

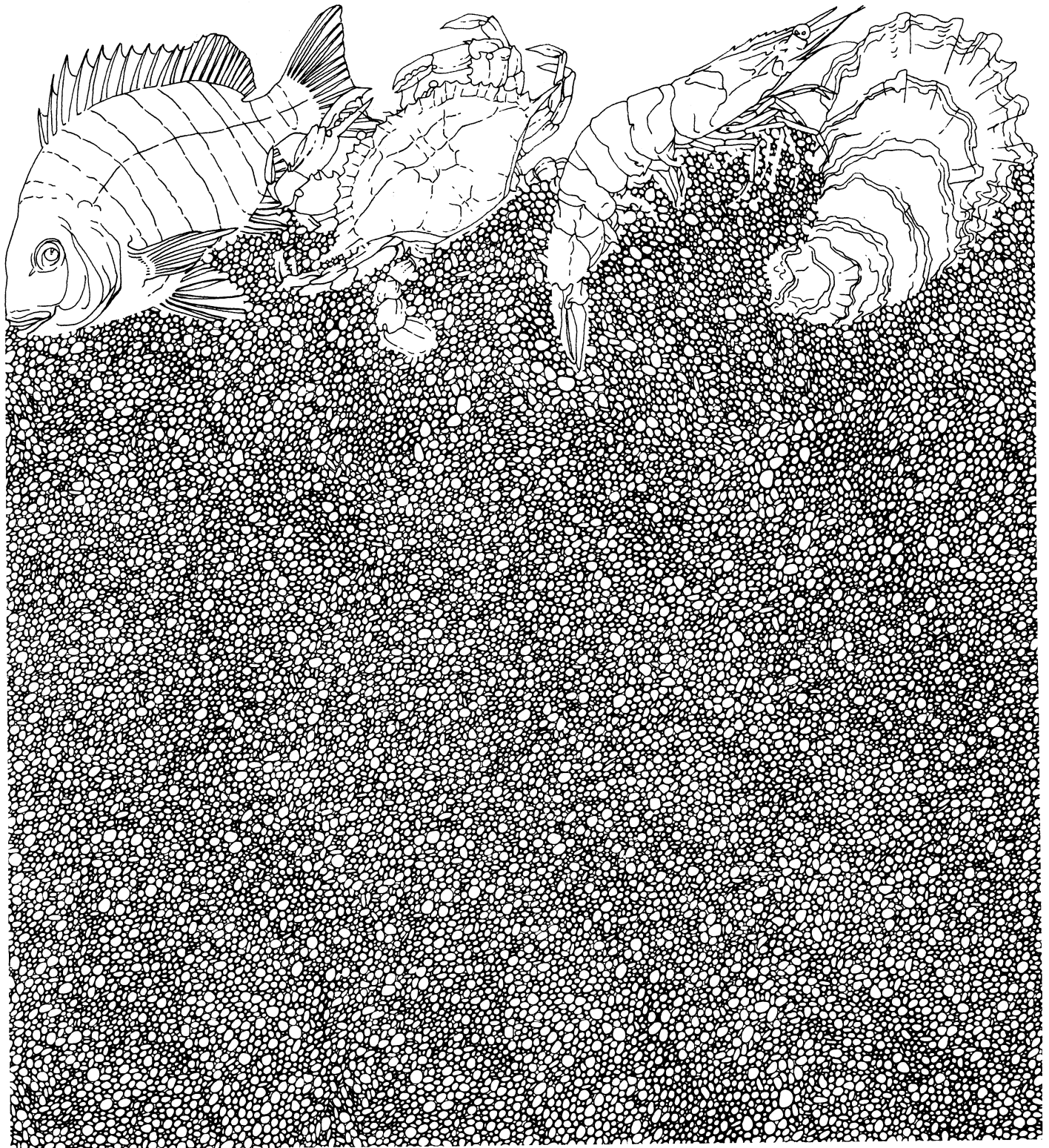
Paul Hammerschmidt

A Comparison of Trotline Catches On Two Hook Types in the Laguna Madre

by L.W. McEachron, A.W. Green, G.C. Matlock, and G.E. Saul

Management Data Series Number 86
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Texas Parks and Wildlife Department
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IN THE LAGUNA MADRE

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Texas Parks and Wildlife Department
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ABSTRACT

Circle hooks caught 3.3 times more fish of each species than straight-shank hooks. The proportion of each species caught on circle and straight-shank hooks was similar. Circle hooks caught smaller (younger) red drum and black drum than did straight-shank hooks. Because circle hooks catch more red drum and black drum, the potential for mortality by hooking fish in locations other than in the lip is as great for circle hooks as it is for straight-shank hooks.

INTRODUCTION

Trotlines and hook and line are the only legal gears for taking fish in the Laguna Madre of Texas, and trotlines have accounted for the majority of the reported commercial fish landings (Simmons and Breuer 1962; Breuer 1973, 1974, 1975; Matlock 1980). Red drum (Sciaenops ocellatus), spotted seatrout (Cynoscion nebulosus), and black drum (Pogonias cromis) were species targeted by trotline fishermen until 1981 when the sale of red drum and spotted seatrout was prohibited (Osburn et al. 1985).

Prior to 1981, harvest was regulated through gear, area and time restrictions (Anonymous 1979, 1981). Most of these regulations were designed to reduce catch of overfished red drum and spotted seatrout (Matlock et al. 1979; Anonymous 1979, 1981, 1983). Additional emergency regulations that included requiring all trotlines be placed on bottom were adopted by the Texas Parks and Wildlife Commission in January 1984 to offset a massive fish kill caused by record low temperatures (McEachron et al. 1984). Allowing bottom trotlines only should have reduced the catch of non-retainable red drum and spotted seatrout without reducing the black drum catch (McEachron et al. 1980). The bottom-only restriction was replaced in August 1984 with a circle hook-only restriction to accommodate commercial fishermen who argued that circle hooks would cause essentially no mortality of non-retainable red drum and spotted seatrout. However, no data on the relative catch or mortality for circle and straight-shank hooks in Texas bays were available.

This study was conducted to determine the difference in potential fishing mortality between circle hooks and straight-shank hooks.

MATERIALS AND METHODS

The catch on circle and straight-shank hooks was compared using trotlines fished by the Texas Parks and Wildlife Department (TPWD) in the same manner, places and times as those of commercial trotline fishermen. Relative mortality caused by the two hook types was estimated by comparing the percent of foul hooking (hooked in a site other than the lip) and assuming that foul hooking caused higher mortality of released fish than "lip hooking".

Ten trotlines, 182.9 m long with 50 circle and 50 straight-shank hooks each, were set in commercially fished areas in the upper and lower Laguna Madre (Figures 1 and 2) during 15 September-31 December 1984 (Appendix A). One or two 24-hour sets were made in each bay in each 2-week period each month except the scheduled September sets in lower Laguna Madre were made in October. Trotlines baited with cut blue crab (Callinectes sapidus) were attended at all times; they were rebaited the following sunset or sunrise. Lines were set in water at similar depths (top, mid or bottom) to commercial trotlines in the fished area. Commercial fishermen were contacted within 24 hours prior to TPWD sets to determine areas of commercial

activity and methods of setting.

Trotlines were built following commercial fishermen specifications (Appendix B). The mainline consisted of #36 nylon twine, knotted twice every 1.8 m for swivel placement. Each trotline contained 50 circle (#8 Mustad 39960 ST) and 50 straight-shank (7/0 Eagle Claw J) hooks (Figure 3) alternately attached by a staging to the mainline; hooks were 1.8 m apart. Each staging consisted of 56.7-kg test monofilament, 610-686 mm long, tied to a 1/0 black brass barrel swivel. Stakes (51 x 76 mm) and/or anchors were placed on each end to stretch the mainline tight. Floats (3.8-liter jugs) were attached to the mainline approximately every 15 hooks for navigation identification.

Fishes caught were identified to species (Hoese and Moore 1977, Robins et al. 1980) and total length was measured to the nearest 1 mm. Location of hook penetration [lip, inside mouth, gill, gut (including throat) and snagged (exterior of fish)] for each fish caught was recorded by hook type.

Salinity (o/oo), water temperature (nearest C), dissolved oxygen (ppm) and turbidity (Jackson Turbidity Units) were measured each time a line was set or baited. Associated meteorological conditions such as wind speed and direction, cloud cover (%) and barometric pressure (millibars) were also noted.

The relative catch efficiency of circle and straight-shank hooks was evaluated by comparing the number of fish caught during both day and night by each hook type in both bays combined. No adjustment for fishing effort was needed because each hook type was fished equally in each area. The expected composition of each species in the catch on each hook type should be similar if each hook type had similar efficiencies. A test of independence (Sokal and Rohlf 1981) was used to determine if there were any significant differences among the proportions of each species caught by each hook type. This nonparametric technique was used because of unequal variances and severe skewness in the catch data. Data for each species or species group which were not different from each other were pooled. Red drum, black drum and hardhead catfish were tested using a chi-square statistic to determine if the numbers of fish caught on each hook type were statistically equal.

An analysis of day and night catches was performed similarly to catch efficiency, except the expected frequencies of day and night catches were weighted by time. Night sets were 32% longer in duration than day sets.

The foul hooking tendency of each hook type was compared using a test of independence; data for both day and night were combined. The total number of fish that were captured by each hook type was placed in three categories: (1) hooked in the lip, (2) hooked in the mouth (including gills), (3) hooked elsewhere (gut or exterior of fish). Data were partitioned by species to determine whether the proportion of the total catch in each capture category was similar.

The relationship between hook type and fish size (mean total length)

was examined by species using analysis of variance (Sokal and Rohlf 1981). The analyses were done in two parts, thereby avoiding an unbalanced design which would have confounded results. The data were partitioned by bay system, hook type, and species in one analysis and by bay system, time period captured and species in another.

The significance of differences in all analyses was determined at $P < 0.05$. Only red drum, black drum and hardhead catfish (Arius felis) were caught in sufficient numbers to be included in all analyses.

RESULTS

Composition of the catches in the upper and lower Laguna Madre were different. Four species of fish were caught in upper Laguna Madre and 11 species were caught in lower Laguna Madre (Appendix C). Hardhead catfish constituted 95% of all fishes caught in upper Laguna Madre and 46% of all fishes caught in lower Laguna Madre (Appendix C). Most black drum (97%) and red drum (75%) were caught in lower Laguna Madre. Black drum and red drum constituted 26% and 17% of the lower Laguna Madre catch, respectively.

Circle hooks caught 3.3 times more fish than straight-shank hooks ($X^2 = 87.2$, d.f. = 1, $P < 0.05$, Appendix C). This was consistent among species during both day and night in both bays. Over 76% of red drum, black drum, and hardhead catfish were caught on circle hooks (Table 1). The proportion of each of these species in the total catch was not significantly different between hook types ($X^2 = 3.828$, d.f. = 2, $P > 0.05$).

Most of the black drum, red drum and hardhead catfish were caught during night (Table 2; $X^2 = 11.299$, d.f. = 2, $P < 0.05$). There was no difference between the proportion of red drum and black drum caught during night ($X^2 = 2.534$, d.f. = 1, $P > 0.05$). The combined proportion (77%, $N = 55$) of red drum and black drum caught at night was significantly greater ($X^2 = 12.131$, d.f. = 1, $P < 0.05$) than would be expected for the time that lines were fished at night.

The proportion of fish hooked in different areas (lip, mouth, or elsewhere) varied significantly among species (Table 3, Appendix D; $X^2 = 35.695$, d.f. = 4, $P < 0.05$) and between hook types ($X^2 = 75.650$, d.f. = 2, $P < 0.05$). However, the proportion of red drum and black drum hooked in different body areas was not significantly different from each other ($X^2 = 3.725$, d.f. = 2, $P > 0.05$). For red drum and black drum caught on circle hooks, 42% were caught in the lip and 57% in the mouth; 1% were hooked in some other part of the body. For straight-shank hooks, 18% were caught in the lip and 64% were caught in the mouth; 18% were hooked in some other part of the body. For hardhead catfish caught on circle hooks, 86% were caught in the mouth, whereas, for straight-shank hooks, 33% were caught in the mouth (Table 3).

Circle hooks caught larger hardhead catfish but smaller red drum and

black drum than did straight-shank hooks (Table 4; Appendix E). There was a significant interaction ($F = 11.19$; d.f. = 2,300; $P < 0.05$) among mean lengths involving species and hook type. Removing hardhead catfish from the analysis demonstrated the interaction among species and hook type was due to hardhead catfish. No significant difference was found between red drum and black drum combined mean lengths ($F = 0.40$; d.f. = 1,67; $P > 0.05$), but the difference between mean lengths and hook type for these two species remained significant ($F = 5.14$; d.f. = 1,67; $P < 0.05$). The combined mean length of red drum and black drum caught on circle hooks was 557 mm and those caught on straight-shank hooks was 625 mm.

Both hook types caught larger black drum during night (581 ± 8 mm) than day (453 ± 28 mm) but red drum (579 ± 26 mm and 565 ± 40 mm, respectively) and hardhead catfish (324 ± 4 mm and 325 ± 4 mm, respectively) mean lengths were not different (Table 4; Appendix E). There was significant interaction among species mean lengths between day and night regardless of hook type ($F = 11.44$; d.f. = 2,300; $P < 0.05$). A significant interaction was also found between the mean lengths of red drum and black drum between day and night ($F = 4.41$; d.f. = 1,67; $P < 0.05$).

Salinities and turbidities were generally higher in upper Laguna Madre than in lower Laguna Madre; other hydrological and meteorological parameters were similar between the two bays (Appendix F).

DISCUSSION

Using circle hooks instead of straight-shank hooks on trotlines will increase mortality. Black drum catches will increase and these fish will be sold. The potential for mortality by foul hooking was just as great for circle hooks as it was for straight-shank hooks. Even though circle hooks foul hook proportionately fewer fish, they catch more fish. For every 100 red drum or black drum caught on straight-shank hooks, one can expect 82 foul hooked fish. If the same number of circle hooks were fished that caught 100 fish on straight-shank hooks, the total catch would be 328 fish and 193 of these would have been foul hooked. Mongillio (1984) demonstrated that salmonid mortality from being hooked in areas other than the mouth or jaw (i.e. gill or eye) was 4 times higher.

Increased catches of red drum and black drum will be comprised of small (younger) individuals. This finding is consistent with those for reef fish in Australia and halibut in Alaska (Bowerman 1984, High In press). This may be due to the difference in width of hook type. The distance between the outer edge of the hook and the shank is less for the circle hook than for the same category straight-shank hook. However, hardhead catfish were larger on circle hooks than on straight-shank hooks. The reason for this inconsistency is unknown.

Red drum and black drum catches were much higher at night than during

the day regardless of hook type. This finding is consistent with that reported for TPWD trotlines set in 1977-78 with straight-shank hooks (McEachron et al. 1980). Perhaps these species feed more actively at night than during day (Simmons and Breuer 1962, Silverman 1979).

Catches in this study were consistent with observed catches on commercial trotlines during September-November 1984 (McEachron et al. In press) but were different than TPWD trotline catches in 1977-78 (McEachron et al. 1980). In this study, hardhead catfish catches were 17% higher and other species 18% lower than recorded in 1977-78; red drum catches were similar and black drum catches were slightly higher. These differences may have been caused by TPWD using only one bait type in this study and by reduced fish populations caused by the December 1983-January 1984 freeze (McEachron et al. 1980, McEachron et al. 1984, McEachron and Green 1985).

Hydrological parameters observed during this study were generally consistent with conditions normally expected in the areas and time of year sampled (Simmons 1957, Breuer 1962, McEachron and Green 1985). The catches in this study were probably not affected by weather conditions any more or less than in previous TPWD studies.

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Table 1. Number and percent of select species caught on circle and straight-shank hooks on Texas Parks and Wildlife Department trotlines in upper and lower Laguna Madre during September-December 1984.

Species	Upper Laguna Madre				Lower Laguna Madre				Combined			
	Circle		Straight-shank		Circle		Straight-shank		Circle		Straight-shank	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Black drum	2	100.0	0	0.0	30	81.1	7	18.9	32	82.1	7	17.9
Hardhead catfish	124	72.5	47	27.5	52	78.8	14	21.2	176	74.3	61	25.7
Red drum	7	87.5	1	12.5	21	87.5	3	12.5	28	87.5	4	12.5
Total	133	73.5	48	26.5	103	81.1	24	18.9	236	76.6	72	23.4

Table 2. Number and percent of select species caught on Texas Parks and Wildlife Department day and night trotline sets in upper and lower Laguna Madre during September-December 1984.

Species	Upper Laguna Madre				Lower Laguna Madre				Combined			
	Day		Night		Day		Night		Day		Night	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Black drum	0	0.0	2	100.0	6	16.2	31	83.8	6	15.4	33	84.6
Hardhead catfish	82	48.0	89	52.0	16	24.2	50	75.8	98	41.3	139	58.7
Red drum	5	62.5	3	37.5	5	20.8	19	79.2	10	31.3	22	68.7
Total	87	48.1	94	51.9	27	21.3	100	78.7	114	37.0	194	63.0

Table 3. Location of hooking for selected species caught on circle and straight-shank hooks on Texas Parks and Wildlife Department trotlines in upper and lower Laguna Madre combined during September-December 1984.

Species	Hook type	Lip		Mouth		Elsewhere	
		No.	%	No.	%	No.	%
Black drum							
	Circle	13	40.6	18	56.3	1	3.1
	Straight-shank	1	14.3	4	57.1	2	28.6
Red drum							
	Circle	12	42.9	16	57.1	0	0
	Straight-shank	1	25.0	3	75.0	0	0
Combined (black drum and red drum)							
	Circle	25	41.7	34	56.7	1	1.7
	Straight-shank	2	18.2	7	63.6	2	18.2
Hardhead catfish							
	Circle	16	9.0	153	85.9	9	5.1
	Straight-shank	8	13.1	20	32.8	33	54.1

Table 4. Mean length \pm 1 SE (mm) and range of select species caught on Texas Parks and Wildlife Department trotlines in upper and lower Laguna Madre by hook type and day type during September-December 1984. ND = no data. Number in parenthesis is number measured.

Species Hook type	Night		Day		Combined	
	Length (mm)	Range (mm)	Length (mm)	Range (mm)	Length (mm)	Range (mm)
Black drum						
Circle	579 \pm 9	455-696 (26)	453 \pm 28	385-568 (6)	555 \pm 13	385-696 (32)
Straight-shank	588 \pm 12	553-643 (7)	ND	ND	588 \pm 12	553-643 (7)
Combined	581 \pm 8	455-696 (33)	453 \pm 28	385-568 (6)		
Red drum						
Circle	564 \pm 29	373-755 (19)	548 \pm 41	402-746 (9)	559 \pm 23	373-755 (28)
Straight-shank	678 \pm 37	605-725 (3)	717	717 (1)	688 \pm 28	605-725 (4)
Combined	579 \pm 26	373-755 (22)	565 \pm 40	402-746 (10)		
Hardhead catfish						
Circle	327 \pm 4	228-432 (99)	332 \pm 5	253-452 (27)	329 \pm 3	228-452 (176)
Straight-shank	319 \pm 9	204-416 (38)	303 \pm 7	239-360 (21)	313 \pm 6	204-416 (59)
Combined	324 \pm 4	204-432 (137)	325 \pm 4	279-452 (98)		

Figure 1. Areas where Texas Parks and Wildlife Department trotlines were set in the upper Laguna Madre during September-December 1985. **x** = area of set.

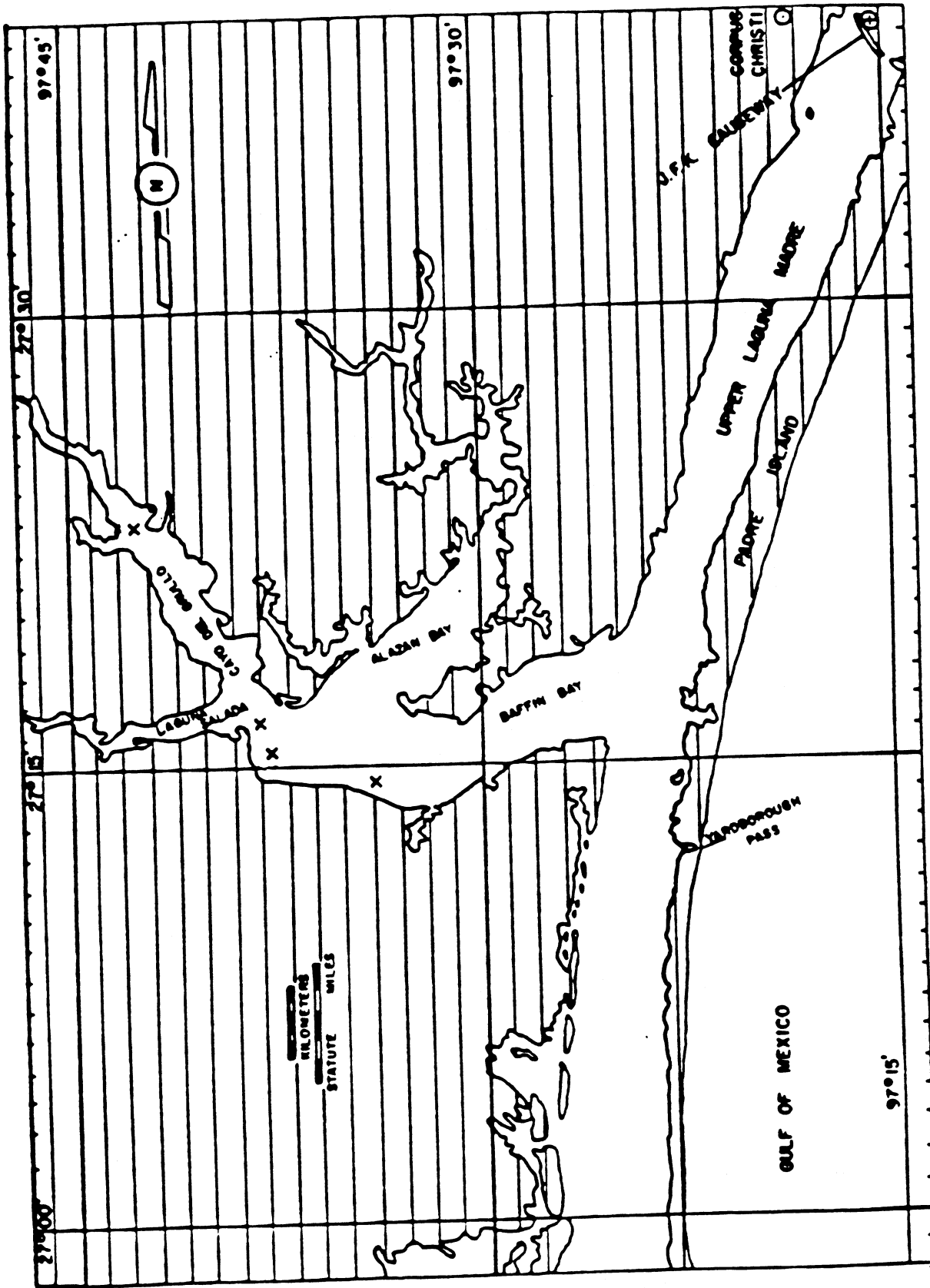


Figure 2. Areas where Texas Parks and Wildlife Department trotlines were set in the lower Laguna Madre during September-December 1984. **x** = area of set.

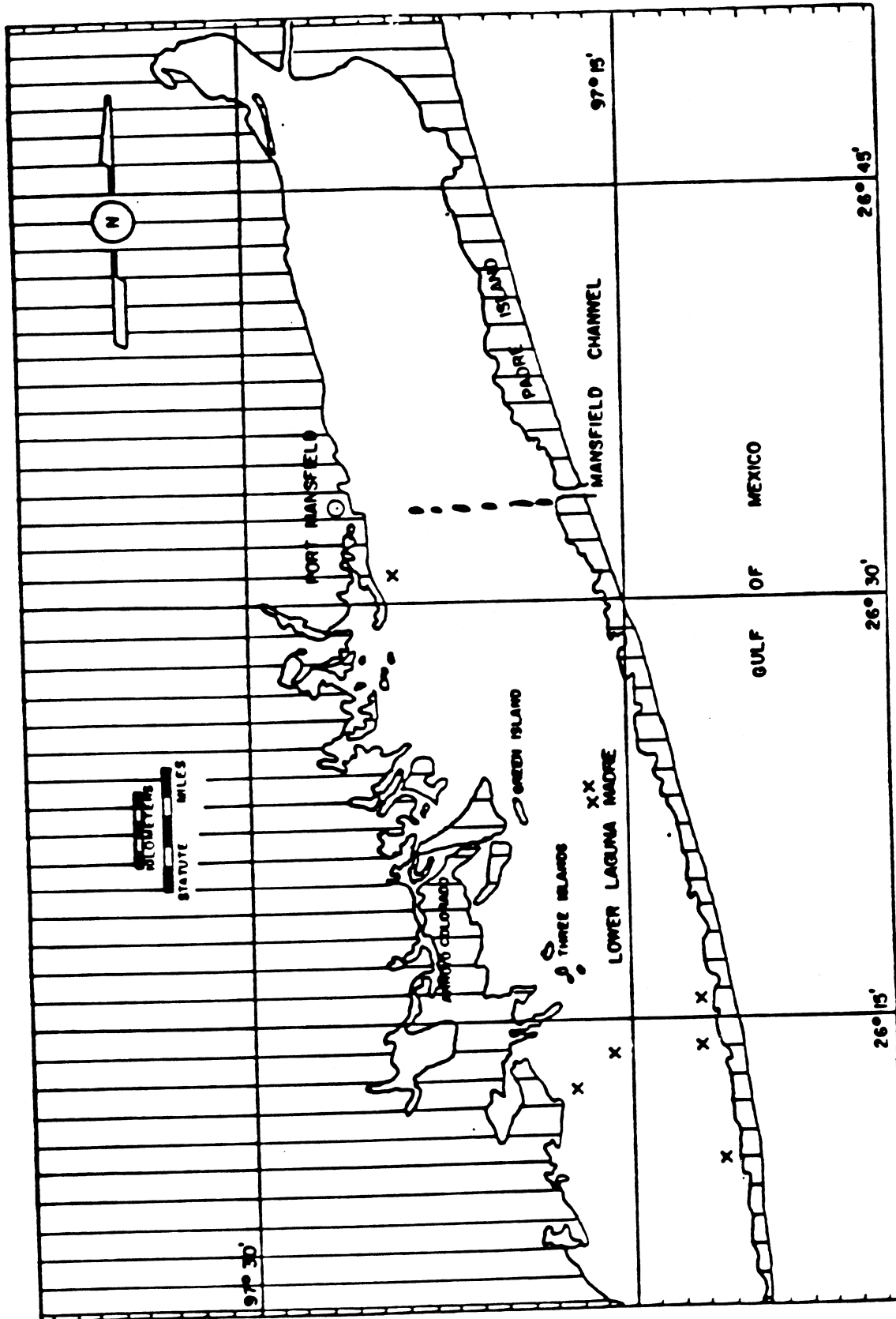
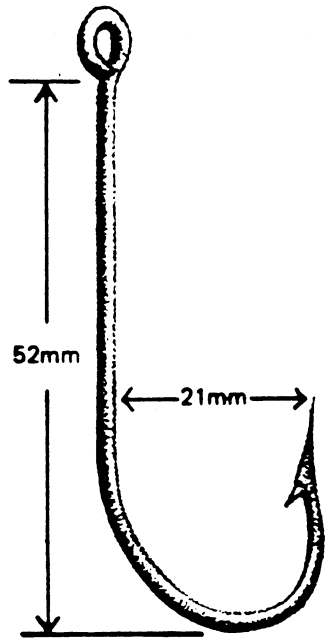
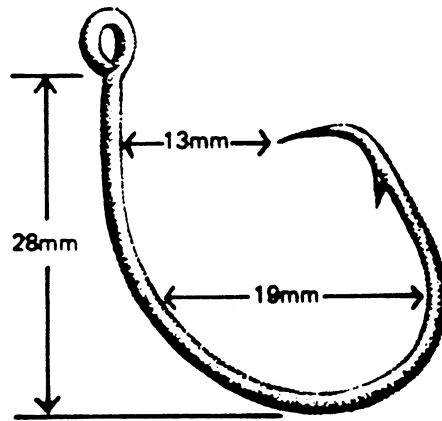


Figure 3. Circle and straight shank hooks used on Texas Parks and Wildlife Department trotlines.



STRAIGHT SHANK ("J" Type)



CIRCLE

Appendix A. Station locations and hours fished for Texas Parks and Wildlife Department trotline sets during September-December 1984.

Table A.1. Texas Parks and Wildlife Department trotline station locations and hours fished by site in the Laguna Madre during September-December 1984.

Bay system	Latitude	Longitude	Set		Retrieval		Hours fished	
			Date	Time	Date	Time	Day	Night
Upper Laguna Madre	27°21'40"	97°42'00"	Sep 19	1910	Sep 20	0650		11.7
	27°21'40"	97°42'00"	20	0650	20	1845	11.9	
	27°16'30"	97°38'30"	25	0735	25	1940	12.1	
	27°16'30"	97°38'30"	25	1940	26	0737		11.9
	27°15'35"	97°37'45"	Oct 10	1910	Oct 11	0712		12.0
	27°15'35"	97°37'45"	11	0712	11	1900	11.8	
	27°21'55"	97°41'50"	17	1830	18	0715		11.8
	27°21'55"	97°41'50"	18	0715	18	1830	11.2	
	27°40'45"	97°13'50"	29	1745	30	0630		11.8
	27°40'45"	97°13'50"	30	0630	30	1710	10.7	
	27°14'15"	97°33'10"	Nov 12	1737	Nov 13	0740		13.0
	27°14'15"	97°33'10"	13	0740	13	1730	9.8	
	27°14'15"	97°33'10"	13	1730	14	0630		13.0
	27°14'15"	97°33'10"	14	0630	14	1700	10.5	
	27°40'45"	97°13'45"	29	0725	29	1700	9.6	
	27°40'45"	97°13'45"	29	1700	30	0710		14.2
	27°16'45"	97°40'45"	Dec 04	1712	Dec 05	0640		12.5
27°16'45"	97°40'45"	05	0640	05	1650	10.2		
27°16'35"	97°39'50"	05	1744	06	0750		14.1	
27°16'35"	97°39'50"	06	0750	06	1713	9.4		
Lower Laguna Madre	26°23'30"	97°17'30"	Oct 01	1745	Oct 02	0800		14.2
	26°23'30"	97°17'30"	02	0800	02	1730	9.5	
	26°22'30"	97°17'30"	02	1900	03	0815		13.2

Table A.1. (Cont'd.).

Bay system	Latitude	Longitude	Set		Retrieval		Hours fished	
			Date	Time	Date	Time	Day	Night
Lower Laguna Madre (Cont'd.).	26°22'30"	97°17'30"	Oct 03	0815	Oct 03	1730	9.2	
	26°14'45"	97°12'55"	10	0815	10	1830	10.2	
	26°14'45"	97°12'55"	10	1830	11	0730		13.0
	26°14'45"	97°12'55"	11	0900	11	1815	9.2	
	26°14'45"	97°12'55"	11	1815	12	0750		13.6
	26°12'30"	97°11'30"	17	0820	17	1815	9.9	
	26°12'30"	97°11'30"	17	1815	18	0845		13.5
	26°15'30"	97°14'30"	Nov 08	0745	Nov 08	1800	10.2	
	26°15'30"	97°14'30"	08	1800	09	0715		13.2
	26°29'30"	97°22'30"	28	0745	28	1705	9.3	
	26°29'30"	97°22'30"	28	1705	29	0720		14.2
	26°29'30"	97°22'30"	29	0720	29	1700	9.7	
	26°29'30"	97°22'30"	29	1700	30	0730		14.5
	26°12'15"	97°17'40"	Dec 05	1705	Dec 06	0730		14.4
	26°12'15"	97°17'40"	06	0730	06	1645	9.2	
	26°14'30"	97°15'30"	10	1535	11	0715		15.7
26°14'30"	97°15'30"	11	0715	11	1645	9.5		

Appendix B. Summary of meetings with commercial fishermen.



OFFICE MEMORANDUM

COORDINATION - ROUTING

TO: Gary Matlock

FROM: Gary Saul

SUBJECT: Trotline Study

RE:

DATE: September 10, 1984

ORG.	NAME	INITIAL	DATE
		gm	9/10
	Robert Kemp	Bk	9/10
REMARKS: <i>gs, Larks good. gm</i>			
RETURN TO: <i>Matlock</i>			

Tom Heffernan contacted Mr. Howard Patterson, Ms. Ruthie West, and Mr. Dan Coley regarding trotline specifications. Mr. Patterson and Ms. West fish in the upper Laguna Madre, whereas, Mr. Coley fishes in the lower Laguna Madre. Below are the specifications for building trotlines.

	Howard Patterson	Ruthie West	Dan Coley
Hooks circle	#8 Mustad (39960ST)	Same	Same
J	7/0 or 8/0 primarily 7/0 Eagle Claw	Don't use	6/0 stainless Bends to make circle
Main line	#36 nylon twine	#48 nylon twine	#42 nylon twine (tarred) - turbid H ₂ O 175 lb test mono - clear H ₂ O
length	500' (80 hooks)	600'	600'
Hook spacing	6'	5-6' (3-4' if a lot of fish)	5'
Staging line	80-125 lb test mono	#36 nylon twine	80-100 lb test mono
length	~27"	18-30"	24"
attachment	tied on	removable loop	tied on
Swivel	1/0 black brass barrel	Same	2/0
Main line knotted	Yes	Yes	Yes
Stakes	2" x 3"	Whatever	Willow poles

Mr. Gary Matlock
Page Two
September 10, 1984

Anchors in deep water	Yes	Yes	Yes
Floats	Clorox bottles	Whatever	Whatever
spacing	~15 hooks	-	-
Baits	Crabs until cold water Shrimp in cold water	Same	Same
Fishing	Keep hooks from just off bottom to within 30" of top of water.		
Number of lines fished	3-7	7	8-12

Based on above information, I have instructed Tom Heffernan to request Mr. Patterson to construct two (2) trotlines with the following specifications:

Main line - #42 nylon twine, knotted twice every 6' for swivel placement. 600' long finished.
Hooks - #8 Mustad circle (39960ST)
7/0 Eagle Claw J
Alternate hook type (50 each per line)
Hook spacing - 6'
Staging - 80-100 lb test mono, 24-27" long finished.
tied on to swivel
Swivel - 1/0 black brass barrel
Stakes - stout poles
Floats - gallon jugs
Float spacing - ~15 hooks
Bait - cut crab until fishermen switch to shrimp, then shrimp.

Tom will try to have these built prior to Friday. He is trying to schedule a meeting with Joe Martin, Ken Rice and Howard Patterson on Friday in Flour Bluff prior to the AFS Meeting. We can get Howard's expertise and familiarize our people with the project. If I do not attend the AFS Meeting, it may be necessary for you to fully explain what is expected.

Gary
Gary E. Saul
Director, Finfish Programs

GES:ms

cc: Tom Heffernan
Larry McEachron

Gary Saul
17 September 1984
Page 2

3. Do we only release fish on last running of lines-
Yes.

I will work up a table that can be used by Ken and Joe to summarize each set. This will be sent to you and to me. I will make copies for Tom and Ed.

If you have any questions, let me know.



LARRY McEACHRON
Finfish Program Leader

LM:nz

cc: Tom Heffernan
Ed Hegen
Ken Rice
Joe Martin



OFFICE MEMORANDUM ²⁵

Exhibit B

TO: Gary Matlock

FROM: Ed Hegen

SUBJECT: Trotline Observations - Upper Laguna Madre, February-March 1984

RE:

DATE: March 26, 1984

ORG	NAME	INITIALS
		gjm
	Bob Kemp	BK
REMARKS: Please copy for me, gjm, Hal Osburn. & att. before 5:00 pm		
RETURN TO: Matlock		

On February 9, 1984, I was requested to contact Mr. Howard Patterson, a commercial trotliner from Corpus Christi, to investigate his fishing gear and methods. Mr. Patterson opposes the TPWD proposals requiring the main fishing line of a trotline to be on the bottom with no floatation devices attached. Mr. Patterson uses floats attached to the main fishing line in order to raise the hooks about 3 inches above the bay bottom.

On February 13-14 and March 14-16, 1984 I accompanied Mr. Patterson in the upper Laguna Madre to observe, photograph and document his trotline operations. Two types of trotlines were fished. Both types of trotlines had multifilament main fishing lines that were 580-600 feet long with monofilament stagings or leaders of 26-27 inch length every 6-7 feet along the mainline. Each of the 80 stagings had one circle or snapper hook (Mustad 39960 ST No. 2) attached. Juglines had plastic bottles (e.g. gallon chlorox bottles) attached approximately every 15 stagings to raise mainline and thus raise the hooks off the bay bottom. Bottomlines had the main fishing line on the bay bottom. Cut portions of crab or shrimp were used as baits.

A log of my daily activities and observations is attached. Major highlights of my log are summarized below:

- o Five juglines were fished a total of 130.7 hours.
- o Three bottomlines were fished a total of 70.1 hours.
- o Juglines caught 13 red drum, 4 black drum, 4 Atlantic stingray and 31 hardhead catfish (Table 1).
- o Bottomlines caught - 1 black drum, 1 Atlantic stingray and 1 hardhead catfish.
- o Cut shrimp bait caught most of the red drum, black drum and Atlantic stingray.
- o Cut crab bait caught most of the hardhead catfish.
- o Snapper or circle hooks were quickly and easily removed from all fish with very little damage to the fish.

Mr. Patterson was extremely cooperative and has offered to allow us to accompany him any time. If you have any questions about this report, please call.

Ed Hegen

Ed Hegen
Regional Director

EH:dr

Attachment

cc: Tom Heffernan
Roy Johnson

Appendix C. Trotline catches in upper and lower Laguna Madre by date during September-December 1984.

Table C.1. Trotline catches (No.) by species and hook type during day and night sets in upper Laguna Madre during September-December 1984.

Date	Atlantic croaker	Black drum	Hardhead catfish	Red drum	Total
Sep 19-20					
Night					
Circle	0	0	2	0	2
Straight-shank	1	0	2	0	3
Day					
Circle	0	0	5	0	5
Straight-shank	0	0	3	0	3
Sep 25-26					
Night					
Circle	0	0	0	3	3
Straight-shank	0	0	2	0	2
Day					
Circle	1	0	3	0	4
Straight-shank	0	0	5	0	5
Oct 10-11					
Night					
Circle	0	0	2	0	2
Straight-shank	0	0	6	0	6
Day					
Circle	0	0	2	0	2
Straight-shank	0	0	0	0	0
Oct 17-18					
Night					
Circle	0	0	18	0	18
Straight-shank	0	0	9	0	9
Day					
Circle	0	0	16	1	17
Straight-shank	0	0	7	0	7

Table C.1. (Cont'd.).

Date	Atlantic croaker	Black drum	Hardhead catfish	Red drum	Total
Oct 29-30					
Night					
Circle	0	0	11	0	11
Straight-shank	0	0	2	0	2
Day					
Circle	0	0	8	0	8
Straight-shank	0	0	0	0	0
Nov 12-13					
Night					
Circle	0	1	13	0	14
Straight-shank	0	0	1	0	1
Day					
Circle	0	0	10	1	11
Straight-shank	0	0	1	1	2
Nov 13-14					
Night					
Circle	0	1	16	0	17
Straight-shank	0	0	4	0	4
Day					
Circle	0	0	18	2	20
Straight-shank	2	0	4	0	6
Nov 29-30					
Night					
Circle	0	0	0	0	0
Straight-shank	0	0	0	0	0
Day					
Circle	0	0	0	0	0
Straight-shank	0	0	0	0	0

Table C.1. (Cont'd.).

Date	Atlantic croaker	Black drum	Hardhead catfish	Red drum	Total
Dec 4-5					
Night					
Circle	0	0	0	0	0
Straight-shank	0	0	1	0	1
Day					
Circle	0	0	0	0	0
Straight-shank	0	0	0	0	0
Dec 5-6					
Night					
Circle	0	0	0	0	0
Straight-shank	0	0	0	0	0
Day					
Circle	0	0	0	0	0
Straight-shank	0	0	0	0	0
Total					
Night					
Circle	0	2	62	3	67
Straight-shank	1	0	27	0	28
Day					
Circle	1	0	62	4	67
Straight-shank	2	0	20	1	23

Table C.2. (Cont'd.).

Date	Atlantic stringray	Atlantic croaker	Black drum	Cownose ray	Hardhead catfish	Red drum	Sheepshead	Smooth puffer	Southern stingray	Spotted seatrout	Striped burrfish	Total
Dec 10-11												
Night												
Circle	0	0	6	0	21	3	0	0	0	0	0	30
Straight-shank	0	0	3	0	10	2	0	0	0	0	0	15
Day												
Circle	1	0	4	0	15	0	0	0	0	0	0	20
Straight-shank	0	0	0	0	1	0	1	0	0	0	0	2
Total												
Night												
Circle	0	1	24	0	37	16	0	0	1	0	2	81
Straight-shank	0	0	7	0	13	3	0	0	0	1	0	24
Day												
Circle	1	0	6	0	15	5	0	1	0	0	6	34
Straight-shank	0	0	0	4	1	0	1	0	0	0	0	6

Appendix D. Place on body of fish where hooked by hook type and species for Texas Parks and Wildlife Department trotline sets during September-December 1984.

Table D.1. Place on body of fish where hooked by hook type and species in upper and lower Laguna Madre during September-December 1984.

Species	Circle					Straight-shank				
	Lip	Inside mouth	Gill	Gut ^a	Snagged ^b	Lip	Inside mouth	Gill	Gut ^a	Snagged ^b
Upper Laguna Madre										
Atlantic croaker	1	0	0	0	0	0	2	0	0	1
Black drum	0	2	0	0	0	0	0	0	0	0
Hardhead catfish	3	115	0	0	6	6	15	0	0	26
Red drum	3	4	0	0	0	0	1	0	0	0
Total	7	121	0	0	6	6	18	0	0	27
Lower Laguna Madre										
Atlantic croaker	0	1	0	0	0	0	0	0	0	0
Atlantic stingray	0	1	0	0	0	0	0	0	0	0
Black drum	13	16	0	1	0	1	4	1	0	1
Cownose ray	0	0	0	0	0	0	0	0	0	4
Hardhead catfish	13	38	0	1	0	2	5	0	2	5
Red drum	9	12	0	0	0	1	2	0	0	0
Sheepshead	0	0	0	0	0	0	0	0	0	1
Smooth puffer	0	1	0	0	0	0	0	0	0	0
Spotted seatrout	0	0	0	0	0	0	0	0	1	0
Striped burrfish	1	7	0	0	0	0	0	0	0	0
Southern stingray	0	0	0	0	0	0	0	0	0	1
Total	36	76	0	2	0	4	11	1	3	12
Combined										
Atlantic croaker	1	1	0	0	0	0	29	0	0	1
Atlantic stingray	0	1	0	0	0	0	0	0	0	0
Black drum	13	18	0	1	0	1	4	1	0	1
Cownose ray	0	0	0	0	0	0	0	0	0	4
Hardhead catfish	16	153	0	1	6	8	20	0	2	31
Red drum	12	16	0	0	0	1	3	0	0	0
Sheepshead	0	0	0	0	0	0	0	0	0	1
Smooth puffer	0	1	0	0	0	0	0	0	0	0
Spotted seatrout	0	0	0	0	0	0	0	0	1	0
Striped burrfish	1	7	0	0	0	0	0	0	0	0
Southern stingray	0	0	0	0	0	0	0	0	0	1
Total	43	197	0	2	6	10	29	1	3	39

^aIncludes throat

^bExterior of fish

Appendix E. Mean length (mm \pm 1 SE) of species caught on Texas Parks and Wildlife Department trotlines in upper and lower Laguna Madre during September-December 1984.

Table E.1. Mean lengths (mm \pm 1 SE) of fishes caught by species and hook type during day and night sets in upper and lower Laguna Madre during September-December 1984. ND = no data. Number in parentheses indicates number measured.

Species	Upper Laguna Madre				Lower Laguna Madre			
	Night		Day		Night		Day	
	Circle	Straight-shank	Circle	Straight-shank	Circle	Straight-shank	Circle	Straight-shank
Atlantic croaker	ND	286 (1)	350 (1)	241 (1)	270 (1)	ND	ND	ND
Atlantic stingray	ND	ND	ND	ND	ND	ND	260 (1)	ND
Black drum	633 \pm 38 (2)	ND	ND	ND	574 \pm 9 (24)	588 \pm 12 (7)	453 \pm 28 (6)	ND
Cownose ray	ND	ND	ND	ND	ND	ND	ND	696 \pm 75 (4)
Hardhead catfish	308 \pm 4 (62)	294 \pm 9 (27)	324 \pm 5 (62)	303 \pm 7 (20)	358 \pm 5 (37)	371 \pm 10 (12)	364 \pm 8 (15)	303 (1)
Red drum	391 \pm 11 (3)	ND	547 \pm 67 (4)	717 (1)	597 \pm 27 (16)	678 \pm 37 (3)	548 \pm 58 (5)	ND
Sheepshead	ND	ND	ND	ND	ND	ND	ND	378 (1)
Smooth puffer	ND	ND	ND	ND	ND	ND	385 (1)	ND
Southern stingray	ND	ND	ND	ND	ND	ND	ND	ND
Spotted seatrout	ND	ND	ND	ND	ND	282 (1)	ND	ND
Striped burrfish	ND	ND	ND	ND	247 \pm 12 (2)	ND	229 \pm 8 (6)	ND

Appendix F. Hydrological and meteorological parameters at start
and completion of Texas Parks and Wildlife
Department trotline sets.

Table F.1. Explanation of hydrological and meteorological abbreviations and codes.

Code	Explanation
Time	I = Initial (time of set); F = Final (time of pickup)
WS	Wind speed (km/h)
WD	Wind direction from: 1 = North; 2 = Northeast; 3 = East; 4 = Southeast; 5 = South; 6 = Southwest; 7 = West; 8 = Northwest
Tide	1 = observed slack; 2 = Observed ebb; 3 = Observed flood; 4 = Published slack
CC	Cloud Cover: 1 = 0-9%; 2 = 10-25%; 3 = 26-50%; 4 = 51-75% 5 = 76-90%; 6 = 91-100%
Precip	Precipitation: 1 = Yes; 2 = No
Fog	1 = Fog present; 2 = None
WH	Wave height (m): 0 = ≤ 0.03 ; 1 = 0.03-0.12; 2 = 0.12-0.37; 3 = 0.37-0.91
Depth Range	Depth (m) at each end of trotline
Turb	Turbidity (Jackson Turbidity Units)
Temp	Water temperature (C)
Sal	Salinity (o/oo)
DO	Dissolved Oxygen (ppm)
BP	Barometric Pressure (millibars)
BT	Bottom Type: 1 = Clay; 2 = silt; 3 = sand; 4 = shell; 5 = gravel; 6 = rocks

Table F.2. Hydrological and meteorological data recorded during Texas Parks and Wildlife Department trotline sets in upper Laguna Madre during September-December 1984.

Date	Day type	Time	WS (km/h)	WD	Tide	CC	Precip	Fog	MH	Depth range (m)	Temp (C)	DO (ppm)	Sal (o/oo)	Turb (JTU)	BP ^a	BT
Sep 20	Night	I	19	2	2	6	2	2	2	0.6-0.8	24.0	4.0	52.2	74	1014	1,2,3
		F	24	2	3	6	2	2	3	0.5-0.8	23.0	4.0	55.0	76	1009	1,2,3
Sep 20	Day	I	24	2	3	6	1	2	3	0.5-0.8	23.0	4.0	55.0	76	1009	1,2,3
		F	29	2	3	6	2	2	3	0.5-0.7	24.0	4.0	55.0	76	1009	1,2,3
Sep 25	Day	I	8	4	3	2	2	2	1	1.3-1.6	27.0	4.0	51.0	28	1014	1,2,3,6
		F	29	4	3	3	2	2	3	1.3-1.6	28.0	7.0	51.0	35	1014	1,2,3,6
Sep 26	Night	I	29	4	3	3	2	2	3	1.3-1.6	28.0	7.0	51.0	35	1014	1,2,3,6
		F	5	3	3	6	2	2	1	1.2-1.6	27.0	3.0	51.0	49	1019	1,2,3,6
Oct 11	Night	I	29	4	2	2	2	2	3	2.2-2.5	27.0	7.0	48.8	97	1017	1,2
		F	16	4	1	4	2	2	2	2.3-2.5	25.0	4.0	48.8	73	1017	1,2
Oct 11	Day	I	16	4	1	4	2	2	2	2.3-2.5	25.0	4.0	48.8	73	1017	1,2
		F	29	4	3	5	2	2	3	2.3-2.5	26.5	6.0	48.8	124	1017	1,2,3,6
Oct 18	Night	I	19	4	3	5	2	2	2	0.8-0.9	27.0	3.0	48.8	140	1012	1,2
		F	16	4	3	3	2	2	2	0.8-0.9	26.0	5.0	48.8	140	1008	1,2
Oct 18	Day	I	16	4	3	3	2	2	2	0.8-0.9	26.0	5.0	48.8	140	1008	1,2
		F	40	4	3	6	2	2	3	0.8-0.9	27.0	6.0	48.8	150	1008	1,2
Oct 30	Night	I	14	3	2	2	2	2	1	0.5-0.7	24.0	8.0	37.2	24	1016	1,2,3
		F	3	3	1	3	2	2	0	0.5-0.7	25.0	6.0	37.8	24	1016	1,2,3
Oct 30	Day	I	3	3	1	3	2	2	1	0.5-0.7	25.0	6.0	37.2	24	1016	1,2,3
		F	19	3	3	4	2	2	1	0.5-0.7	28.0	10.0	37.8	24	1016	1,2,3

Table F.2. (Cont'd.).

Date	Day type	Time	WS (km/h)	WD	Tide	CC	Preclp	Fog	WH	Depth range (m)	Temp (C)	DO (ppm)	Sal (c/oo)	Turb (JTU)	BP ^a	BT
Nov 13	Night	I	16	3	3	2	2	2	2	0.9-0.9	20.0	5.0	43.0	41	1021	1,2,6
	F	3	2	3	3	3	2	2	1	1.0-1.0	19.5	4.0	42.0	33	1017	1,2,6
Nov 13	Day	I	3	2	3	3	2	2	1	1.0-1.0	19.5	4.0	42.0	33	1017	1,2,6
	F	19	4	3	6	6	2	2	2	1.0-1.0	20.0	6.0	43.0	41	1017	1,2
Nov 14	Night	I	19	4	3	6	2	2	2	1.0-1.0	20.0	5.0	43.0	48	1017	1,2
	F	16	3	3	2	2	2	2	1	1.0-1.0	19.5	5.0	43.0	38	1016	1,2
Nov 14	Day	I	16	3	3	2	2	2	1	1.0-1.0	19.5	5.0	43.0	38	1016	1,2
	F	37	4	3	2	2	2	2	3	1.1-1.1	20.0	5.0	43.0	77	1016	1,2
Nov 29	Day	I	6	5	2	0	2	2	1	0.5-0.8	15.0	5.0	34.4	24	1013	1,2,3
	F	10	5	2	5	5	2	2	1	0.4-0.7	18.0	8.0	34.4	24	1009	1,2,3
Nov 30	Night	I	10	5	2	5	2	2	1	0.4-0.7	18.0	8.0	34.4	24	1013	1,2,3
	F	19	1	3	1	1	2	1	1	0.5-0.7	16.0	8.0	34.4	24	1015	1,2,3
Dec 5	Night	I	24	2	1	6	1	1	1	1.7-2.2	15.0	3.0	43.8	97	1014	1,2
	F	19	1	2	6	6	2	1	1	1.7-2.1	14.0	3.0	44.4	87	1018	1,2
Dec 5	Day	I	19	1	2	6	2	1	1	1.7-2.1	14.0	3.0	44.4	87	1018	1,2
	F	24	1	2	3	3	2	2	1	1.7-2.2	13.0	5.0	44.4	89	1018	1,2
Dec 6	Night	I	13	2	3	2	2	2	2	1.3-1.9	13.0	4.0	44.0	78	1018	1,2
	F	19	2	3	1	1	2	2	1	1.3-1.9	11.5	4.0	44.0	74	1037	1,2
Dec 6	Day	I	19	2	3	1	2	2	1	1.3-1.9	11.5	4.0	44.0	74	1037	1,2
	F	24	2	3	2	2	2	2	3	1.2-1.9	12.0	5.0	44.0	80	1037	1,2

^aBarometric pressure not temperature compensated.

Table F.3. Hydrological and meteorological data recorded during Texas Parks and Wildlife Department trollline sets in lower Laguna Madre during September-December 1984.

Date	Day Type	Time	WS (km/h)	WD	Tide	CC	Precip	Fog	WH	Depth		Temp (C)	DO (ppm)	Sal (o/oo)	Turb (JTU)	BP ^a	BT
										range (m)							
Oct 2	Night	I	16	3	3	6	2	2	1	0.4-0.4	22.5	13.0	26.0	24	1024	1,3	
		F	16	3	3	6	2	2	1	0.4-0.4	21.0	5.0	30.0	24	1020	1,3	
Oct 2	Day	I	16	3	3	6	2	2	1	0.4-0.4	21.0	5.0	30.0	24	1020	1,3	
		F	24	4	1	6	2	2	1	0.4-0.4	24.5	9.0	27.0	24	1020	1,3	
Oct 3	Night	I	24	4	1	6	2	2	1	0.4-0.4	24.5	9.0	27.0	24	1017	1,3	
		F	8	4	3	6	2	2	1	0.4-0.4	22.0	7.0	27.0	24	1017	1,3	
Oct 3	Day	I	8	4	3	6	2	2	1	0.4-0.4	22.0	7.0	27.0	24	1017	1,3	
		F	16	4	1	4	2	2	1	0.4-0.4	26.0	10.0	27.0	24	1017	1,3	
Oct 10	Day	I	24	4	1	2	2	2	1	0.5-0.6	26.5	7.0	18.0	24	1016	1,3	
		F	24	4	3	2	2	2	1	0.5-0.6	27.5	11.0	16.0	24	1016	1,3	
Oct 11	Night	I	24	4	3	2	2	2	1	0.5-0.6	27.5	11.0	16.0	24	1016	1,3	
		F	13	4	1	2	2	2	1	0.5-0.6	25.0	8.0	18.0	24	1018	1,3	
Oct 11	Day	I	13	4	1	2	2	2	1	0.5-0.6	25.0	8.0	18.0	24	1018	1,3	
		F	32	4	3	5	2	2	2	0.5-0.6	28.0	9.0	20.0	24	1016	1,3	
Oct 12	Night	I	32	4	3	5	2	2	2	0.5-0.6	28.0	9.0	20.0	24	1016	1,3	
		F	16	4	1	3	2	2	1	0.5-0.6	25.0	9.0	20.0	24	1022	1,3	
Oct 17	Day	I	19	4	1	2	2	2	0	0.7-0.7	27.0	8.0	34.0	24	1011	1,3	
		F	40	4	2	4	2	2	2	0.5-0.5	29.5	8.0	34.0	24	1011	1,3	
Oct 18	Night	I	40	4	2	4	2	2	2	0.5-0.5	29.5	8.0	34.0	24	1011	1,3	
		F	48	4	2	2	2	2	2	0.8-0.8	27.0	11.0	34.0	24	1011	1,3	

Table F.3. (Cont'd.).

Date	Day type	Time	WS (km/h)	WD	Tide	CC	Precip	Fog	MH	Depth range (m)	Temp (C)	DO (ppm)	Sal (o/oo)	Turb (JTU)	BP ^a	BT
Nov 8	Day	I	29	4	1	2	2	2	1	0.9-1.0	23.0	7.0	31.0	28	1012	1,3
	Day	F	40	4	3	1	2	2	2	1.0-1.1	24.5	8.0	31.0	145	1012	1,2
Nov 9	Night	I	40	4	3	1	2	2	2	1.0-1.1	24.5	8.0	31.0	145	978	1,2
	Night	F	32	4	1	2	2	2	2	0.9-1.0	23.5	7.0	31.0	150	1013	1,2
Nov 28	Day	I	8	8	1	1	2	2	1	0.5-0.5	12.0	9.0	27.0	24	1026	1,2
	Day	F	19	4	3	1	2	2	1	0.5-0.5	17.0	12.0	26.0	24	1024	1,2
Nov 29	Night	I	19	4	3	1	2	2	1	0.5-0.5	17.0	12.0	26.0	24	1011	1,2
	Night	F	8	4	1	2	2	2	1	0.5-0.5	15.0	7.0	29.0	24	1015	1,2
Nov 29	Day	I	8	4	1	1	2	2	1	0.5-0.5	15.0	7.0	29.0	24	1011	1,2
	Day	F	24	5	2	1	2	2	1	0.5-0.5	20.0	10.0	27.0	24	1011	1,2
Nov 30	Night	I	24	5	2	1	2	2	1	0.5-0.5	20.0	10.0	27.0	24	1011	1,2
	Night	F	16	8	1	1	2	2	1	0.6-0.6	17.5	8.0	25.0	24	1015	1,2
Dec 6	Night	I	32	8	2	4	2	2	1	0.8-0.9	13.0	11.0	26.0	27	1022	1,2,4
	Night	F	40	1	1	6	2	2	1	0.4-0.5	8.5	12.0	26.0	65	1036	1,2,4
Dec 6	Day	I	40	1	1	6	2	2	1	0.4-0.5	8.5	12.0	26.0	65	1036	1,2,4
	Day	F	40	1	3	4	2	2	1	0.4-0.5	10.0	10.0	26.0	120	1036	1,2,4
Dec 11	Night	I	18	4	1	1	2	2	1	0.4-0.4	22.5	10.0	25.0	24	1019	1,2
	Night	F	8	4	4	1	2	2	1	0.7-0.7	18.5	9.0	26.0	34	1017	1,2
Dec 11	Day	I	8	4	4	1	2	2	1	0.7-0.7	18.5	9.0	26.0	34	1018	1,2
	Day	F	32	5	1	1	2	2	1	0.6-0.6	21.0	10.0	25.0	100	1018	1,2

^aBarometric pressure not temperature compensated.

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