texas and South Carolina fish, 531 mm TL (Harrington et al. 1979)).

As neither geographic population exhibited a clear advantage in growth, production or survival, no recommendation to stock one group in preference to the other can be made at this time.

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Table 1. Lengths and weights of South Carolina and Texas red drum during long-term growth trial. Dates listed are either pond harvest dates or dates at which fish held in indoor tanks were last sampled.

Harvest or sample date	Age (days)	Group	No.	Standard length (mm)		Weight (g)	
				mean	t-statistic	mean	t-statistic
05 Jun 1986 <sup>a</sup>	34	Texas	100	23 ± 1.5		0.24 ± 0.05	
10 Jun <sup>a</sup>	37	South Carolina	100	25 ± 1.3	13.503**	0.30 ± 0.05	8.296**
19 Nov 1986 <sup>a</sup>	207	Texas	100	209 ± 36.5		157 ± 69.4	
18 Nov <sup>a</sup>	204	South Carolina	100	197 ± 45.0	2.067*	161 ± 89.6	0.414
23 Mar 1987 <sup>b</sup>	338	Texas	64	305 ± 34.7		483 ± 145.0	
23 Mar <sup>b</sup>	336	South Carolina	65	309 ± 39.2	0.625	482 ± 157.9	0.001
09 Nov 1987 <sup>a</sup>	569	Texas	53	331 ± 35.3		688 ± 253.1	
10 Nov <sup>a</sup>	568	South Carolina	57	360 ± 41.3	3.838**	828 ± 300.2	2.623*
13 Apr 1988 <sup>b</sup>	680	Texas	20	422 ± 21.4		1,612 ± 237.8	
13 Apr <sup>b</sup>	682	South Carolina	22	440 ± 20.0	2.820**	1,641 ± 311.1	0.347

<sup>a</sup> Pond harvest

<sup>b</sup> Tank sample

\* P < 0.05

\*\* P < 0.01



Table 2. Production and survival of South Carolina and Texas red drum at the end of each pond culture period.

Pond production period	Days in pond	Group	No. stocked	Weight stocked (kg)	Weight harvested (kg)	Production (kg/ha/day)	Survival (%)
May-Jun 1986	33	Texas	2,000,000	fry <sup>a</sup>	180.6	3.4	43.5
	37	South Carolina	300,000	fry <sup>a</sup>	66.0	8.7	75.3
Jun-Nov 1986	167	Texas	2,000	0.4	228.1	0.85	72.9
	161	South Carolina	2,000	0.6	221.3	0.86	68.6
Apr-Nov 1987	216	Texas	64	30.9	36.5	0.02	83.0
	217	South Carolina	64	31.4	47.2	0.05	89.0

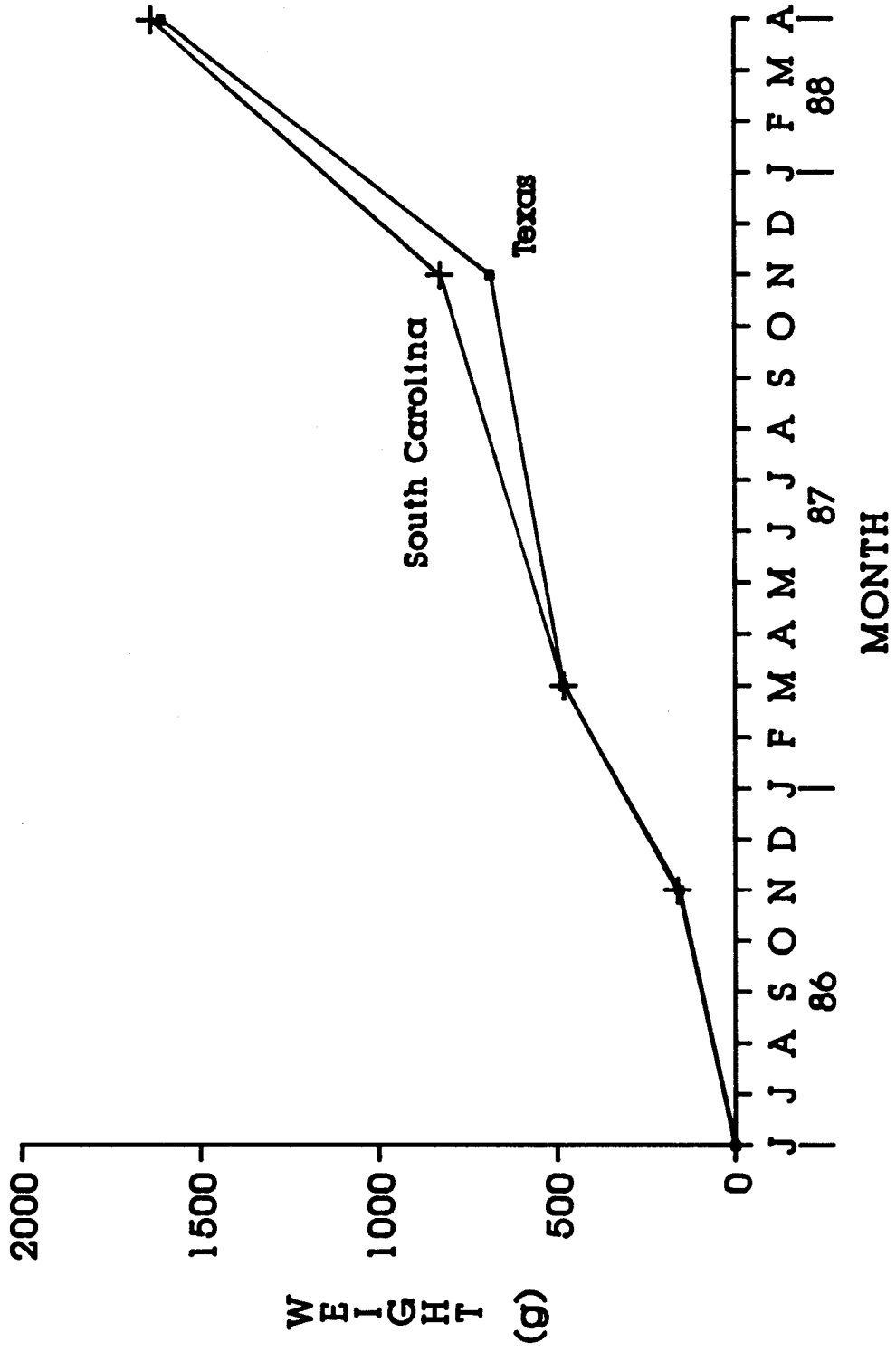
<sup>a</sup>Not weighed

Table 3. Mean ( $\pm$  SD) temperature, salinity, and dissolved oxygen values for the three pond production periods of the red drum long-term growth study.

Dates	Group	Temperature (C)		Salinity (o/oo)		Dissolved oxygen (mg/l)	
		mean	t-statistic	mean	t-statistic	mean	t-statistic
May-Jun 1986	Texas	24.8 $\pm$ 2.00	1.406	27 $\pm$ 0.83	-3.283**	4.0 $\pm$ 1.27	1.702
	South Carolina	25.5 $\pm$ 2.10		26 $\pm$ 1.21		4.6 $\pm$ 1.17	
Jun-Nov 1986	Texas	26.0 $\pm$ 3.98	0.978	30 $\pm$ 4.57	0.698	4.1 $\pm$ 1.43	1.055
	South Carolina	26.0 $\pm$ 3.97		30 $\pm$ 4.26		4.3 $\pm$ 1.26	
Apr-Nov 1987	Texas	25.1 $\pm$ 3.35	0.764	25 $\pm$ 4.84	-1.144	4.7 $\pm$ 1.22	0.454
	South Carolina	25.4 $\pm$ 3.49		25 $\pm$ 3.94		4.8 $\pm$ 1.22	

\*\* P<0.01

Figure 1. Mean weight (g) of South Carolina and Texas red drum from 34 to 680 days of age held in ponds and tanks.



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