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by Anne Henderson-Arzapalo, Robert L. Colura and Anthony F. Maciorowski

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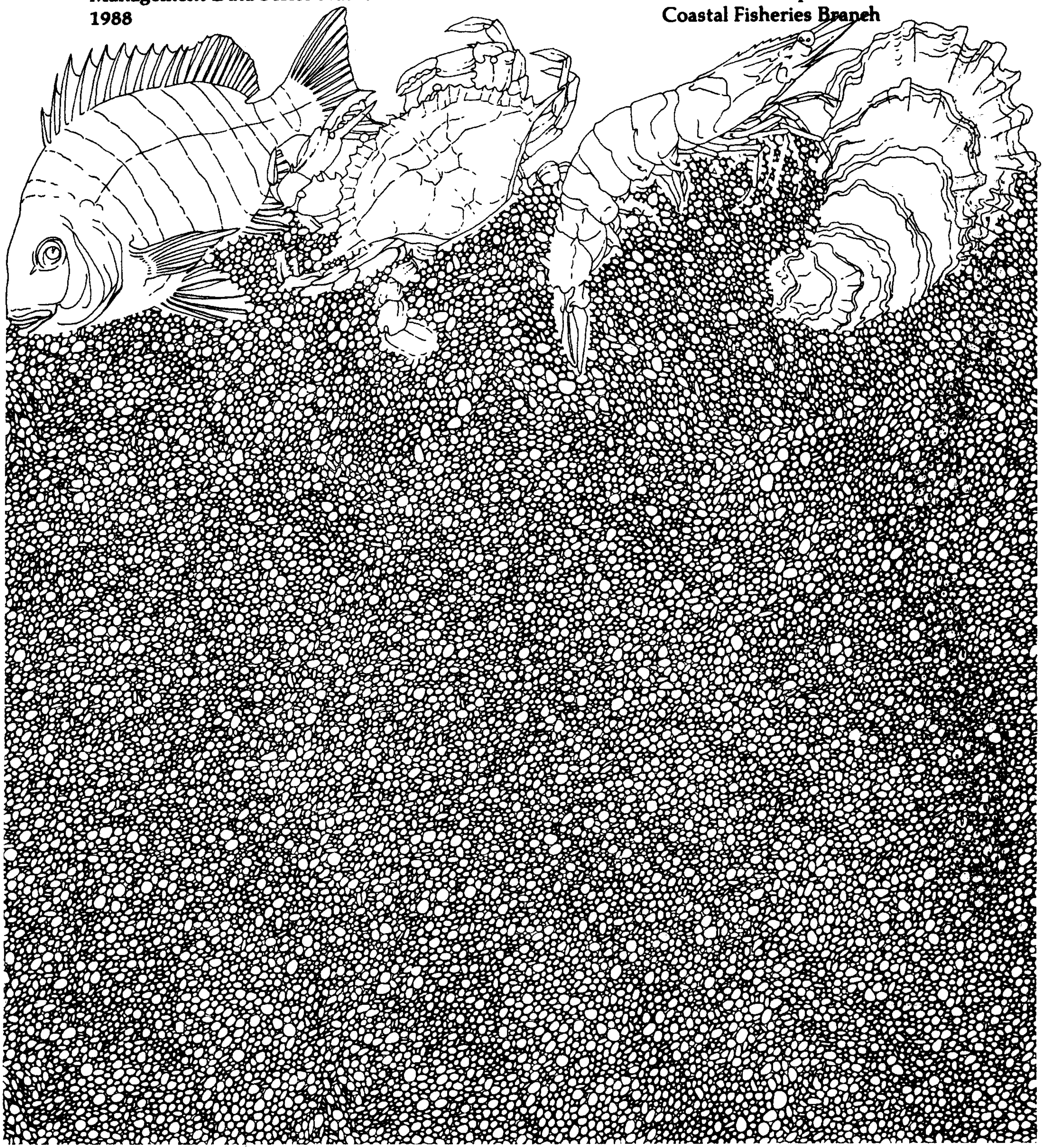

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ABSTRACT

Snook Centropomis undecimalis fingerling pond production was conducted during June-September 1986. The effect of reduced salinity on growth and survival of snook fingerlings in brackish water culture ponds was examined. Six 0.1-ha and three 0.2-ha ponds were fertilized and stocked with 34,000 and 314,000 fry/pond, respectively. Salinity was reduced from 34 to 11 o/oo over several days in three 0.1-ha ponds and all 0.2-ha ponds. Two-hundred and sixty-nine fingerlings were harvested from a single 0.2-ha pond on 25 September. No snook were recovered from the other ponds. Poor fingerling survival of snook precluded evaluation of reduced salinity on growth and production in culture ponds.

INTRODUCTION

The snook *Centropomus undecimalis* is a highly prized saltwater game fish in the southern United States, Caribbean and Mexico (La Monte 1952). Declining populations, coupled with value as a food and game species has intensified interest in the development of artificial spawning and hatchery production of snook in Texas and Florida (Maciorowski et al. 1986a; Daniel Roberts, Florida Department of Natural Resources, personal communication). Although pond culture experiments have demonstrated snook could be mass-reared in saltwater culture ponds, overall fry-to-fingerling survival averaged <14% in ponds ranging 20-48 o/oo salinity (Maciorowski et al. 1986a). Life history studies indicate juvenile snook as small as 11 mm standard length (SL) migrate into freshwater tributaries and marshes and remain in low salinity habitats until approximately 4 months old (Gilmore et al. 1983). Accordingly, high salinities were viewed as one possible cause for the low survival in previous pond culture studies. This study was conducted to determine whether reduced salinities would improve snook fingerling survival in culture ponds.

MATERIALS AND METHODS

Snook fry were obtained from the Florida Department of Natural Resources (FDNR), Marine Research Laboratory, St. Petersburg. Spawning, shipping, and egg incubation procedures were similar to those of Maciorowski et al. (1986a). Pond culture trials were performed at the Texas Parks and Wildlife Department (TPWD), Perry R. Bass Marine Fisheries Research Station (MFRS), Palacios, Texas. Trial 1 was conducted 11 July-20 August 1986 in six 0.1-ha ponds each of which received 34,000 fry on 24 July 1986. Trial 2 utilized three 0.2-ha ponds between 15 August-25 September 1986 and each pond received 314,000 fry on 24 August 1986. Fry enumeration and pond stocking procedures were similar to those of Bonn et al. (1976).

Ponds were prepared in advance by tilling and smoothing pond bottoms. Fertilization treatments are described in Table 1. The initial cottonseed meal application was spread on the dry pond bottoms. Ponds were filled with filtered saltwater (0.5-mm mesh) from Matagorda Bay, Texas. Fresh water from a well was used to adjust salinity. Fertilizer application was withheld if morning dissolved oxygen concentrations were below 2.0 mg/L.

Pond salinity was reduced in three of the six 0.1-ha ponds and all of the 0.2-ha ponds. A 5-cm diameter PVC siphon was used to reduce the water depth approximately 0.5 m. The pond was then refilled with freshwater. To prevent salinity stratification, a regenerative blower and a 5-cm diameter hose were used to mix ponds by aeration. For trial 1, salinity reduction was initiated 17 days after fry stocking (9 August) and salinity reduction for trial 2 was initiated 21 days after stocking (13 September). Ambient salinity prior to adjustment ranged 25-34 o/oo, and was reduced to 10-12 o/oo within 7-12 days.

Snook were sampled weekly by ichthyoplankton tows or dip net. A 0.15-mm mesh ichthyoplankton net was pulled across each pond at an oblique angle and the contents examined for fish. A 0.5-mm mesh dip net was also used to capture fish in the pond drain box. Trial 1 and 2 ponds were harvested after 28 and 33 days, respectively. Thirty fish were individually measured for standard length, total length and weighed.

Pond water quality was determined daily between 0730-0900 hours. Temperature was measured with a glass thermometer and salinity with an SCT meter (Model 33, Yellow Springs Instruments, Yellow Springs, Ohio). Dissolved oxygen was determined by the membrane electrode method (Model 51B, Yellow Springs Instruments, Yellow Springs, OH).

Zooplankton were sampled three times weekly using apparatus described by Farquhar and Geiger (1984). Twenty-five liters of pond water was pumped through a 64-μ mesh Wisconsin plankton net, and the zooplankton retained and preserved in 4% buffered formalin until analysis. Preserved samples were subsampled and counted using standard subsampling and counting techniques (Weber 1973; American Public Health Association et al. 1985).

RESULTS AND DISCUSSION

Poor survival of snook in all culture ponds precluded evaluation of the effect of salinity reduction on fingerling production. No fish were recovered from trial 1 ponds and definitive reasons for the complete mortality are unknown. Snook fry from the same spawns retained in intensive culture tanks at the FDNR Marine Research Laboratory died 30 h after hatching (Daniel Roberts, FDNR, personal communication). The fry appeared to exhaust their yolk reserve and could not remain bouyant. Fry stocked into culture ponds may have been similarly affected. Mean weekly salinity, temperature, and dissolved oxygen concentrations of trial 1 culture ponds are summarized in Table 2. Water quality was adequate throughout the culture period. Mean zooplankton densities are presented in Tables 3 and 4 and indicated sufficient forage should have existed for fry (Maciorowski et al. 1986b).

Snook were recovered from only a single trial 2 culture pond during weekly sampling, and 269 fingerlings were recovered at harvest on 25 September (Table 5). The growth rate during the culture period is shown in Figure 1. One 0.2-ha pond produced no fish and the mortality was presumably related to poor fry quality in conjunction with low dissolved oxygen concentrations which occurred several days after fry stocking (Table 6). The third pond contained 12,600 orangemouth corvina (Cynoscion xanthulus) fingerlings at harvest. The orangemouth corvina apparently entered from an adjacent pond through a leak in an abandoned 15-cm diameter pipe. The orangemouth corvina were stocked into the adjoining pond on 21 August and were probably present when the snook fry were stocked. Orangemouth corvina are highly predacious and presumably consumed the snook.

Zooplankton abundance in trial 2 ponds (Table 7) was lower than that normally encountered in pond production with other marine fish during the August-September period (Colura et al. 1976; Colura et al. 1986; Colura et al. 1987; Maciorowski et al. 1986b; McCarty et al. 1986). Snook fry were stocked 4-7 days after initial filling and insufficient forage may have resulted in poor survival. Previous saltwater pond culture studies suggest a 9-18 day period between pond filling and fry stocking is optimal for the development of peak copepod densities (Bonn et al. 1976; Colura and Matlock 1984; Colura et al. 1986a; Colura et al. 1987). Copepods are the primary forage organism for most predacious marine fish fry (May 1970; Houde 1972). Additionally, culture ponds had only been dry a short period before being refilled. Previous experience at the MFRS has shown culture ponds usually require 1-2 weeks to oxidize residual fertilizer on the dry pond bottom. Refilling ponds immediately after prior use often results in heavy filamentous algae growth and poor zooplankton production (Piper et al. 1982).

The poor snook fry-to-fingerling survival observed in the present study is less than the 14% average survival reported for previous snook pond production trials (Maciorowski et al. 1986a). One apparent problem was the difficulty in synchronizing snook spawning with pond preparation to allow maximum zooplankton development prior to fry stocking. Ideally, fertilized ponds should be stocked with fry when appropriately sized zooplankton forage organisms are undergoing peak reproduction (Geiger 1983a,b). However, ideal pond management practices are wholly dependent upon predictable spawning methods. As experience with snook spawning increases, predictable spawning should allow better use of pond management techniques. Such pond management practices should improve snook fry-to-fingerling survival as has been demonstrated for other predacious marine fishes such as red drum (McCarty et al. 1986) and spotted seatrout (Porter and Maciorowski 1984; Colura et al. 1986a).

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Table 1. Summary of pond preparation and fertilizer applications in snook production ponds in 1986. Cottonseed meal (41% protein) is denoted by CSM. Urea was applied as 45% dry granulated pellets and phosphoric acid (55% P_2O_5) as a liquid.

Trial	Pond number	Pond size (ha)	Date filled	Date stocked	Initial fertilizer application	Periodic fertilizer application
1	6	0.1	12 Jul	24 Jul	28.4 kg CSM 0.4 kg urea 1.0 L phosphoric acid	3.2 kg CSM[a] 0.4 kg urea[b] 1.0 L phosphoric acid[b]
2	3	0.2 0.2 0.2	22 Aug 22 Aug 18 Aug	24 Aug 24 Aug 24 Aug	56.8 kg CSM 0.9 kg urea 2.0 L phosphoric acid	6.4 kg CSM[c] 0.2 kg urea[d] 0.5 L phosphoric acid[d]

[a]applied on 21, 23, 25, 28, and 30 July and 1, 6, 11, and 13 Aug
[b]applied 1 Aug
[c]applied on 29 Aug and 1, 3, 5, 8, 10, 12, 15, 17, 19, and 22 Sep
[d]applied 29 Aug, and 5 and 12 Sep

Table 2. Mean (± SD) weekly water quality data from six 0.1-ha saltwater culture ponds (13 July-20 August 1986). Ponds were stocked 24 July with 34,000 fry/pond.

Salinity treatment replicate number	Week	Mean (± SD) salinity (o/oo)	Mean (± SD) temperature (C)	Mean (± SD) dissolved oxygen (mg/l)
Ambient	13-19 Jul	25.4 ± 0.8	29.3 ± 0.5	3.2 ± 1.5
1	20-26 Jul	28.1 ± 1.2	30.0 ± 0.0	3.2 ± 0.4
	27 Jul-02 Aug	30.0 ± 1.5	28.9 ± 0.7	3.3 ± 0.4
	03-09 Aug	32.6 ± 1.1	28.4 ± 0.5	3.0 ± 0.6
	10-16 Aug	33.3 ± 0.5	28.4 ± 0.5	2.8 ± 0.7
	17-20 Aug	33.5 ± 0.6	29.0 ± 0.8	2.1 ± 0.4
Ambient	13-19 Jul	25.4 ± 1.1	29.1 ± 0.4	3.1 ± 1.4
2	20-26 Jul	27.9 ± 1.2	29.9 ± 0.4	3.3 ± 0.5
	27 Jul-02 Aug	30.1 ± 1.5	29.1 ± 0.4	3.4 ± 0.3
	03-09 Aug	32.6 ± 0.5	28.6 ± 0.5	2.8 ± 1.3
	10-16-Aug	33.7 ± 0.5	28.6 ± 0.5	3.0 ± 0.6
	17-20 Aug	34.3 ± 0.5	28.8 ± 0.5	2.6 ± 0.4
Ambient	13-19 Jul	25.1 ± 0.7	29.6 ± 0.8	2.9 ± 1.3
3	20-26 Jul	28.4 ± 1.4	30.0 ± 0.0	3.4 ± 0.6
	27 Jul-02 Aug	29.6 ± 1.8	28.9 ± 0.7	3.7 ± 0.4
	03-09 Aug	32.6 ± 0.5	28.6 ± 0.5	3.3 ± 0.7
	10-16 Aug	33.1 ± 0.4	28.4 ± 0.5	3.1 ± 0.5
	17-20 Aug	33.3 ± 1.0	29.0 ± 0.8	3.0 ± 0.2
Reduced	13-19 Jul	25.3 ± 0.8	29.4 ± 0.5	3.0 ± 1.7
1	20-26 Jul	28.6 ± 1.6	30.0 ± 0.6	3.5 ± 0.4
	27 Jul-02 Aug	30.7 ± 1.4	28.9 ± 0.7	4.0 ± 0.4
	03-09 Aug	30.9 ± 4.9	28.7 ± 0.8	3.3 ± 0.9
	10-16 Aug	12.0 ± 4.8	28.7 ± 1.1	4.2 ± 0.9
	17-20 Aug	10.0 ± 0.0	29.0 ± 0.8	3.7 ± 0.5
Reduced	13-19 Jul	25.3 ± 0.8	29.4 ± 0.5	2.9 ± 1.5
2	20-26 Jul	28.3 ± 1.1	29.7 ± 0.8	3.3 ± 0.4
	27 Jul-02 Aug	29.6 ± 1.7	28.9 ± 0.7	3.6 ± 0.3
	03-09 Aug	31.1 ± 3.2	29.1 ± 1.1	3.6 ± 1.0
	10-16 Aug	12.1 ± 4.8	28.7 ± 0.8	4.2 ± 0.6
	17-20 Aug	11.0 ± 0.0	29.2 ± 0.5	3.3 ± 0.4
Reduced	13-19 Aug	25.1 ± 0.4	29.1 ± 0.4	3.3 ± 1.6
3	20-26 Jul	27.6 ± 1.1	30.0 ± 0.0	3.3 ± 0.9
	27 Jul-02 Aug	29.6 ± 1.5	29.1 ± 0.4	3.3 ± 0.3
	03-09 Aug	32.7 ± 1.0	29.3 ± 1.3	3.9 ± 0.7
	10-16 Aug	9.3 ± 0.5	28.4 ± 0.8	4.4 ± 0.7
	17-20 Aug	10.0 ± 0.0	28.8 ± 0.5	3.7 ± 0.5

Table 3. Mean (± SD) weekly zooplankton densities (organisms/liter) in three 0.1-ha salinity adjusted snook culture ponds during July and August 1986. Fry were stocked 24 July 1986. Pond salinity was reduced to approximately 10 o/oo beginning 9 August.

Week	n	Rotifers	Nauplii	Polychaete larvae	Calanoid copepods	Cyclopoid copepods	Harpacticoid copepods	Copepodids	Total zooplankton
14-18 Jul	3	3712 ± 5869	95 ± 84	5 ± 6	4 7	17 ± 14	156 ± 253	65 ± 58	4055 ± 6254
21-25 Jul	3	104 ± 123	202 ± 112	1 ± 2	131 ± 57	5 ± 4	472 ± 251	17 ± 27	933 ± 481
28 Jul-01 Aug	3	9 ± 4	177 ± 104	137 ± 60	76 ± 5	0	80 ± 25	3 ± 5	482 ± 81
04-08 Aug	3	71 ± 89	179 ± 219	429 ± 602	58 ± 51	3 ± 3	25 ± 10	1 ± 2	766 ± 922
11-15 Aug	3	22 ± 26	80 ± 36	109 ± 49	24 ± 17	1 ± 1	4 ± 4	0	243 ± 95
18 Aug	1	5	58	53	54	0	8	0	178
14-18 Jul	3	3685 ± 5845	170 ± 138	7 ± 6	4 ± 7	15 ± 8	43 ± 57	19 ± 19	3942 ± 6033
21-25 Jul	3	32 ± 48	223 ± 61	7 ± 6	127 ± 74	7 ± 8	764 ± 758	12 ± 7	1171 ± 637
28 Jul-01 Aug	3	1 ± 1	119 ± 5	245 ± 169	67 ± 19	0	75 ± 18	3 ± 4	513 ± 176
04-08 Aug	3	11 ± 11	94 ± 107	291 ± 81	32 ± 16	1 ± 1	25 ± 7	0	454 ± 197
11-15 Aug	3	10 ± 8	121 ± 57	263 ± 166	34 ± 10	0	3 ± 4	1 ± 1	432 ± 204
18 Aug	1	16	179	50	54	0	10	0	309
14-18 Jul	3	2656 ± 4018	55 ± 40	5 ± 5	4 ± 4	9 ± 0	21 ± 24	17 ± 30	2768 ± 4048
21-25 Jul	3	403 ± 670	659 ± 654	5 ± 9	75 ± 24	7 ± 8	257 ± 40	23 ± 29	1482 ± 1366
28 Jul-01 Aug	3	343 ± 286	91 ± 48	144 ± 82	96 ± 34	9 ± 16	49 ± 47	1 ± 1	733 ± 222
04-08 Aug	3	104 ± 92	167 ± 141	148 ± 48	38 ± 16	0	17 ± 10	1 ± 1	475 ± 124
11-15 Aug	3	25 ± 23	56 ± 27	134 ± 51	28 ± 22	0	19 ± 31	1 ± 2	263 ± 26
18 Aug	1	75	42	48	14	0	2	0	181

Table 4. Mean (± SD) weekly zooplankton densities (organisms/liter) in three 0.1-ha ambient salinity snook culture ponds during July and August 1986. Fry were stocked 24 July 1986. Ponds were maintained at ambient salinities between 25-34 o/oo.

Week	n	Rotifers	Nauplii	Polychaete larvae	Calanoid copepods	Cyclopoid copepods	Harpacticoid copepods	Copepodids	Total zooplankton
14-18 Jul	3	1,114 ± 18,498	89 ± 46	7 ± 8	6 ± 7	9 ± 10	46 ± 70	8 ± 14	11,326 ± 18,655
21-25 Jul	3	76 ± 114	231 ± 156	1 ± 2	105 ± 28	8 ± 4	640 ± 135	12 ± 7	1,073 ± 317
28 Jul-01 Aug	3	50 ± 16	264 ± 198	157 ± 126	101 ± 57	0	99 ± 40	1 ± 1	671 ± 359
04-08 Aug	3	42 ± 43	59 ± 23	270 ± 147	17 ± 13	0	17 ± 9	0	404 ± 192
11-15 Aug	3	55 ± 68	33 ± 16	163 ± 126	33 ± 6	1 ± 1	9 ± 2	0	294 ± 103
18 Aug	1	16	210	205	32	0	5	2	470
14-18 Jul	3	4,013 ± 6,328	96 ± 88	53 ± 58	5 ± 5	2 ± 24	27 ± 32	11 ± 15	4,229 ± 6,417
21-25 Jul	3	52 ± 80	279 ± 96	13 ± 12	97 ± 30	9 ± 8	335 ± 87	7 ± 2	792 ± 226
28 Jul-01 Aug	3	85 ± 134	297 ± 212	91 ± 53	70 ± 34	0	86 ± 26	1 ± 1	638 ± 213
04-08 Aug	3	18 ± 11	91 ± 72	136 ± 44	40 ± 25	0	7 ± 8	0	293 ± 112
11-15 Aug	3	100 ± 127	92 ± 55	25 ± 3	32 ± 25	4 ± 6	19 ± 9	0	272 ± 85
18 Aug	1	3	48	130	22	0	0	0	203
14-18 Jul	3	6,847 ± 11,353	59 ± 45	5 ± 6	7 ± 8	20 ± 14	21 ± 15	47 ± 64	7,005 ± 11,343
21-25 Jul	3	140 ± 225	666 ± 706	5 ± 9	25 ± 14	23 ± 15	263 ± 180	17 ± 12	1,139 ± 1,101
28 Jul-01 Aug	3	43 ± 23	75 ± 9	93 ± 26	33 ± 16	1 ± 1	31 ± 16	1 ± 1	276 ± 51
04-08 Aug	3	9 ± 8	195 ± 149	109 ± 91	57 ± 38	0	13 ± 7	1 ± 1	239 ± 76
11-15 Aug	3	29 ± 38	59 ± 21	99 ± 35	36 ± 12	0	3 ± 1	1 ± 1	227 ± 11
18 Aug	1	6	30	102	18	2	5	0	163

Table 5. Summary of harvest data from trial 2 0.2-ha snook culture ponds. Harvest occurred on 25 September 1986.

Pond	Total fertilizer applied	Production days	Number of fry stocked (10^3)	Number of fingerlings recovered	% survival	Mean (± SD) SL (mm)	Mean (± SD) TL (mm)	Mean (± SD) WT (g)
1	127 kg CSM 1.6 kg Urea 3.5 Phosphoric acid	32	314	0	0	--	--	--
2	127 kg CSM 1.6 kg urea 3.5 Phosphoric acid	32	314	[a]	0	--	--	--
3	127 kg CSM 1.6 kg Urea 3.5 Phosphoric acid	33	314	269	0.009	26.7 ± 1.2	34.0 ± 1.7	0.34 ± 1.7

[a] 12,600 orangemouth corvina (*Cynoscion xanthulus*) were recovered from this pond at harvest. The corvina were stocked into adjoining pond on 21 August. Corvina entered the snook culture pond through an abandoned pipe discovered at harvest.

Table 6. Weekly mean (± SD) water quality characteristics for 0.2-ha snook production ponds used in August and September 1986. Date of fry stocking was 24 August.

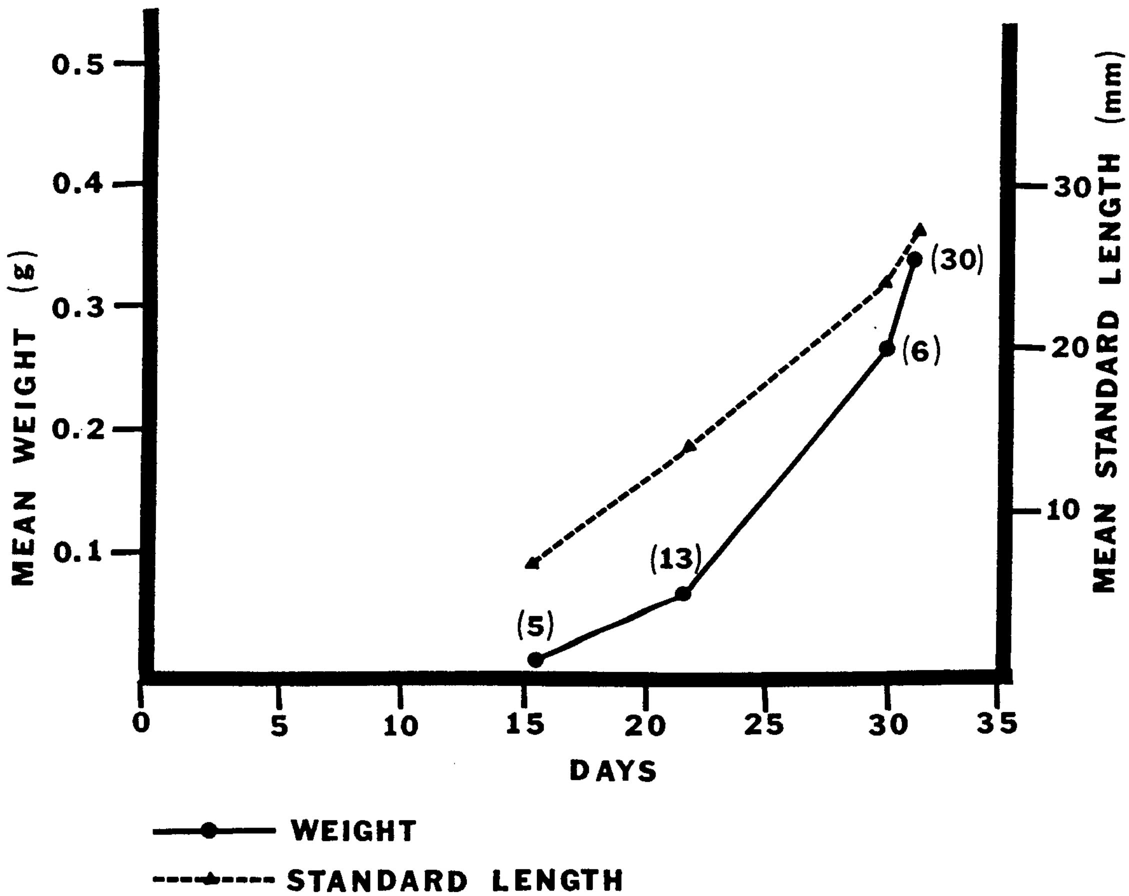
Pond number	Date	Temperature (C)	Salinity (mm)	Dissolved oxygen (mg/l)
1	20-23 Aug	27.8 ± 2.1	27.3 ± 0.5	2.4 ± 0.5[a]
	24-30 Aug	27.1 ± 1.6	25.9 ± 2.2	4.5 ± 1.0
	31 Aug-09 Sep	27.0 ± 1.0	27.6 ± 0.5	3.9 ± 0.4
	07-13 Sep	27.3 ± 1.0	27.6 ± 0.8	3.6 ± 0.7
	14-20 Sep	27.7 ± 0.5	salinity change	4.8 ± 1.0
	21-25 Sep	27.4 ± 0.5	13.6 ± 0.5	5.6 ± 0.7
2	25-30 Sep	26.8 ± 1.6	23.7 ± 2.9	2.8 ± 1.3
	31 Aug-06 Sep	27.0 ± 1.0	26.4 ± 0.5	3.7 ± 0.2
	07-13 Sep	27.3 ± 1.0	26.3 ± 0.8	5.2 ± 1.1
	14-20 Sep	27.7 ± 0.5	salinity change	4.6 ± 0.7
	21-24 Sep	27.5 ± 0.6	10.5 ± 0.6	5.9 ± 0.9
3	25-30 Aug	27.0 ± 1.7	23.7 ± 2.5	3.8 ± 1.3
	31 Aug-06 Sep	27.0 ± 1.0	26.4 ± 0.5	3.7 ± 0.3
	07-13 Sep	27.3 ± 1.0	25.7 ± 1.8	4.5 ± 0.8
	14-20 Sep	27.7 ± 0.5	salinity change	5.5 ± 0.4
	21-24 Sep	27.5 ± 0.6	salinity change	6.2 ± 0.3

[a]Three consecutive days of oxygen concentrations <2.0 mg/l. Water was exchanged.

Table 7. Mean (± SD) weekly zooplankton densities (organisms/liter) in trial 2 snook culture ponds August-September 1986. Ponds were stocked 24 August 1986.

Pond	Week	n	Rotifers	Nauplii	Polychaete larvae	Calanoid copepods	Cyclopoid copepods	Harpacticoid copepods	Copepodids	Total zooplankton
1	27 Aug-1 Sep	3	450 ± 358	193 ± 102	0	36 ± 62	97 ± 117	60 ± 75	1 ± 1	837 ± 324
	03-08 Sep	3	431 ± 483	71 ± 106	0	74 ± 82	114 ± 31	405 ± 159	0	1189 ± 382
	10-15 Sep	3	3 ± 1	59 ± 45	25 ± 27	28 ± 24	14 ± 9	6 ± 5	0	134 ± 94
	17-22 Sep	3	1 ± 1	38 ± 10	27 ± 33	39 ± 8	13 ± 12	1 ± 1	0	119 ± 30
2	27 Aug-1 Sep	3	907 ± 663	375 ± 194	3 ± 2	65 ± 25	6 ± 5	206 ± 246	15 ± 22	1577 ± 543
	03-08 Sep	3	377 ± 240	49 ± 12	107 ± 150	92 ± 69	13 ± 16	262 ± 168	43 ± 36	944 ± 378
	10-15 Sep	3	35 ± 5	50 ± 43	262 ± 87	80 ± 62	0	7 ± 3	5 ± 5	439 ± 81
	17-22 Sep	3	110 ± 6	78 ± 47	227 ± 127	47 ± 27	0	1 ± 1	1 ± 1	465 ± 150
3	18-22 Aug	3	203 ± 158	217 ± 152	8 ± 9	23 ± 24	11 ± 2	15 ± 9	5 ± 5	511 ± 275
	25-29 Aug	3	77 ± 97	187 ± 59	9 ± 13	117 ± 152	45 ± 51	161 ± 116	23 ± 14	619 ± 88
	01-05 Sep	3	28 ± 28	145 ± 169	381 ± 304	231 ± 231	5 ± 5	33 ± 6	14 ± 23	822 ± 594
	08-12 Sep	3	19 ± 19	124 ± 98	758 ± 626	63 ± 42	2 ± 2	5 ± 4	3 ± 4	974 ± 624
	15-19 Sep	3	10 ± 10	29 ± 16	123 ± 49	86 ± 64	0	0	1 ± 2	249 ± 101
	22-24 Sep	2	19 ± 7	193 ± 132	377 ± 106	26 ± 11	0	0	3 ± 2	610 ± 6

Figure 1. Mean weight and mean standard length of pond reared snook sampled between 24 August to 25 September 1986. The horizontal axis represents the number of days after fry stocking, the vertical axis indicates the mean weight and mean standard length. Numbers in parentheses are sample sizes.


0.5
0.4
0.3
0.2
0.1
MEAN WEIGHT (g)
30
20
10
MEAN STANDARD LENGTH (mm)
(5)
(13)
(6)
(30)
0
5
10
15
20
25
30
35
DAYS
WEIGHT
STANDARD LENGTH

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