Observations on Length and Gonadal Maturation of Young-of-the-Year Spotted Seatrout

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TEXAS PARKS & WILDLIFE

COASTAL FISHERIES DIVISION

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ABSTRACT

Six collections of young-of-the-year spotted seatrout (*Cynoscion nebulosus*) were made from 17 saltwater fish culture ponds between 1984 and 1988. Filling of ponds began between 3 April and 6 June of each year. All incoming water was filtered through a 6-mm mesh square filter so that only young-of-the-year fish could enter the ponds. Ponds were drained between 13 October and 15 November of each year. Two hundred and eleven spotted seatrout were recovered. Mean total length (TL) of females from the six collections ranged from 207 to 303 mm and males from 220 to 293 mm. Mean TL of the fish collected were generally greater than mean TL previously reported for age-1 spotted seatrout. The presence in the collections of a female with yolked eggs suggest spawning by some young-of-the year spotted seatrout may be possible.

INTRODUCTION

Estimated growth of spotted seatrout (Cynoscion nebulosus) has received considerable attention from fisheries scientists who have reported a wide range of lengths at first annulus formation. Pearson (1929), for example, reported mean total length (TL) of combined sexes of spotted seatrout from the mid-Texas coast as 147 mm at first annulus formation. Tabb (1961), however, reported a mean TL[1] of 200 mm for age-1 fish (combined sexes) from the Florida east coast and Wade (1984) reported Alabama fish averaged 270 mm TL. For separate sexes, mean TL of age-1 males from several areas of western Florida is reported to range from 143-159 mm, and females 145-161 mm (Klima and Tabb 1959, Moffett 1961). Mean TL of males and females from Galveston Bay, Texas, were reported to be 227 and 209 mm, respectively (Maceina et al. 1987), whereas one female was 363 mm TL at first annulus formation. Complicating estimations of length at first annulus formation is lack of known-age fish to confirm estimates.

From 1984 through 1988, 17 earthen ponds at the Perry R. Bass Marine Fisheries Station (MFRS) located on Matagorda Bay near Palacios, Texas, were used in studies of juvenile red drum (Sciaenops ocellatus), juvenile black drum (Pogonias cromis), juvenile hybrid black drum female X red drum male, (Procarione and Matlock 1990, Bumguardner et al 1992, Henderson-Arzapalo et al 1994) adult snook (Centropomis undecimalis)(TPWD unpublished data), or juvenile tarpon (Megalops atlanticus)(Gray and Colura 1992). All ponds were filled with bay water filtered through a 6-mm mesh screen. Because of the size of the filter, eggs and larvae of spotted seatrout could enter the pond while older individuals were excluded. These spotted seatrout were recovered when ponds were drained in the autumn of each year and provided a unique opportunity to document lengths of young-of-the-year spotted seatrout. The present report summarizes those observations.

METHODS

Spotted seatrout were collected on six occasions from the 17 ponds (Table 1). Three of the collections were made from 14 ponds in three replicated studies; six 0.2 hectare ponds in 1984 (Henderson-Arzapalo et al 1994); two 0.4 hectare ponds in 1987 (TPWD unpublished data); and six 0.2 hectare ponds in 1988(Bumguardner et al 1992). Ponds in the replicated studies received supplementary fill water to replace water lost to seepage and evaporation on the same dates from initial filling to draining. The remaining three collections were made from one 0.8 hectare pond in 1988 (Gray and Colura 1992) and two 1.6 hectare ponds in 1987 (Procarione and Matlock 1990). These three ponds were filled and drained individually.

Filling of ponds began between 3 April, and 6 June, of each year. Water was pumped from Matagorda Bay, using a 7.5 or 25 hp electrically powered turbine pump. All incoming water was filtered through a 6-mm square mesh filter screen before entering the pump. Filling was completed 3 to 51 days after filling began. Thereafter, ponds received additional water about once a week to replace water lost to seepage and evaporation. Spotted seatrout spawn from April to September in Matagorda Bay (Colura et al. 1988), therefore, young-of-the-year spotted seatrout could enter the pond from filling initiation to the end of the spawning season. Because of the filter size, fish older than young-of-the-year were excluded.

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[1]Standard lengths were reported by Klima and Tabb 1959, Tabb 1961, Moffett 1961, Overstreet 1983, and Brown-Peterson et al. 1988 and in the present report were converted to total lengths (TL) using TL = 11.804 + 1.138 SL (Harrington et al. 1979).

All ponds were stocked after filling with either juvenile (<300 mm TL) red drum, juvenile (<300 mm TL) black drum juvenile (<300 mm TL) hybrid black drum female X red drum male , adult (>400 mm TL) snook, or juvenile (700 - 900 mm TL) tarpon. No spotted seatrout were stocked. Stocked fish were fed dead mullet (Mugil spp.), gizzard shad (Dorosoma cepedianum), shrimp (Penaeus spp.) or a commercial salmon feed five to seven days per week. In addition, supplemental pumping resulted in the introduction of live prey species, primarily shrimps (Penaeus spp. and Palemonetes spp.), silversides (Menidia spp.), bay anchovies (Anchoa mitchilli) and blue crabs (Callinectes sapidus).

Ponds were drained between 13 October and 15 November of each year and stocked fishes were recovered. After removing stocked species, spotted seatrout found were placed on ice and transported to the laboratory where TL (nearest mm) of each fish was measured, sex determined and gonadal development classified by macroscopic appearance according to Tabb (1961). Mean (± SD) TL was calculated for each sex in each collection and a Kruskal-Wallis test performed to test for differences in TL between sexes within the six collections. Tests were considered significant at the $P \leq 0.05$ level. Statistical analysis was performed using the Statistical Analysis System, (SAS 1987).

RESULTS

Two hundred and eleven spotted seatrout were recovered from the 17 ponds. Of the fish recovered, 95 were females, 95 were males, and sex of 21 could not be determined. Mean TL of females from the six collections ranged 207 to 303 mm and males 220 to 293 mm (Table 1). Fish for which sex could not be determined were smaller than those that were identified, averaging 103 to 163 mm TL. Mean TL of both sexes generally increased with the length of time ponds were filled. However, the largest fish recovered, a 355 mm female, came from a pond that was filled for the shortest period (136 days). The largest males (309 mm) were collected from two ponds filled for the greatest period (221 and 222 days). Mean TL of males exceeded that of females in one collection but the difference was not significant. However, female mean TL was significantly greater than male mean TL in two of the collections (Collections 2 and 3, Table 1).

Gonads of both sexes were classified as immature except for the 355 mm female. Yolked eggs were present in this individual and the fish was classified as ripe.

DISCUSSION

The potential for growth of young-of-the-year spotted seatrout appears to be greater than reported in previous studies (Pearson 1929, Klima and Tabb 1959, Moffett 1960, Tabb 1961, Colura et al. 1984, Maceina et al. 1987). Furthermore, observed lengths probably underestimate lengths which young-of-the-year spotted seatrout can obtain. Green et al. (1990) estimated spotted seatrout growth in Texas slows due to cold temperatures and annulus formation presumably begins about 20 December of each year. Fish in the present inquiry were collected 35 to 69 days before 20 December suggesting additional growth is possible before annulus formation begins.

Observed mean lengths should not be viewed as representative of mean lengths of wild spotted seatrout populations near the end of the first season of growth. The long spawning season (April to September) characteristic of the species coupled with the potential for several spawning peaks within the season (Brown-Peterson et al. 1988,) probably serve to lessen mean lengths of age-1 wild populations. Greatest lengths observed, however, probably are representative of lengths that could be obtained by spotted seatrout spawned early in the spawning season. Ponds received the greatest volume of water during filling and because filling occurred in the first several months of the spawning season, fish had the greatest opportunity to enter the pond at that time. As such, lengths of fish collected probably represented that of early spawned fish and accounts for the preponderance of relatively large fish in the collections. Presence of these larger fish also may have limited survival of younger fish entering the pond later in the spawning season either through intraspecific competition or predation. The interspecific competition of the species stocked and spotted seatrout growth is unknown, but the addition of supplemental feeds may have contributed to increased growth.

Females are reported to grow larger than males by most investigators (Pearson 1929, Klima and Tabb 1959, Tabb 1961, Colura et al. 1984, Maceina et al. 1987). However, conflicting reports suggest there is little difference in growth between the sexes in young-of-the-year spotted seatrout. Greater TL of females at first annulus formation has been reported by Pearson 1929, Klima and Tabb 1959, Tabb 1961. Conversely, Moffett (1961) and Wade (1984) reported no difference in TL of either sex at age-1 and Maceina et al. (1987) found males to have a significantly greater TL at age-1 than females. In the present investigation some evidence of differential growth between the sexes was found but the trend was not strong. Female mean TL, although greater than that of males in 5 of the 6 collections, significantly exceeded that of males in only 2 collections and then by only 1-2 cm.

Presence of a ripe female in an October collection suggests some spawning by young-of-the-year spotted seatrout may be possible and maturity is a function of size rather than age. Spawning potential has been reported for age-1 fish (Sundararaj and Suttkus 1962, Brown et al. 1984, Colura et al. 1988) but not for young-of-the-year fish. Size is reported by Overstreet (1983) to influence sexual maturity of spotted seatrout. He additionally reported spawning potential was great for females greater than 262 mm TL. Similarly, all males greater than 240 mm TL are reported to be mature (Brown-Peterson et al. 1988). About 43% of the females and 58% of males recovered exceeded 262 and 240 mm TL respectively, some by as much as 60-90 mm. This implies more ripe fish may have been recovered if ponds had been drained in September, near the conclusion of the spawning season in the Matagorda Bay area, rather than in October or later when ripe females are seldom collected (Colura et al. 1988).

The spotted seatrout is one of the few species of fish that spends it's entire life in the unstable environment of an estuary (Tabb 1966). Species inhabiting unstable environments must be able to quickly re-establish their populations following catastrophic events or else face possible extinction should another catastrophic event occur (Hoenig and Gruber 1990). As such, the ability to grow rapidly and mature at a very young age may play a significant role in the spotted seatrout's ability to survive in an estuary. For example, estuarine populations of Gulf of Mexico spotted seatrout are periodically devastated by sudden freezes (Tabb 1966, Martin and McEachron 1995). Assuming no other factors are adversely affecting the remnant population (ie. overfishing, pollution, etc.), rapid growth and early maturation would allow the fish to quickly re-establish it's population following a killing freeze. Spawning by a portion of the young-of-the-year would allow for even quicker recovery. Further research on age at sexual maturity of spotted seatrout would be appropriate to determine if this occurs.

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Table 1. Summary of total length (TL) data from young-of-the-year spotted seatrout collected from earthen ponds and results of a Kruskal-Wallis test comparing total lengths of males and females from each collection. An asterisk denotes a significant χ^2 value at $P \leq 0.05$.

	Date (M-D-Y)		Sex Unidentified TL (mm)			Females TL (mm)			Males TL (mm)			
Collection	Filled	Drained	Mean±SD	Range	N	Mean±SD	Range	N	Mean±SD	Range	N	χ^2
1[a]	5-02-84	11-15-84	-	-	0	233±16	215-269	17	226±16	196-251	15	3.7132
2[b]	5-05-87	10-13-87	103±0	103-103	2	281±20	250-319	13	261±10	251-279	6	3.9426*
3[c]	4-03-87	11-10-87	-	-	0	303±14	261-321	15	293±17	244-309	16	4.7067*
4[c]	4-03-87	11-09-87	-	-	0	299±32	251-331	7	285±24	250-309	7	2.7653
5[a]	6-08-88	10-21-88	118±9	108-130	6	270±37	212-355	12	255±31	197-295	24	0.7330
6[d]	5-27-88	10-21-88	163±22	141-228	13	207±36	159-307	30	220±33	165-292	27	2.8440

[a]Collection from 6, 0.2 hectare ponds.
[b]Collection from 2, 0.4 hectare ponds.
[c]Collection from 1, 1.6 hectare pond.
[d]Collection from 1, 0.8 hectare pond.

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