

P437.7
M315d
#93

Evaluation of the Commercial Trotline Fishery in the Laguna Madre during Fall 1984

Government Publications
Texas State Documents

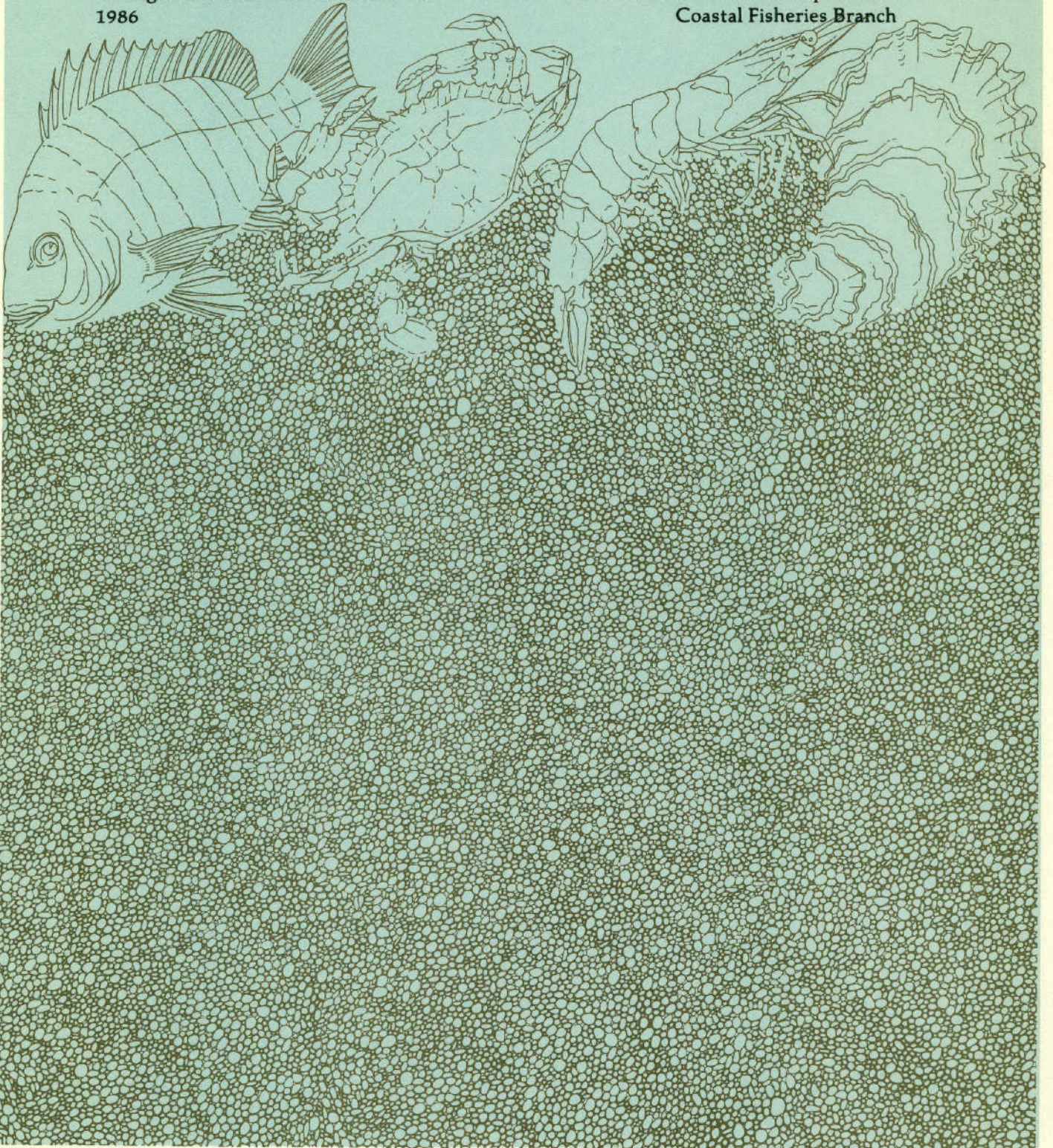
AUG 19 1986

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

Dallas Public Library

Management Data Series Number 93
1986

Texas Parks and Wildlife Department
Coastal Fisheries Branch



EVALUATION OF THE COMMERCIAL TROTLINE FISHERY IN THE
LAGUNA MADRE DURING FALL 1984

by

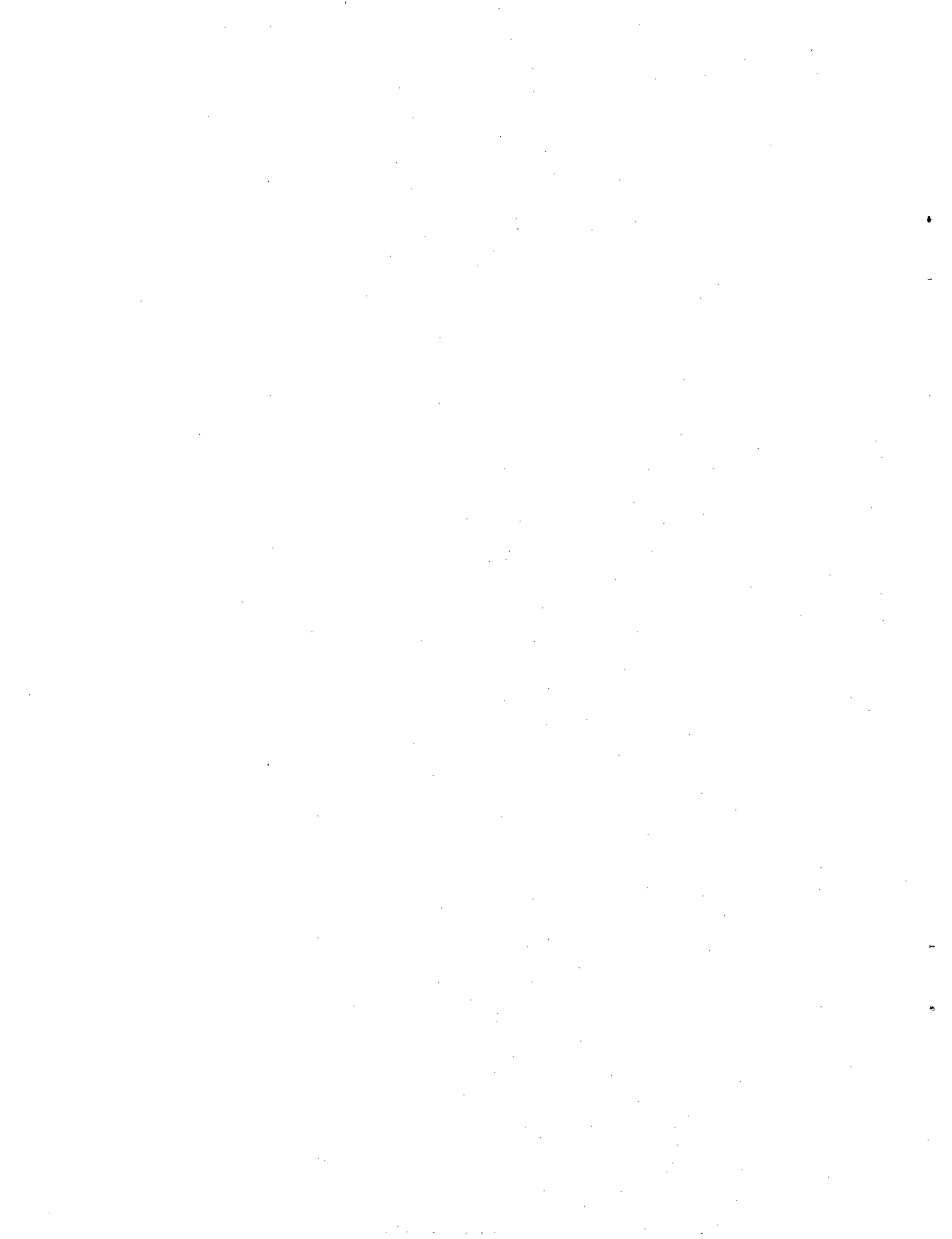
L. W. McEachron, A. W. Green, G. C. Matlock,
and G. E. Saul

MANAGEMENT DATA SERIES

No. 93

1986

Texas Parks and Wildlife Department
Coastal Fisheries Branch
4200 Smith School Road
Austin, Texas 78744



ACKNOWLEDGMENTS

We would like to thank the personnel in the Laguna Madre and all others who so conscientiously collected all samples. Tom Heffernan, Hal Osburn, Lynn Benefield, C. E. Bryan and Ed Hegen reviewed the manuscript. Thanks also go to the commercial trotline fishermen who provided information about the areas of commercial activity and who allowed us to take measurements of their lines.

ABSTRACT

The estimated night catch of fish on commercial trotlines in the Laguna Madre during September-December 1984 was 472,000 fishes including 54,000 red drum (Sciaenops ocellatus), 100,000 black drum (Pogonias cromis), 307,000 hardhead catfish (Arius felis) and 12,000 "other" fishes. The estimated night catch of black drum on commercial trotlines was twice the amount reported landed (50,000 fish) by commercial fishermen in the Laguna Madre. Commercial trotline catch rates (No./100 hooks) and species composition were similar to those for trotlines set by the Texas Parks and Wildlife Department in the Laguna Madre. The number of commercial trotline hooks being fished has declined by at least 50% since 1969. An estimated 68-85 commercial fishermen presently use trotlines in the Laguna Madre.

INTRODUCTION

Effective management of marine fishes requires stock assessment and harvest estimates. The Texas Parks and Wildlife Department (TPWD) assesses stocks through fishery-independent sampling (McEachron and Green 1985). Estimates of sport harvest are determined principally from on-site interviews (Osburn and Ferguson 1985a, 1985b). Commercial harvest is determined through a self-reporting system by commercial seafood dealers (Osburn et al. 1985). Commercial landings are generally inaccurate because of unreliable reporting of landings (Williams 1977, Matlock 1982). Biases in the commercial data could be reduced if independent sampling techniques were used to estimate landings.

Trotlines have historically accounted for the majority of the reported commercial finfish landings in the Laguna Madre (Breuer 1973, 1974, 1975; Simmons and Breuer 1962; Matlock 1980). Counts of trotline stakes and number of hooks/line and collection of trotline catch/effort studies have been conducted on the commercial trotline fishery (Simmons and Breuer 1962; Breuer 1973, 1974, 1975; McEachron 1980a, 1980b). A study was conducted in the Laguna Madre by TPWD during 1977-78 which assessed the catch on top and bottom trotlines fished during day and night with natural and artificial baits (McEachron et al. 1980).

Current self-reported commercial landings do not provide the required information to describe and assess the participation in the trotline fishery. Therefore, the Texas Parks and Wildlife Commission approved a study in 1984 to determine the reliability of reported commercial trotline landings and to collect information not provided on current self-reported forms.

MATERIALS AND METHODS

Commercial trotline surveys were conducted in conjunction with TPWD trotline sets made during September-December 1984 in areas fished by commercial trotlines (McEachron et al. 1985). Commercial trotline areas were identified by telephone interviews with commercial trotliners before each set (McEachron et al. 1985). All commercial trotlines (straight lines of stakes or floats) observed in each 1-min (latitude-longitude) square grid (2.59 km²) were counted while traveling to and from the dock to each TPWD set site (Figures 1 and 2). TPWD personnel did not always investigate whether mainlines were attached to all stakes or floats.

Immediately after TPWD trotlines had been baited each morning (McEachron et al. 1985) no more than five commercial trotlines in the adjacent area were inspected by a Game Warden and biologist prior

to commercial fishermen running their lines. TPWD personnel were at each site throughout the preceding night to determine which lines had not been run. The following data were recorded from these commercial lines: the number of hooks, number of floats and/or stakes, number of fish by species, position of mainline in water column, length measurements of five random stagings and distance between five different pairs of hooks. After the lines were checked TPWD personnel traveled through the grid where the TPWD trotline was set and all adjacent grids ($\approx 23.3 \text{ km}^2$) and counted trotlines.

The total night time catch by commercial trotlines was estimated for black drum (Pogonias cromis), red drum (Sciaenops ocellatus), hardhead catfish (Arius felis) and "other" fishes for each area as follows:

$$F_{ij}^{\Delta} = 9396 \cdot A_j \cdot f_i \cdot l_j$$

where:

F_{ij}^{Δ} = estimated catch for species i from area j

9396 = product of the mean number of hooks per trotline (based on data collected during this study) and the number of legal fishing nights from 1 September-31 December 1984

A_j = area in square km for area j

f_i = mean number of fish of species i caught per hook night

l_j = mean number of trotlines observed in area j .

Variances were calculated as a product of f_i and l_j following Goodman (1960).

The mean number of commercial trotlines observed in the same 1-min grids in which TPWD set trotlines was compared to means obtained from surveying grids immediately adjacent to the TPWD set and to means obtained from surveying all grids while traveling to and from the set grid using analysis of variance ($P < 0.05$). Data were partitioned by bay system and by grid type. Grids were grouped into the following categories: 1) grids in which TPWD set their trotline, 2) grids immediately adjacent to grid in which TPWD set, 3) grids passed through while traveling from the dock to the set site, 4) grids passed through while traveling from the set site to the dock. The "set" grid and grids adjacent to the "set" grid were not included in categories 3 and 4.

Mean catch rates (fish caught/hook) on circle hooks on commercial and TPWD trotlines were compared using analysis of variance ($P < 0.05$). TPWD used trotlines comprised of 50% circle hooks and 50% straight shank hooks (McEachron et al. 1985). Since commercial trotliners legally

used circle hooks only TPWD catch rates were calculated using only circle-hook data. The proportion that each of black drum, hardhead catfish, red drum and "other" fishes comprised of the commercial and TPWD catches was compared using a test of independence ($P < 0.05$)

RESULTS

The total commercial trotline catch in the Laguna Madre was 472,000 \pm 205,000 fish during 1 September-31 December 1984 (Table 1). The estimated catch of black drum and red drum was 100,000 \pm 43,000 and 54,000 \pm 24,000 fish, respectively. The total catch from grids having the highest density ("set" grids) of trotlines accounted for 14% of the total catch, however, they represented only 4% of the total area (~ 24 km²).

The commercial trotline fishery in the upper Laguna Madre had different characteristics than that in the lower Laguna Madre. Twenty different commercial trotline fishermen were observed on the water during TPWD sets or were contacted by phone (Table 2). Eleven and 43 commercial trotlines were checked in upper Laguna Madre and lower Laguna Madre, respectively (Appendix A). All observed commercial trotlines in the upper Laguna Madre were fished with the mainline on bottom while 54% of the lines in lower Laguna Madre were fished on the bottom (Appendix A). Trotlines were set in water ≤ 1.0 m deep except one set in upper Laguna Madre which was set in water 2.5 m deep (Appendix B). Trotlines in both upper and lower Laguna Madre had the same mean number of hooks/line (~ 108 /line) and mean spacing length (~ 165 cm) (Table 3). Mean staging length was longer (64.6 ± 4.5 vs 44.4 ± 2.0 cm) and more floats were used (4.9 ± 1.8 vs 2.0 ± 0.5 floats) on upper Laguna Madre trotlines than on lower Laguna Madre trotlines. Fewer stakes were used on upper Laguna Madre trotlines (1.8 ± 0.2) than on lower Laguna Madre trotlines (3.2 ± 0.2). Blue crab and oleander leaves were the only baits observed on commercial trotlines. Three species of fishes were observed on upper Laguna Madre trotlines and 10 species on lower Laguna Madre trotlines (Appendix A). Hydrological and meteorological parameters varied among sets (Appendix B).

Commercial trotlines were not randomly distributed throughout the bay (Table 4; Appendix C). The mean number of commercial trotlines within the same grid (3.9 ± 0.4 /grid) in which TPWD set their trotlines was significantly higher ($F = 13.88$, d.f. = 3, $P < 0.05$) than in grids which were surveyed while traveling "to" (0.7 ± 0.5 /grid) or away "from" (0.7 ± 0.5 /grid) the TPWD set site. The mean number of lines/grid in areas adjacent to the TPWD set was intermediate (1.3 ± 0.4 /grid) to the site mean and to the grids surveyed while traveling "to" and

"from" the site; it was not significantly different ($P > 0.05$) from either the site mean or the travel "to" or travel "from" sites. An estimated 44,000 hooks were fished at night during this time (~ 108 hooks/trotline \times 406 trotlines).

The proportion of species caught on TPWD and on commercial trotlines was similar (Table 5; $X^2 = 2.11$, d.f. = 3, $P > 0.05$). There was no significant difference in catch rates (No./100 hooks) between TPWD and commercial trotlines ($F = 0.86$, d.f. = 1, $P > 0.05$) nor between bays ($F = 0.29$, d.f. = 1, $P > 0.05$). The mean catch rate for TPWD and commercial trotlines combined was 15 ± 4 fish/100 hooks; hardhead catfish constituted 69% of the catch, black drum 19%, red drum 10% and "other" fishes 2% (Table 5).

DISCUSSION

The night catch estimate of 472,000 fishes represents a minimum catch. Based on TPWD day catches (McEachron et al. 1985) a total of 796,000 fishes could have been caught commercially including an additional 33,000 black drum and 18,000 red drum if lines were fished during the day. Assumptions used to make these catch estimates include: catch rates in the vicinity of the TPWD sets were similar to catch rates in areas of low fishing activity; and lines were attached to all stakes and/or floats. If either of these assumptions are not true then our estimates overestimate actual catch by an unknown amount.

Not all fishes caught by commercial fishermen are landed or reported. Hardhead catfish was the most abundantly caught species; yet they were not reported in commercial landings (Osburn et al. 1985). During September-December 1984, 50,000 black drum were reported landed commercially in the Laguna Madre assuming a mean weight of 1.36 kg (Osburn et al. 1985; Heffernan et al. 1976; Breuer et al. 1977). Our estimated night black drum catch is twice these reported landings.

Trotlining in the Laguna Madre has decreased at least 50% in the past 20 years. During November 1966-February 1967 about 197,000 hooks were fished in lower Laguna Madre (McMahan and Fritz 1967). By September 1974 the number had dropped to 94,500 hooks (Breuer 1974) and to $\sim 66,000$ hooks after September. In the upper Laguna Madre about 75,000 hooks were fished during 1969-1970 (Harrington 1970). These compare to 44,000 hooks fished in both the upper and lower Laguna Madre during September-December 1984. Not all observed trotline stake lines had mainlines attached so the number of hooks in this study could be an overestimate. However, the reduction in number of hooks fishing is consistent with TPWD trotline tag sales (Osburn et al. 1985).

Our results are consistent with information provided by commercial fishermen and obtained from commercial trotlines. Commercial fishermen in communication with TPWD personnel in lower Laguna Madre during this study indicated that one trotliner could efficiently work 6 trotlines/day. If true, then there are an estimated 68 commercial trotliners. This is lower but similar to estimates (75-85) given by representatives of P.I.S.C.E.S. (an organization of commercial bay fishermen) during public testimony on 29 August 1984 (TPWD public hearing minutes, Austin).

Commercial fishermen have altered trotline fishing methods to reflect restrictions on the use of trotlines since 1970. The mean number of hooks/line was higher in this study (\bar{x} = 108/line) than Breuer (1974) reported in lower Laguna Madre in 1974 (\bar{x} = 85/line). Artificial baits (plastic strips and rubber worms) accounted for 60-70% of all baits used on commercial trotlines prior to 1971 (Harrington 1970, Breuer 1974). These baits were selective for commercially preferred red drum and spotted seatrout (Harrington 1970). Immediately after the ban on artificial baits in 1974 use of these decreased to 7% and use of natural baits increased to 93% on all trotlines (Breuer 1974). Commercial fishermen utilized many different natural baits (i.e. cranberries, pinfish, dead shrimp, oleander leaves) in an effort to catch red drum, spotted seatrout and black drum (McEachron et al. 1980). In 1981, the Texas Legislature prohibited the sale of red drum and spotted seatrout to protect overfished stocks (Anonymous 1983). Commercial trotliners testified in public hearings on 29 August 1984 (TPWD public hearing minutes, Austin) and in meetings with TPWD personnel (McEachron et al. 1985) that bottom lines baited with blue crab will catch black drum with a reduced by-catch of red drum and spotted seatrout. Most of the commercial lines in this study were on bottom and baited with blue crabs and/or oleander leaves. Fishing with blue crabs on bottom lines will catch mainly black drum (McEachron 1980, Cornelius 1984), however, oleander leaves will catch mainly red drum (McEachron 1980).

TPWD night trotline catches and species composition (McEachron et al. 1985) on circle hooks were similar to night commercial trotline catches during the same period. This would be expected since TPWD personnel used similar gear, methods, and fished in the same area as commercial fishermen. The low catches on both TPWD and commercial trotlines may be the result of reduced population levels due to the freeze in December 1983-January 1984 that killed over 15 million animals (McEachron and Green 1985, McEachron et al. 1984).

LITERATURE CITED

- Anonymous. 1983. Saltwater finfish research and management in Texas. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, PWD Rep. No. 3000-154. 48 p.
- Breuer, J. P. 1973. A survey of the juvenile and adult food and game fish of the Laguna Madre. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Proj. Rep. 173-202.
- _____. 1974. Juvenile and adult food and game fish of the Laguna Madre. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Proj. Rep. 109-130.
- _____. 1975. Biological studies in the lower Laguna Madre of Texas, 1975. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Proj. Rep. 158-196.
- _____, R. L. Benefield, M. G. Weixelman, A. R. Martinez and I. Nava. 1977. Survey of finfish harvest in selected Texas bays Segment II. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Proj. Rep. No. 2-231-R-2. 116 p.
- Cornelius, S. E. 1984. Contribution to the life history of black drum and analysis of the commercial fishery of Baffin Bay, Volume II. Ceasar Kleberg Wildl. Research Center, Tex. A&I Univ. Kingsville, Tech. Bull. No. 6. 56 p.
- Goodman, Leo A. 1960. On the exact variance of products. J. Amer. Stat. Assoc. 55:708-713.
- Harrington, R. A. 1970. Evaluation of the trotline fishery of the upper Laguna Madre. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Proj. Rep. 1-22.
- Heffernan, T. L., A. W. Green, L. W. McEachron, M. G. Weixelman, P. C. Hammerschmidt, and R. A. Harrington. 1976. Survey of finfish harvest in selected Texas bays. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Proj. Rep. No. 2-231-R-1. 116 p.
- Matlock, C. G. 1980. History and management of the red drum fishery. Proc. Colloq. on Red Drum and Seatrout, Gulf States Mar. Fish. Comm. No. 5:37-54.
- _____. 1982. The conflict between user groups of red drum and spotted seatrout in Texas. Proceed. Seventh Annu. Mar. Rec. Fish. Symp. May 10-11, 1982, Ft. Lauderdale, Fla., Sport Fish. Inst., Wash. D.C. 101-108.

- McEachron, L. W. 1980a. Recreational and commercial finfish catch statistics for Texas bay systems September 1977-August 1978. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 7. 22 p.
- _____. 1980b. Recreational and commercial finfish catch statistics for Texas bay systems September 1978-August 1979. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 9. 76 p.
- _____, G. C. Matlock, A. R. Martinez, and J. E. Breuer. 1980. Evaluation of natural, leaf, vegetable, worm and cork baits used on trotlines in upper and lower Laguna Madre, Texas (September 1977-October 1978). Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 8. 68 p.
- _____, G. E. Saul, J. Cox, C. E. Bryan, and G. C. Matlock. 1984. Fish kill. Tex. Pks. Wildl. Dep. Mag. XXXXII(4):10-13.
- _____, and A. W. Green. 1985. Trends in relative abundance of selected finfishes along the Texas coast: November 1975-June 1984. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 79. 187 p.
- _____, _____, G. C. Matlock, and G. E. Saul. 1985. A comparison of trotline catches on two hook types in the Laguna Madre. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 86.
- McMahan, C. A., and R. L. Fritz. 1967. Mortality to ducks from trotlines in lower Laguna Madre, Texas. J. Wildl. Mngmnt. XXXI(4):783-787.
- Osburn, H. R., G. E. Saul, and C. L. Hamilton. 1985. Texas commercial harvest statistics, 1977-1984. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 84. 95 p.
- _____, and M. Ferguson. 1985a. Charterboat fishermen finfish catch statistics for Texas marine waters (May 1983-May 1984). Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 77. 64 p.
- _____, _____. 1985b. Trends in finfish catches by private sport boat fishermen in Texas marine waters through May 1984. Tex. Pks. Wildl. Dep., Coast. Fish. Branch, Mngmnt. Data Ser. No. 78. 165 p.
- Simmons, E. G., and J. P. Breuer. 1962. A study of redfish, Sciaenops ocellata Linnaeus and black drum, Pogonias cromis Linnaeus. Publ. Inst. Mar. Sci., Univ. Tex. 8:184-211.

Williams, T. 1977. The raw material of population dynamics. In:
J. A. Gulland, ed., Fish population dynamics. John Wiley and
Sons, Ltd. 27-45.

Figure 1. Areas of commercial fishing activity during September-December 1984 in which Texas Parks and Wildlife Department trotlines were set in upper Laguna Madre. * = area of set.

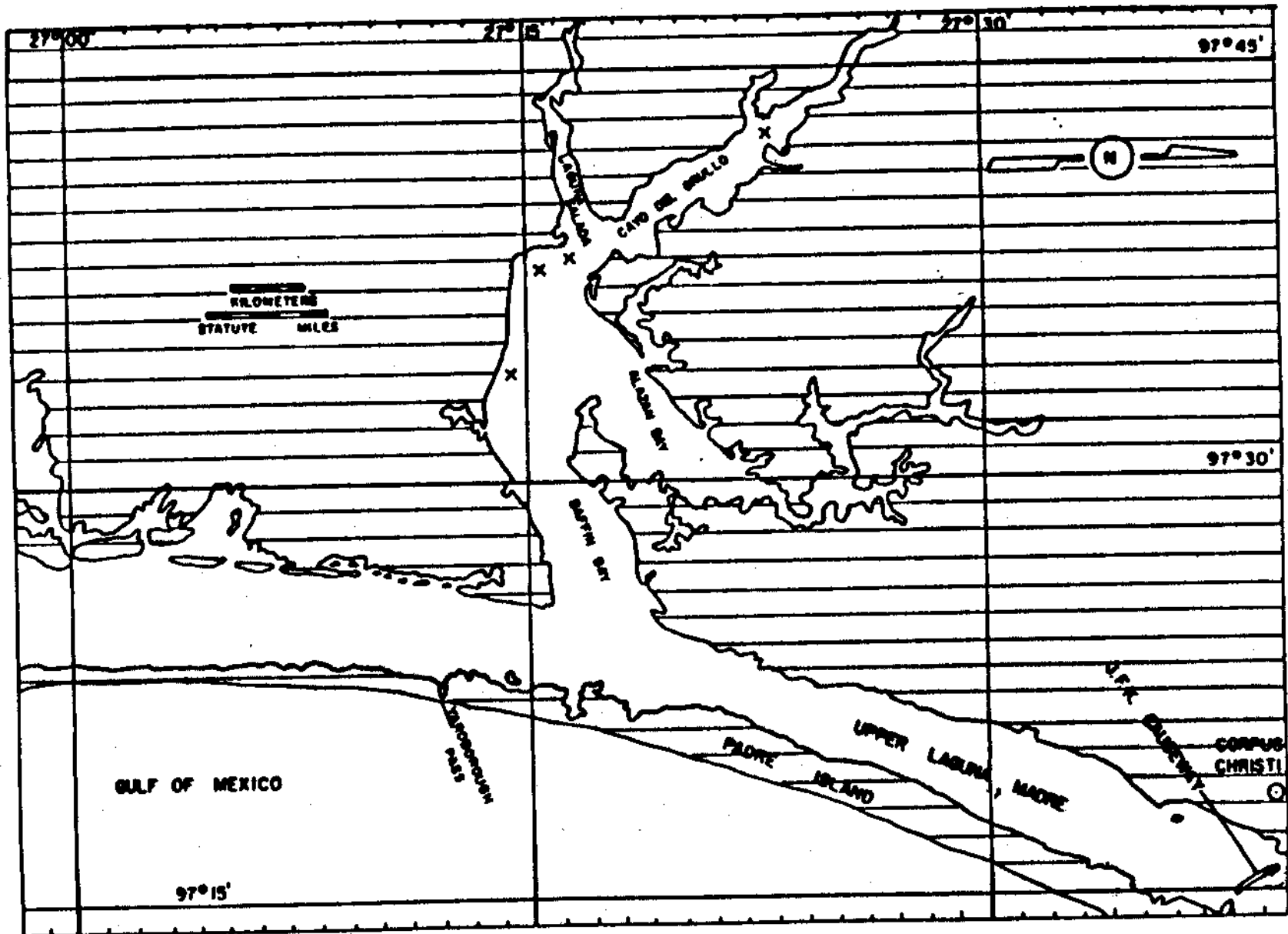


Figure 2. Areas of commercial fishing activity during September-December 1984 in which Texas Parks and Wildlife Department trotlines were set in lower Laguna Madre. * = area of set.

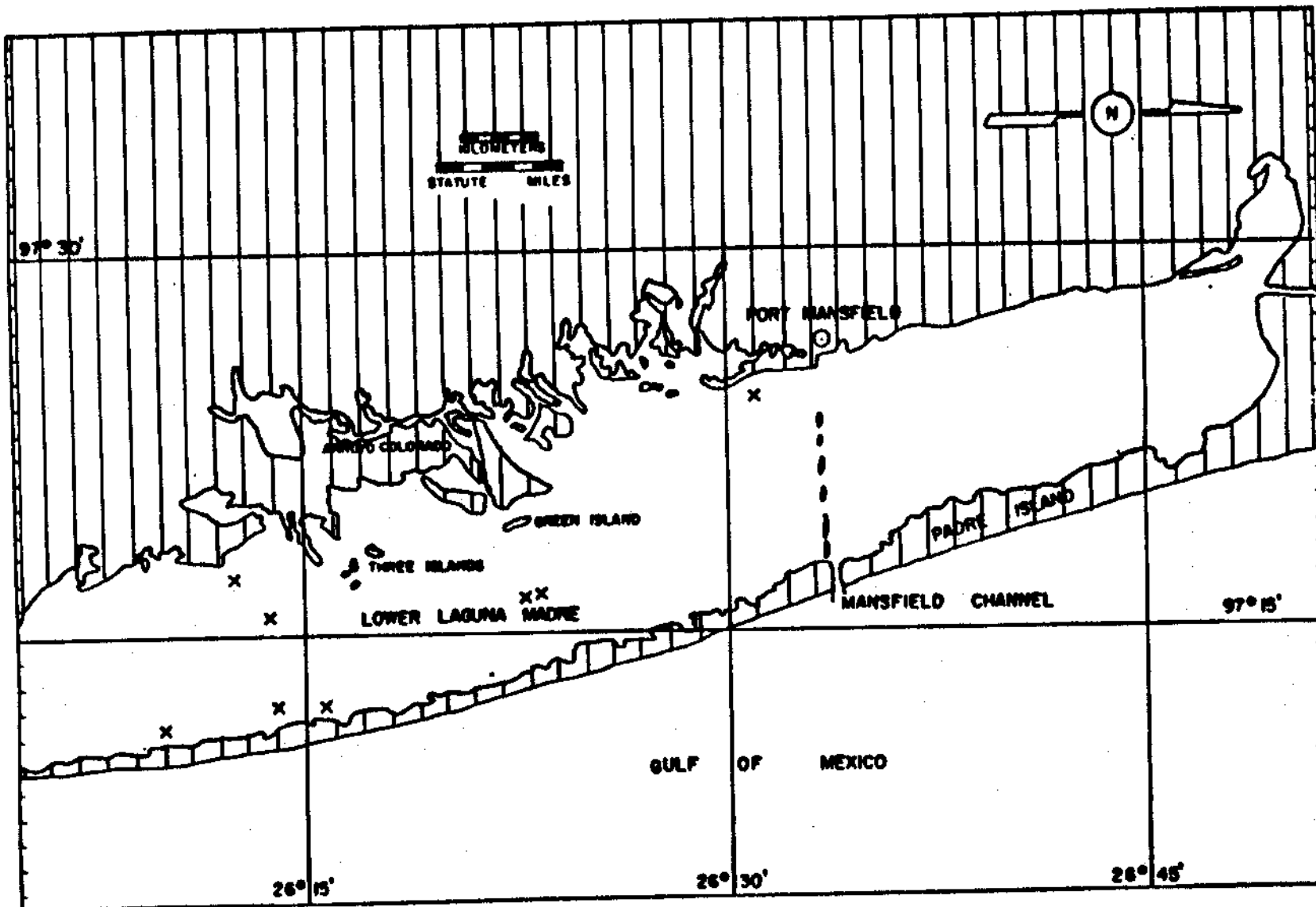


Table 1. Estimated night commercial trotline catch (No. X 1000 \pm 1 SE) by species in the Laguna Madre based on observed night catch rates (fish/hook), trotline densities by area and total number of nights which could be legally fished during 1 September-31 December 1984.

Density ^a	Mean No. trotlines per grid	Total grids	Total hook ^b nights (No. X 1000)	Estimated catch ^c				
				Black drum	Red drum	Hardhead catfish	Other	Total
High	3.9 \pm 0.4	15	543 \pm 63	14 \pm 3	8 \pm 2	43 \pm 11	2 \pm 1	67 \pm 14
Intermediate	1.3 \pm 0.4	120	1432 \pm 447	37 \pm 13	20 \pm 7	115 \pm 44	4 \pm 2	176 \pm 63
Low	0.7 \pm 0.5	271	1859 \pm 1330	48 \pm 35	26 \pm 19	149 \pm 109	6 \pm 4	229 \pm 166
Combined	1.0 \pm 0.4 ^d	476	3833 \pm 1546	100 \pm 43	54 \pm 24	307 \pm 140	12 \pm 6	472 \pm 205

^aHigh = set grids; Intermediate = grids adjacent to set grids; Low = grids counted traveling "to" and "from" set grids.

^bBased on 87 fishing nights and 108 \pm 6 hooks/trotline

^cBased on the following night catch rates (fish/hook \pm 1 SE): black drum = 0.026 \pm 0.004; red drum = 0.014 \pm 0.003; hardhead catfish = 0.080 \pm 0.019; other = 0.003 \pm 0.001; total = 0.123 \pm 0.022.

^dWeighted mean for the total area in the Laguna Madre.

Table 2. Number of different commercial fishermen contacted or seen on the water and number not contacted in the upper and lower Laguna Madre area during September-December 1984.

Commercial fishermen	Upper Laguna Madre (No.)	Lower Laguna Madre (No.)	Total (No.)
Contacted and/or seen on water	6	14	20
Not contacted ^a	8	40	47
Total	14	54	68

^aThese names were obtained from the TPWD Commercial Finfish Fishermen license list but TPWD personnel were unable to contact them.

Table 3. Select physical characteristics ($\bar{x} \pm 1$ SE) of commercial trotlines checked by Texas Parks and Wildlife Department personnel in the upper and lower Laguna Madre during September-December 1984.

Physical characteristic	Upper Laguna Madre	Lower Laguna Madre
No. hooks	107.5 \pm 15.2	108.8 \pm 3.6
Staging length (cm)	64.6 \pm 4.5	44.4 \pm 2.0
Spacing length (cm)	165.5 \pm 5.2	164.1 \pm 2.9
No. floats	4.9 \pm 1.8	2.0 \pm 0.5
No. stakes	1.8 \pm 0.2	3.2 \pm 0.2

Table 4. Mean daily number of trotlines counted (± 1 SE) per grid during Texas Parks and Wildlife Department trotline sets, by grid category in upper and lower Laguna Madre during September-December 1984.

Category	Upper Laguna Madre	Lower Laguna Madre	Combined
In	2.7 \pm 0.6	5.0 \pm 0.6	3.9 \pm 0.4
Adjacent	1.0 \pm 0.7	1.5 \pm 0.7	1.3 \pm 0.4
Travel to	1.1 \pm 0.7	0.4 \pm 0.7	0.7 \pm 0.5
Travel from	1.0 \pm 0.7	0.5 \pm 0.6	0.7 \pm 0.5

Table 5. Catch composition (No. and %) of Texas Parks and Wildlife Department sets and observed catches on commercial trotlines in upper and lower Laguna Madre combined during September-December 1984.

Species	TPWD		Commercial	
	No.	%	No.	%
Black drum	26	18	135	20
Hardhead catfish	99	67	479	69
Red drum	19	13	62	9
Other	3	2	15	2
Total	147		691	

Appendix A. Gear description and catch (No.) of commercial trotlines
in the Laguna Madre during September-December 1984.

Table A.1. Gear description and catch (No.) of commercial trotlines fished in the vicinity of upper Laguna Madre Texas Parks and Wildlife Department sets during September–December 1984. ND = bare hooks.

Date	Gear						Catch			
	Position ^a of mainline	Hooks (No.)	Mean staging length (mm)	Mean staging spacing (cm)	Floats (No.)	Stakes (No.)	Bait type	Black drum	Hardhead catfish	Red drum
Sep 20	3	40	645	125	6	2	ND	0	0	0
20	3	227	650	152	22	0	ND	1	8	0
25	3	143	722	176	4	2	ND	0	0	0
Oct 18	3	100	562	174	4	2	Crabs	0	12	0
Nov 13	3	135	728	174	5	2	ND	0	0	0
13	3	80	708	174	1	2	ND	0	0	0
13	3	86	710	176	3	2	ND	0	0	0
14	3	80	710	174	1	2	ND	0	0	0
14	3	86	710	176	3	2	ND	0	0	0
14	3	135	730	174	5	2	ND	0	0	0
29	3	70	225	145	0	2	ND	0	0	0

^a3 = mainline on bottom

Table A.2. Gear description and catch (No.) of commercial trotlines fished in the vicinity of lower Laguna Madre Texas Parks and Wildlife Department sets during September-December 1984. ND = bare hooks.

Date	Gear							Catch									
	Position ^a of mainline	Hooks (No.)	Mean staging length (mm)	Mean staging spacing (cm)	Floats (No.)	Stakes (No.)	Bait type	Atlantic croaker	Atlantic stingray	Black drum	Hardhead catfish	Ladyfish	Red drum	Sand seatrout	Sheepshead	Southern stingray	Spotted seatrout
Oct 02	3	110	578	168	0	5	Crabs	0	0	0	0	0	0	0	0	0	0
02	3	110	584	168	0	5	Crabs	0	0	9	0	0	1	0	0	0	0
02	3	110	571	163	0	5	Crabs	0	0	5	0	0	0	0	0	0	0
02	3	110	524	166	0	5	Crabs	0	0	16	0	0	12	0	0	0	0
02	3	110	588	163	0	5	Crabs	0	0	4	0	0	0	0	0	0	0
03	3	110	527	160	0	5	Crabs	0	0	3	0	0	1	0	1	0	0
03	3	110	596	173	0	5	Crabs	0	0	6	0	0	1	0	0	0	0
03	3	110	595	167	0	5	Crabs	0	0	4	0	0	1	0	0	0	0
03	3	110	582	164	0	5	Crabs	0	0	3	0	0	1	0	0	0	0
03	3	110	584	161	0	5	Crabs	0	0	4	0	0	0	0	0	0	0
11	2	110	395	167	8	4	Leaves	0	0	1	13	0	0	0	0	0	0
11	2	200	423	102	8	2	Leaves	0	0	7	40	0	5	0	0	0	0
11	2	110	383	171	6	3	Leaves	1	0	2	12	0	2	0	0	0	0
11	2	110	412	151	5	3	Leaves	0	0	2	10	0	1	0	0	0	0
11	2	110	365	146	4	3	Leaves	0	0	1	6	0	0	0	0	0	1
12	2	110	403	167	4	4	Leaves	0	0	1	2	0	0	0	0	0	0
12	2	200	405	146	8	4	Leaves	0	0	0	6	0	0	0	0	0	0
12	2	110	391	167	6	3	Leaves	0	0	1	5	0	0	0	0	2	1
12	2	100	443	150	7	2	Leaves	0	0	1	6	0	0	0	0	2	0
12	2	100	458	166	7	2	Leaves	2	0	2	2	0	0	0	0	0	0
18	2	90	406	172	0	5	Leaves	0	0	0	0	0	0	0	0	0	0
18	2	90	290	178	0	4	Leaves	0	0	0	0	0	0	0	0	0	0
18	2	90	370	178	0	4	Leaves	0	0	0	0	0	0	0	0	0	0
18	2	90	377	184	0	4	Leaves	0	0	0	0	1	0	0	0	0	0
18	2	90	366	170	0	4	Leaves	0	0	0	0	0	0	0	0	0	0

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

Date	Position ^a of mainline	Hooks (No.)	Gear				Catch										
			Mean staging length (mm)	Mean staging spacing (cm)	Floats (No.)	Stakes (No.)	Bait type	Atlantic croaker	Atlantic stingray	Black drum	Hardhead catfish	Ladyfish	Red drum	Sand seatrout	Sheepshead	Southern stingray	Spotted seatrout
Nov 09	1	100	325	146	5	2	Leaves	0	0	1	5	0	2	1	0	0	0
09	1	100	353	144	5	2	Leaves	0	0	0	5	0	2	0	0	0	0
09	1	100	347	163	6	2	Leaves	0	0	2	5	0	2	0	0	0	0
09	1	100	349	153	4	2	Leaves	0	0	0	5	0	2	0	0	0	0
09	1	100	368	150	5	2	Leaves	0	0	1	3	0	2	0	0	0	0
29	3	115	383	158	0	2	Crabs	2	0	6	3	0	2	0	0	0	0
29	3	115	390	155	0	2	Crabs	0	0	7	0	0	1	0	0	0	0
29	3	115	341	157	0	2	Crabs	0	0	1	1	0	0	0	0	0	0
29	3	115	324	149	0	2	Crabs	0	0	2	0	0	2	0	0	0	0
29	3	100	328	163	0	2	Crabs	1	0	1	0	0	1	0	0	0	0
30	3	132	762	177	0	2	Crabs	0	0	0	6	0	0	0	0	0	0
30	3	100	703	144	0	2	Crabs	0	0	0	2	0	1	0	0	0	0
30	3	50	861	132	0	2	Crabs	0	0	0	1	0	0	0	0	0	0
Dec 11	3	96	342	191	0	2	Crabs	0	0	12	59	0	4	0	0	0	0
11	3	96	338	205	0	2	Crabs	0	0	6	52	0	2	0	0	0	0
11	3	96	304	202	0	2	Crabs	0	0	9	65	0	3	0	0	0	0
11	3	120	340	201	0	2	Crabs	0	0	7	73	0	4	0	0	0	0
11	3	120	332	200	0	2	Crabs	0	0	7	71	0	7	0	0	0	0

^a 1 = mainline just under surface; 2 = mainline in mid-water; 3 = mainline on bottom.

Appendix B. Hydrological and meteorological parameters recorded during commercial trotline checks.

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

Code	Explanation
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 = present; 2 = none
WH	Wave height (m): 1 = 0.03-0.12; 2 = 0.12-0.36; 3 = 0.36-0.91
Depth range	Depth (m) at each end of trotline
Temp	Degrees (C)
BP	Barometric pressure (millibars)
BT	Bottom type: 1 = clay; 2 = silt; 3 = sand; 4 = shell; 5 = gravel; 6 = rocks

Table B.2. Hydrological and meteorological data recorded during commercial trotline checks in upper and lower Laguna Madre during September-December 1984. ND = no data.

Area	WS	WD	Tide	CC	Precip	Fog	WH	Depth range	Temp	BP ^a	Bt
Upper Laguna Madre											
Sep 20	19	2	3	6	1	2	2	0.5-0.6	24.0	1009	1,2,3
20	16	2	3	6	1	2	1	0.3-0.3	24.0	1009	1,2,3
25	19	4	3	3	2	2	2	2.5-2.5	29.0	1014	1,2,4
Oct 18	23	4	3	3	2	2	3	0.5-0.5	26.0	1010	1,2
Nov 13	16	4	3	3	2	2	2	0.9-0.9	20.0	1017	1,2
13	16	4	3	3	2	2	2	0.6-1.0	20.0	1017	1,2
13	16	4	3	3	2	2	2	1.0-1.0	20.5	1017	1,2
14	27	4	3	2	2	2	2	1.0-1.0	20.5	1016	1,2
14	24	4	3	2	2	2	2	1.0-1.0	20.0	1016	1,2
14	27	4	3	2	2	2	2	0.7-1.0	20.0	1016	1,2
29	2	5	3	3	2	2	1	0.6-0.6	16.0	1012	1,2,3
Lower Laguna Madre											
Oct 02	16	3	3	6	2	2	1	0.4-0.4	21.0	1020	1,3
02	16	3	3	6	2	2	1	0.4-0.4	21.0	1020	1,3
02	16	3	3	6	2	2	1	0.5-0.5	21.0	1020	ND
02	16	3	3	6	2	2	1	0.5-0.5	21.0	1020	1,3
02	16	3	3	6	2	2	1	0.4-0.4	21.0	1020	1,3
03	8	4	3	6	2	2	1	0.4-0.4	22.0	1017	1,3
03	8	4	3	6	2	2	1	0.4-0.4	22.0	1017	1,3
03	8	4	3	6	2	2	1	0.4-0.4	22.0	1017	1,3
03	8	4	3	6	2	2	1	0.4-0.4	22.0	1017	1,3
03	8	4	3	6	2	2	1	0.4-0.4	22.0	1017	1,3
11	13	4	1	2	2	2	1	0.6-0.7	25.0	1018	1,3
11	13	4	1	2	2	2	1	0.9-0.9	25.0	1018	1,3
11	13	4	1	2	2	2	1	0.9-0.9	25.0	1018	1,3
11	13	4	1	2	2	2	1	0.7-0.7	25.0	1018	1,3
11	13	4	1	2	2	2	1	0.6-0.6	25.0	1018	1,3

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

Area	WS	WD	Tide	CC	Precip	Fog	WH	Depth range	Temp	BP ^a	Bt
Date											
Lower Laguna Madre											
(Cont'd.).											
Oct 12	16	4	1	3	2	2	1	0.6-0.6	25.0	1022	1,3
12	16	4	1	3	2	2	1	0.6-0.8	25.0	1022	1,3
12	16	4	1	3	2	2	1	0.8-0.8	25.0	1022	1,3
12	16	4	1	3	2	2	1	0.9-0.9	25.0	1022	1,3
12	16	4	1	ND	2	2	1	0.9-0.9	25.0	1022	1,3
18	48	4	2	2	2	2	2	1.0-1.0	27.0	1010	1,3
18	48	4	2	2	2	2	2	0.8-0.8	27.0	1010	1,3
18	48	4	2	2	2	2	2	1.0-1.0	27.0	1010	1,3
18	48	4	2	2	2	2	2	0.9-0.9	27.0	1010	1,3
18	48	4	2	2	2	2	2	1.0-1.0	27.0	1010	1,3
Nov 09	32	4	1	2	2	2	2	1.0-1.0	23.5	1013	1,2
09	32	4	1	2	2	2	2	1.0-1.0	23.5	1013	1,2
09	32	4	1	2	2	2	2	1.0-1.0	23.5	1013	1,2
09	32	4	1	2	2	2	2	1.0-1.0	23.5	1013	1,2
09	32	4	1	2	2	2	2	1.0-1.0	23.5	1013	1,2
29	8	4	1	2	2	2	1	0.6-0.6	15.0	1011	1,2
29	8	4	1	2	2	2	1	0.6-0.6	15.0	1011	1,2
29	8	4	1	2	2	2	1	0.5-0.5	15.0	1011	1,2
29	8	4	1	2	2	2	1	0.4-0.4	15.0	1011	1,2
29	8	4	1	2	2	2	1	0.5-0.5	15.0	1011	1,2
30	16	8	1	1	2	1	1	0.6-0.6	17.5	1015	1,2
30	16	8	1	1	2	1	1	0.6-0.6	17.5	1015	1,2
30	16	8	1	1	2	1	1	0.6-0.6	17.5	1015	1,2
Dec 11	8	4	4	1	2	2	1	0.6-0.6	18.5	1018	1,2
11	8	4	4	1	2	2	1	0.5-0.5	18.5	1018	1,2
11	8	4	4	1	2	2	1	0.6-0.6	18.5	1018	1,2
11	8	4	4	1	2	2	1	0.6-0.6	18.5	1018	1,2
11	8	4	4	1	2	2	1	0.6-0.6	18.5	1018	1,2

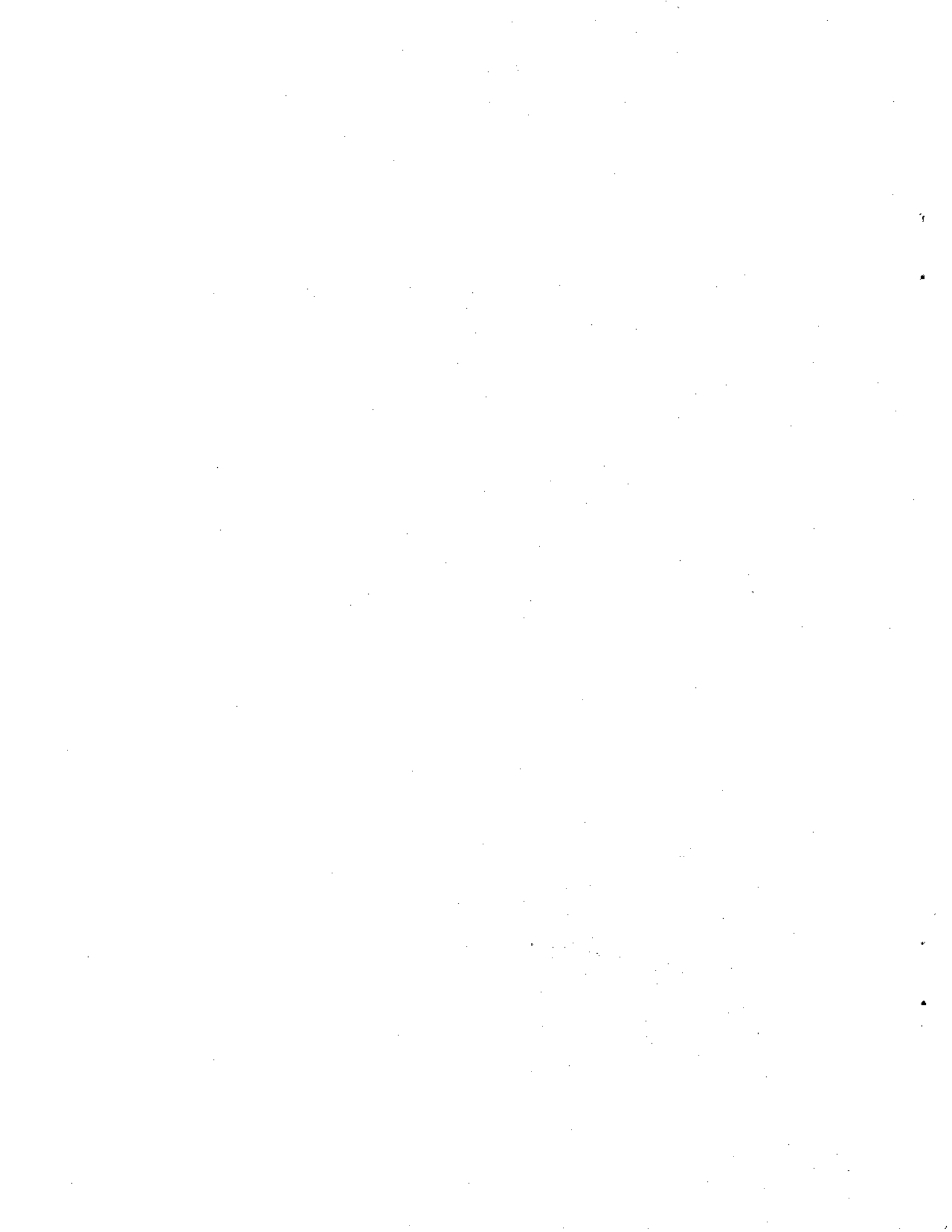
^aBarometric pressure not temperature compensated.

Appendix C. Number of trotlines observed in grids during Texas Parks and Wildlife Department checks of commercial trotlines.

Table C.1. Number of trotlines in the grid in which Texas Parks and Wildlife Department (TPWD) set, in grids adjacent to TPWD set, in the grids traveling to TPWD set and in the grids traveling from TPWD set in upper and lower Laguna Madre during September-December 1984.

Area Date	In ^a	Adjacent		Travel to		Travel from	
	Trotlines (No.)	Grids (No.)	Trotlines (No.)	Grids (No.)	Trotlines (No.)	Grids (No.)	Trotlines (No.)
Upper Laguna Madre							
Sep 20	4	7	14	0	0	0	0
25	1	7	1	3	0	3	0
Oct 11	3	8	1	5	5	5	5
18	2	7	9	0	0	0	0
30	5	6	4	1	1	1	1
Nov 13	2	7	6	5	0	5	0
14	1	6	5	5	3	5	3
30	5	6	5	1	1	1	1
Dec 05	3	4	9	1	2	1	2
06	1	6	9	2	6	2	5
Lower Laguna Madre							
Oct 02	4	7	4	10	4	1	0
03	4	8	1	0	0	10	0
11	3	8	10	7	0	1	0
12	3	8	10	1	0	8	19
18	6	5	12	5	9	5	9
Nov 09	4	8	23	10	0	10	0
28	17	8	20	13	8	0	0
30	4	8	7	0	0	12	0
Dec 06	1	7	3	7	0	6	0
11	4	8	14	8	0	9	3

^aIn = one grid





PWD Report 3400-219
February 1986