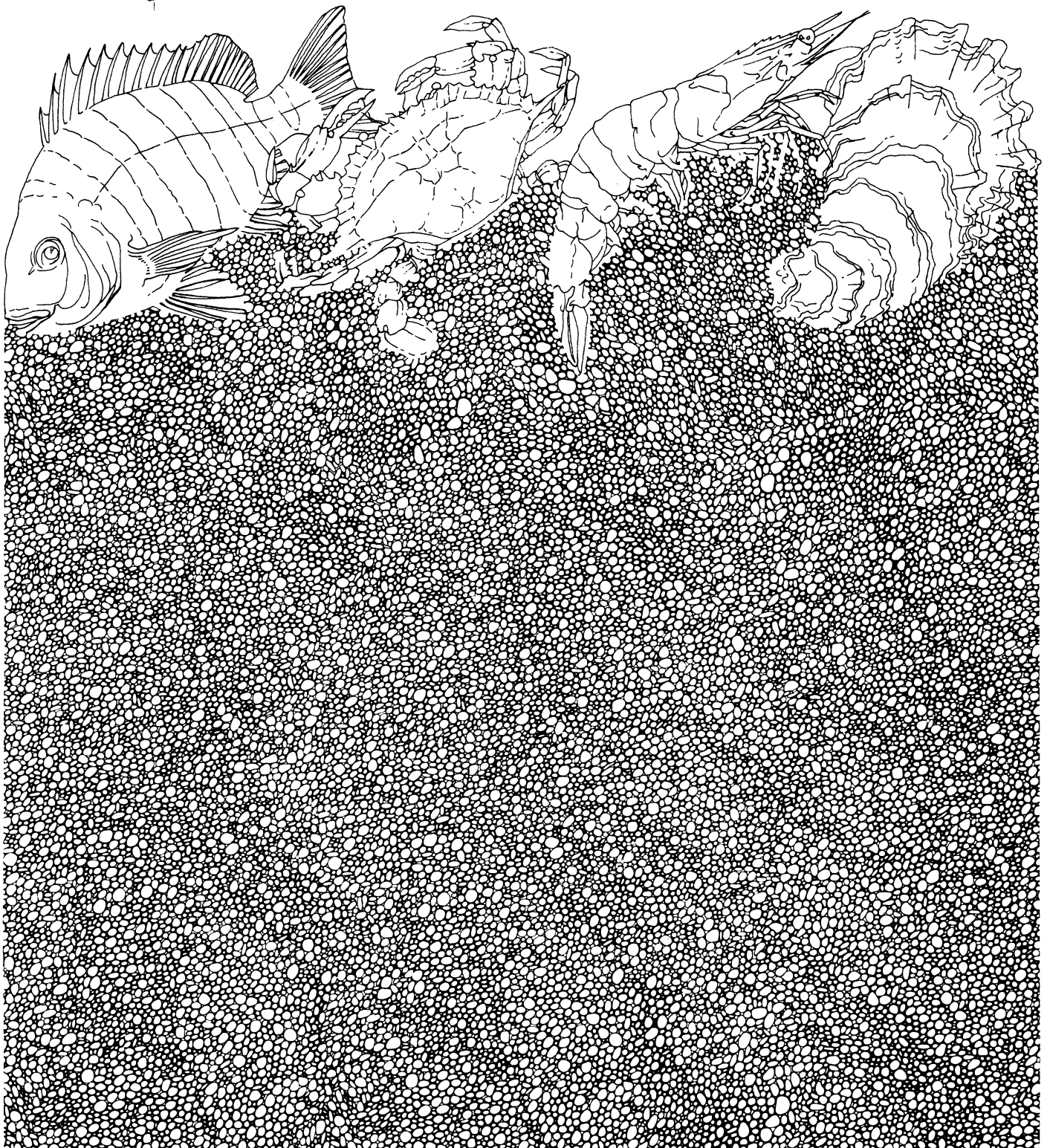


Survival of Three Fishes Caught on Trotlines

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Management Data Series Number 111
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Texas Parks and Wildlife Department
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ABSTRACT

Most (>60%) black drum (Pogonis cromis), red drum (Sciaenops ocellatus), and spotted seatrout (Cynoscion nebulosus) taken off trotlines while alive will survive if they are released back into the water. No black drum, red drum, or spotted seatrout died in 48-h winter cage studies in the Laguna Madre. Survival during summer was 67%, 100% and 64% for black drum, red drum, and spotted seatrout, respectively. The majority of all fishes taken off Texas Parks and Wildlife Department trotlines were alive regardless of position of line or bait used. This was expected because most fish were hooked in the lip or mouth. The percentage of spotted seatrout found alive on trotlines was lower than for black drum, and red drum because more spotted seatrout were hooked somewhere other than the lip or mouth. Spotted seatrout populations could be adversely impacted if trotline methods are used that catch spotted seatrout in high numbers during summer.

INTRODUCTION

An extensive trotline fishery developed in the Laguna Madre in the early 1950's (Simmons and Breuer 1962). By 1980 the Laguna Madre produced over 50% of Texas' reported commercial finfish landings; red drum (Sciaenops ocellatus) and spotted seatrout (Cynoscion nebulosus) were targeted species (Hamilton 1981). Attempts to regulate this fishery failed, so the sale of these two species was prohibited in 1981 (Matlock 1982). However, commercial trotlining continued with the fishery directed at black drum (Pogonias cromis). Red drum and spotted seatrout caught incidental to black drum could not be retained. In an effort to increase survival of released fish, a circle hook-only restriction was enacted in 1984, but survival data on trotline caught and released fish were not available. McEachron et al. (1985) examined survival in fall 1985 using hook location as a proxy. However, the study was conducted only in the fall, and the assumption that a foul hooked fish would have higher mortality than fish caught in the mouth or jaw had not been verified.

This study was conducted to determine if black drum, red drum and spotted seatrout survive capture and subsequent release off trotlines.

METHODS AND MATERIALS

To examine survival of black drum, red drum, and spotted seatrout, the Texas Parks and Wildlife Department (TPWD) simulated commercial trotline methods in the Laguna Madre (McEachron et al. In preparation). Catch and release survival was estimated by: 1) counting the number of dead fish after overnight trotline sets, 2) recording the location of hook penetration for each fish captured and 3) conducting 48-h cage studies during winter and summer.

The TPWD conducted a trotline study in the Laguna Madre during February 1985-January 1986 simulating commercial methods (McEachron et al. In preparation). Fish captured were recorded as dead or alive. Location of hook penetration for each fish captured was recorded in one of three categories: 1) hooked in lip, 2) hooked in mouth and 3) hooked elsewhere (gut, gill or exterior of fish). On-line survival (%) for each category, was determined for black drum, red drum, and spotted seatrout by combining all catches for each species. All healthy black drum, red drum, and spotted seatrout were tagged and released; days free and mean distance traveled (km) were determined for all recaptures.

Cage studies were conducted in both the upper and lower Laguna Madre during winter (February-March) and summer (July-August) 1985.

Fish were placed in two control and two test cages in each of winter and summer for red drum in both bay systems and for black drum in the lower Laguna Madre; not enough black drum were caught in the upper Laguna Madre during summer. No spotted seatrout were placed in control cages; control cage studies had been previously conducted (Hegen et al. 1982, Hegen et al. 1984). Cages were constructed of 4x4 cm mesh galvanized hardware cloth. Cages were 1.2 m long, 1.2 m wide and 0.4 m deep. Three to five fish were placed in each cage. Cages were checked at 24 and 48 h and all dead fish removed. Water temperature (C) and salinity (o/oo) were measured during each inspection. After the final inspection all healthy fish were tagged and released.

Control fish were caught on rod and reel or on attended trotlines. Fish were placed in cages with handling kept to a minimum.

Test fish were randomly selected from those caught on overnight trotline sets using methods described by McEachron et al. (1985). During this study only circle hooks were used. Trotlines were fished in two positions (top and bottom). Three baits were used: crab (Callinectes sp.), dead shrimp (Penaeus sp.) and oleander (Nerium sp.) leaves.

RESULTS

Most black drum, red drum, and spotted seatrout survive capture on trotlines and subsequent release. Black drum and red drum survive trotline capture better than spotted seatrout. None of the 325 black drum and only two of the 968 red drum captured during this study died on the trotlines. Of 127 spotted seatrout captured, 21 died on the trotlines; highest mortality (31%) occurred on top trotlines baited with leaves (Fig. 1). Most (86%) of the spotted seatrout mortalities occurred during the warm water months (May-October).

The majority (>62%) of all fishes caught on TPWD trotlines were hooked inside the mouth or in the lip regardless of bait or position fished (Figs. 2-4). The percentage of spotted seatrout hooked in the lip and mouth was generally lower (62-94%) than for black drum and red drum (97-100%), for corresponding baits and position of line.

In this study, no fish died in either test or control cages during winter and no red drum died during summer (Table 1). Mean survival of black drum during summer ranged from 67% to 100% for test and control cages, respectively (Table 1). Mean survival of spotted seatrout during summer ranged from 43% in the lower Laguna Madre to 50% in the upper Laguna Madre (Table 1).

Cage study water temperatures during winter ranged from 12.0 to 25.0 C and salinities ranged from 27.0 to 41.1 o/oo (Appendix A).

Summer water temperatures ranged from 28.0 to 31.0 C and salinities ranged from 34.0 to 39.0 C o/oo (Appendix A).

During this study, 139 black drum, 349 red drum, and 17 spotted seatrout were tagged and released off trotlines (Table 2). As of May 1986 two black drum, 21 red drum, and two spotted seatrout had been recaptured (Table 2). Of these recaptures, both black drum, three red drum, and one spotted seatrout had been used in the cage study. The black drum in the upper Laguna Madre was free 12 d and the one in the lower Laguna Madre was free 437 d. The two tagged spotted seatrout were free (211 ± 10 d) approximately two times longer than the tagged red drum (Table 2). Tagged fishes in the upper Laguna Madre traveled greater distances (24-37 km) than did those in the lower Laguna Madre (0-6 km) between release and recapture (Table 2).

DISCUSSION

The current non-retention requirements will not eliminate mortality of red drum and spotted seatrout caught incidental to commercial trotlining for black drum. Red drum mortality was extremely low and the impact on this species will most likely be minimal. Since most commercial trotline operations now occur during winter and spring (TPWD unpublished data) spotted seatrout mortality should also be low.

It is possible that circle hooks are partially responsible for the high survival rates observed in this study, since most fish were hooked in the lip or mouth. The percentage of spotted seatrout hooked elsewhere (other than lip or mouth) was higher than for black drum or red drum. Mongillo (1984) reported that salmonid mortality from being hooked in areas other than the mouth or jaw (i.e. gill or eye) was 4 times higher.

Mortality due to cage construction is an inherent bias in any cage study. Boydstrum and Hopelain (1977), Moring (1982) and Hegen et al. (1982) reported fin erosion and scale detrition on fish held in cages. Two spotted seatrout which died during the cage study suffered extensive cuts and abrasions. All cage fish released during this study suffered some degree of hardware cloth abrasion.

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Table 1. Percent survival of trotline caught and control black drum, red drum and spotted seatrout held in wire cages in the Laguna Madre during winter and summer 1985. ND = no data.

Period	Area	Cage type	Black drum	Red drum	Spotted ^a seatrout
Winter	Upper Laguna Madre	Control	100	100	67
		Test	100	100	100
	Lower Laguna Madre	Control	100	100	100
		Test	100	100	100
	Combined	Control	100	100	86
		Test	100	100	100
Summer	Upper Laguna Madre	Control	ND	100	60
		Test	ND	100	50
	Lower Laguna Madre	Control	100	100	60
		Test	67	100	43
	Combined	Control	100	100	60
		Test	67	100	47

^aControl % obtained from Hegen et al. (1982, 1984)

Table 2. Number of trotline caught black drum, red drum and spotted seatrout tagged and recaptured (through May 1986) with corresponding mean number of days free (\pm 1SE) and mean distance traveled (km \pm 1SE) in the upper and lower Laguna Madre during February 1985–January 1986.

Area	Category	Black drum	Red drum	Spotted seatrout
Upper Laguna Madre				
	Tagged	48	147	9
	Recaptured	1	12	1
	Days free	12	121 \pm 21	201
	Distance traveled	37	30 \pm 8	24
Lower Laguna Madre				
	Tagged	91	202	8
	Recaptured	1	9	1
	Days free	437	102 \pm 20	221
	Distance traveled	3	6 \pm 3	0
Combined				
	Tagged	139	349	17
	Recaptured	2	21	2
	Days free	224 \pm 212	112 \pm 14	211 \pm 10
	Distance traveled	20 \pm 17	20 \pm 5	12 \pm 12

Figure 1. Block chart (with %) of spotted seatrout found alive and dead on trotlines by position (top, bottom) and bait (shrimp, crab, leaves).

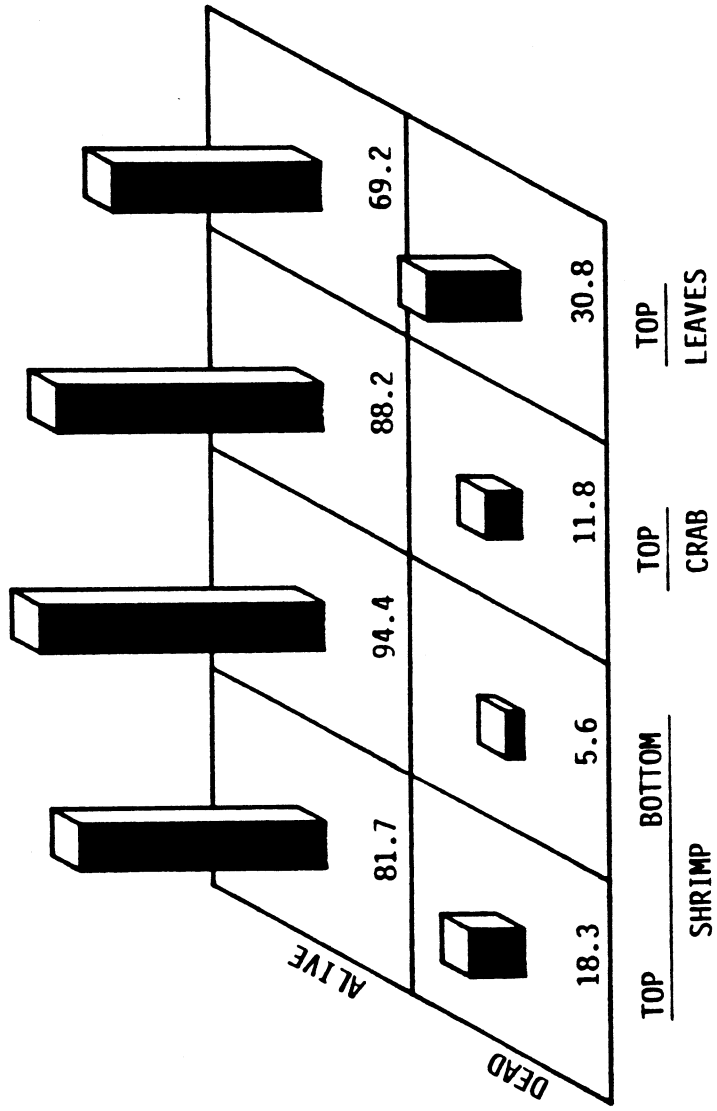


Figure 2. Block chart (with %) of place hooked (inside mouth, lip, elsewhere) by position (top vs bottom) and bait (shrimp, crab, leaves) for black drum.

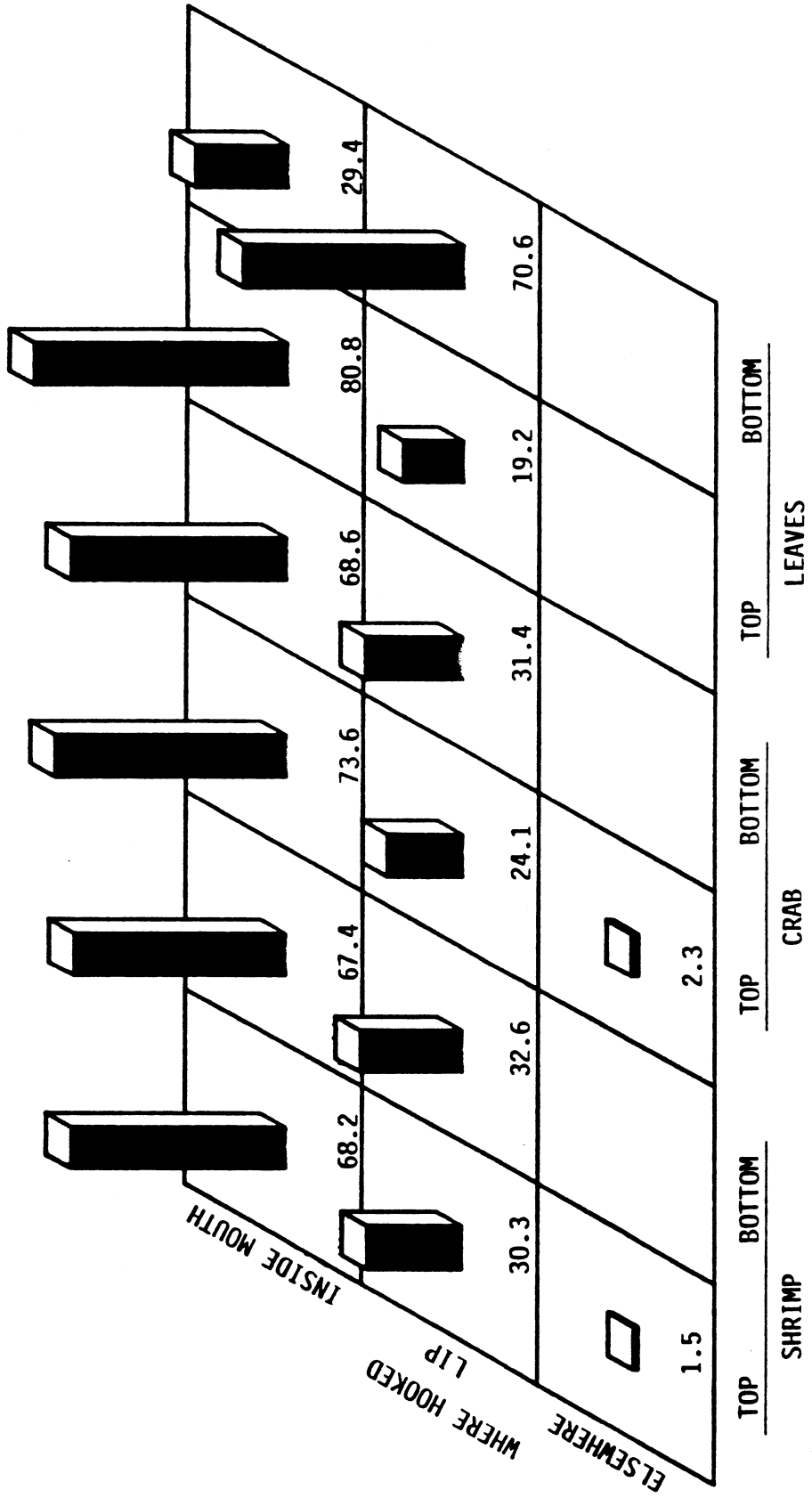


Figure 3. Block chart (with %) of place hooked (inside mouth, lip, elsewhere) by position (top vs bottom) and bait (shrimp, crab, leaves) for red drum.

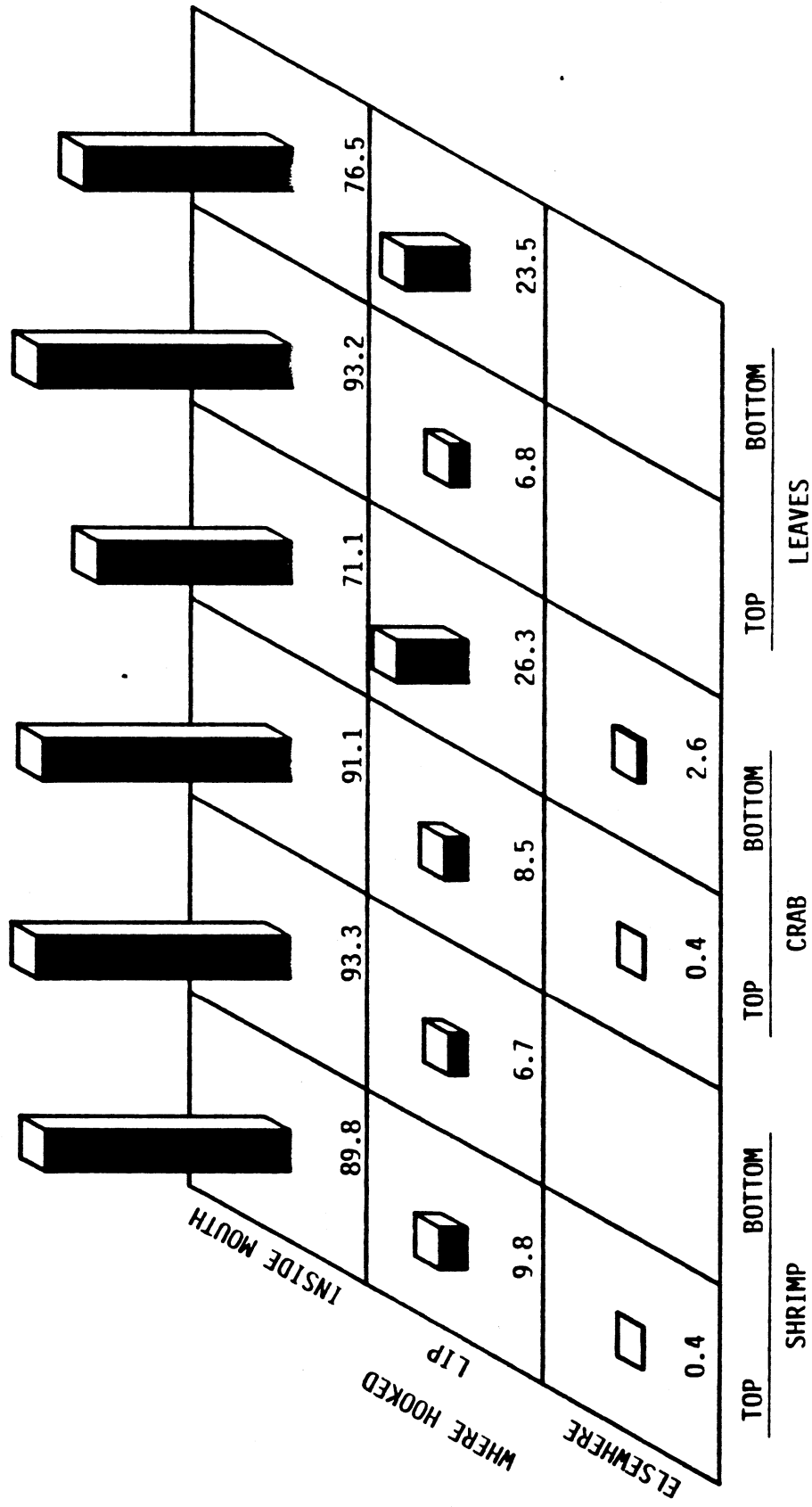
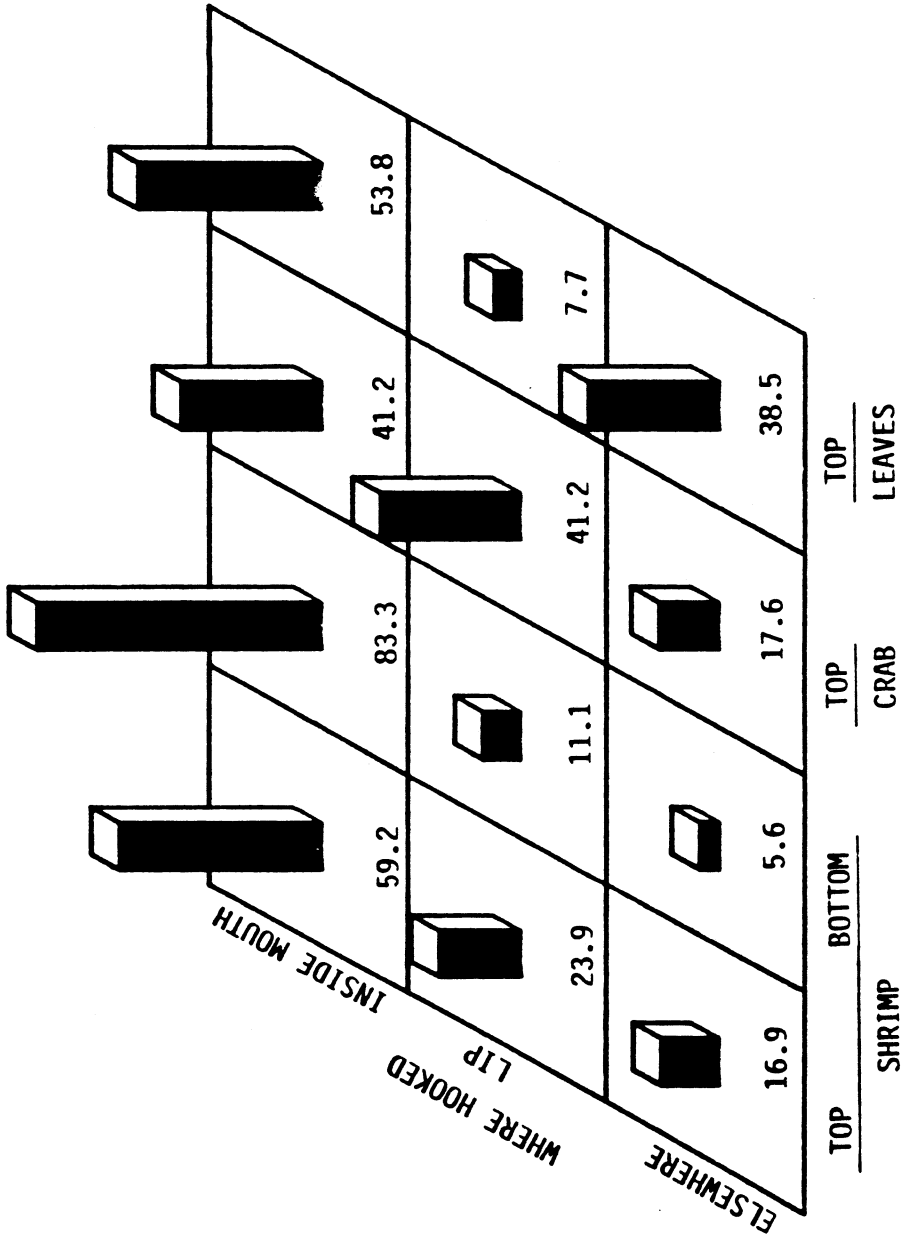


Figure 4. Block chart (with %) of place hooked (inside mouth, lip, elsewhere) by position (top vs bottom) and bait (shrimp, crab, leaves) for spotted seatrout.



Appendix A. Summary of results of cage studies conducted on black drum, red drum, and spotted seatrout during winter and summer 1985.

Table A.1. Total number of trotline caught and control black drum, red drum, and spotted seatrout alive in wire cages in the Laguna Madre with associated mean length ($\text{mm} \pm \text{1SE}$), water temperature and salinity during winter and summer 1985. ND = no data.

Species Period	Bay system	Date	Time	Hours in cage	Control (No.)	Test (No.)	Range (mm)	\bar{X} length (mm \pm 1SE)	Temperature (C)	Salinity (o/oo)
Black drum	Upper Laguna Madre	Feb 12	1500	0.0	2	ND	ND	ND	15.5	37.2
		13	1200	21.0	2	ND	ND	ND	ND	ND
		14	1200	45.0	3 ^a	ND	ND	ND	ND	ND
		15	1200	69.0	3	ND	ND	ND	ND	ND
		16	1336	94.6	3	ND	ND	ND	15.5	37.2
		Feb 13	1130	0.0	ND	5	405-616	466 \pm 38	12.0	41.1
	14	1200	24.5	ND	5	ND	ND	ND	ND	
	15	1140	48.2	ND	5	ND	ND	14.0	41.1	
	Feb 19	1600	0.0	4	ND	303-396	338 \pm 21	19.5	40.0	
	20	1200	20.0	4	ND	ND	ND	ND	ND	
	21	1200	44.0	4	ND	ND	ND	ND	ND	
	22	1310	69.2	4	ND	ND	ND	20.5	39.0	
	Feb 21	1200	0.0	ND	3	300-356	323 \pm 17	20.0	38.9	
	22	1200	24.0	ND	3	ND	ND	ND	ND	
	23	1248	48.8	ND	3	ND	ND	20.5	39.0	
	Lower Laguna Madre	Feb 12	1500	0.0	5	ND	371-560	508 \pm 35	14.0	30.0
13		1000	19.0	5	ND	ND	ND	13.5	30.0	
14		1000	43.0	5	ND	ND	ND	14.0	32.0	
15		1000	67.0	5	ND	ND	ND	13.5	30.0	
16	1000	91.0	5	ND	ND	ND	13.0	31.0		

Table A.1 (Cont'd.).

Species Period	Bay system	Date	Time	Hours in cage	Control (No.)	Test (No.)	Range (mm)	\bar{X} length (mm \pm 1SE)	Temperature (C)	Salinity (o/oo)	
Black drum (Cont'd.)	Lower Laguna Madre (Cont'd.)	Feb 13	1000	0.0	ND	5	535-656	593 \pm 19	13.5	30.0	
		14	1000	24.0	ND	5			14.0	32.0	
		15	1000	48.0	ND	5			13.5	30.0	
		16	1000	72.0	ND	5			13.0	31.0	
Black drum (Cont'd.)	Lower Laguna Madre	Jul 09	1445	0.0	4	ND	278-432	371 \pm 34	30.5	34.0	
		10	1445	24.0	4	ND			31.0	34.0	
		11	1500	48.1	4	ND			31.0	34.0	
Black drum (Cont'd.)	Lower Laguna Madre	Jul 10	1115	0.0	ND	3	360-455	408 \pm 48	28.0	34.0	
		11	1130	24.2	ND	3			28.0	34.0	
		12	1520	52.1	ND	2			31.0	35.0	
Red drum	Upper Laguna Madre	Feb 12	1500	0.0	5	ND	442-542	475 \pm 25	15.5	37.2	
		13	1200	21.0	5	ND			ND	ND	
		14	1200	45.0	5	ND			ND	ND	
		15	1341	70.7	5	ND			15.5	37.2	
		Feb 13	1045	0.0	ND	5			425-522	470 \pm 21	41.1
Red drum	Upper Laguna Madre	Feb 14	1200	25.3	ND	5			ND	ND	
		15	1140	48.9	ND	5			14.0	41.1	
		Feb 19	1600	0.0	5	ND			427-515	461 \pm 16	40.0
		20	1200	20.0	5	ND				ND	ND
		21	1200	44.0	5	ND				ND	ND
Red drum	Upper Laguna Madre	Feb 22	1310	69.2	5				20.5	39.0	

Table A.1 (Cont'd.).

Species Period	Bay system	Date	Time	Hours in cage	Control (No.)	Test (No.)	Range (mm)	\bar{X} length (mm \pm 1SE)	Temperature (C)	Salinity (o/oo)	
Red drum (Cont'd.).											
Winter (Cont'd.).	Upper Laguna Madre (Cont'd.).	Feb 20	1240	0.0	ND	4	351-374	363 \pm 5	20.0	38.9	
		21	1200	23.3	ND	4			ND	ND	
		22	1248	48.1	ND	4			20.5	39.0	
	Lower Laguna Madre	Feb 12	1500	0.0	5	ND		433-580	510 \pm 28	14.0	30.0
		13	1000	19.0	5	ND				13.5	30.0
		14	1000	43.0	5	ND				14.0	32.0
		15	1000	67.0	5	ND			13.5	30.0	
		16	1000	91.0	5	ND			13.0	31.0	
		Feb 14	1000	0.0	ND	5	432-680	566 \pm 40	14.0	32.0	
		15	1000	24.0	ND	5			13.5	30.0	
		16	1000	48.0	ND	5			13.0	31.0	
		Feb 26	1745	0.0	5	ND	446-559	494 \pm 34	19.0	29.0	
		27	1000	15.3	5	ND			19.0	31.0	
		28	1250	42.1	5	ND			18.0	30.0	
		Mar 01	1030	62.8	5	ND			18.5	27.5	
		Feb 27	1000	0.0	ND	5	411-586	466 \pm 32	19.0	31.0	
		28	1250	26.8	ND	5			18.0	30.0	
		Mar 01	1030	48.5	ND	5			18.5	27.5	
Summer	Upper Laguna Madre	Jul 16	1800	0.0	5	ND	286-522	459 \pm 47	31.0	35.5	
		17	1000	16.0	5	ND			28.5	35.5	
		18	0910	39.2	5	ND			29.0	35.5	
		19	1100	65.0	5	ND			29.0	36.1	

Table A.1 (Cont'd.).

Species Period	Bay system	Date	Time	Hours in cage	Control (No.)	Test (No.)	Range (mm)	\bar{X} length (mm \pm ISE)	Temperature (C)	Salinity (o/oo)
Red drum (Cont'd.).	Upper Laguna Madre (Cont'd.).	Jul 17	1000	0.0	3	ND	519-442	460 \pm 30	28.5	35.5
		18	0910	23.2	3	ND			29.0	35.5
		19	1100	49.0	3	ND			29.0	36.1
	Jul 17	1000	0.0	ND	3	504-718	611 \pm 107	28.5	35.5	
	18	0910	23.2	ND	3			29.0	35.5	
	19	1100	49.0	ND	3			29.0	36.1	
	Jul 18	0910	0.0	ND	5	504-740	628 \pm 51	29.0	35.5	
	19	1100	25.8	ND	5			29.0	36.1	
	20	0915	48.1	ND	5			28.0	36.6	
Lower Laguna Madre	Jul 09	1445	0.0	4	ND	483-635	570 \pm 32	30.5	34.0	
	10	1445	24.0	4	ND			31.0	34.0	
	11	1500	48.1	4	ND			31.0	34.0	
	Jul 09	1445	0.0	5	ND	430-657	544 \pm 36	30.5	34.0	
	10	1445	24.0	5	ND			31.0	34.0	
	11	1500	48.1	5	ND			31.0	34.0	
	Jul 10	1115	0.0	ND	5	425-690	364 \pm 56	28.0	34.0	
	11	1130	24.2	ND	5			28.0	34.0	
	12	1520	52.1	ND	5			31.0	35.0	
	Jul 10	1115	0.0	ND	5	408-569	470 \pm 30	28.0	34.0	
	11	1130	24.2	ND	5			28.0	34.0	
	12	1520	52.1	ND	5			31.0	35.0	

Table A.1 (Cont'd.).

Species Period	Bay system	Date	Time	Hours in cage	Control (No.)	Test (No.)	Range (mm)	\bar{X} length (mm \pm ISE)	Temperature (C)	Salinity (o/oo)
Spotted seatrout										
Winter	Upper Laguna Madre ^b	Feb 28	0900	0.0	ND	5	ND	ND	15.0	27.0
		Mar 01	1610	33.2	ND	5			15.5	27.0
		02	1200	51.0	ND	b			b	b
	Feb 28	0900	0.0	ND	5			ND	15.0	27.0
	Mar 01	1610	33.2	ND	5			ND	15.5	27.0
	02	1200	51.0	ND	b			ND	b	b
	Feb 13	1000	0.0	ND	5		272-360	328 \pm 15	13.5	30.0
	14	1000	24.0	ND	5				14.0	32.0
	15	1000	48.0	ND	5				13.5	30.0
	16	1000	72.0	ND	5				13.0	31.0
Feb 27	1000	0.0	ND	3		356-427	406 \pm 35	19.0	31.0	
28	1250	26.8	ND	3				18.0	30.0	
Mar 01	1030	48.5	ND	3				18.5	27.5	
Summer	Upper Laguna Madre	Jul 31	1000	0.0	ND	5	315-380	344 \pm 12	30.0	37.8
		Aug 01	1000	24.0	ND	4			29.0	38.9
		02	1000	48.0	ND	1			30.0	37.8
	Jul 31	1000	0.0	ND	5		290-399	298 \pm 12	30.0	37.8
	Aug 01	1000	24.0	ND	4				29.0	38.9
	02	1000	48.0	ND	4				30.0	37.8
	Aug 02	1020	0.0	ND	4		335-598	438 \pm 57	28.0	38.0
	03	1020	24.0	ND	2				ND	ND
	04	1030	48.2	ND	2				29.0	39.0

Table A.1 (Cont'd.).

Species Period	Bay system	Date	Time	Hours in cage	Control (No.)	Test (No.)	Range (mm)	\bar{X} length (mm \pm 1SE)	Temperature (C)	Salinity (o/oo)
Spotted seatrout (Cont'd.).										
Summer (Cont'd.).	Lower Laguna Madre (Cont'd.).	Aug 02 03 04	1020 1020 1030	0.0 24.0 48.1	ND ND ND	3 1 1	423-452	440 \pm 9	28.0 ND 29.0	38.0 ND 39.0

^aOne black drum was caught on February 14 and added to cage.

^bAll spotted seatrout were stolen sometime between 1610 on 1 March and 1200 on 2 March.

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