THE DAYTIME FALL SOUTHERN FLOUNDER RECREATIONAL FISHERY IN THREE TEXAS PASSES

by Kyle W. Spiller

Management Data Series Number 46
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ABSTRACT

A survey of wade/bank daytime southern flounder (Paralichthys lethostigma) fishermen in the Galveston jetty-Pelican Island area, the Colorado River tidal area, and the Port Aransas pass area was conducted from October through December 1980.

This study indicated that special surveys are probably not needed to monitor the southern flounder harvest on a coastwide basis. By increasing the sample size in the routine creel survey, the precision of the harvest estimates of southern flounder and all other species on a bay system basis could be improved.

The estimated harvest of southern flounder in the Galveston jetty-Pelican Island area was 4277 fish (2560 kg; 5644 lbs); in the Colorado River tidal area was 2637 fish (1582 kg;3488 lbs) and in the Port Aransas pass area was 5275 fish (3165 kg; 6978 lbs).

In the Galveston jetty-Pelican Island area 94% of the southern flounder retained by sport fishermen were females and of these 75% were $\geq$ 305 mm (12 in) in length. In both the Colorado River tidal and Port Aransas pass areas 79% of the southern flounder retained were females. Of these, 62% in the Colorado River tidal area and 54% in the Port Aransas pass area were $\geq$ 305 mm (12 in) in length.

Live shrimp, dead shrimp and live fish were the major baits used in all three areas except in the Port Aransas pass area where artificial bait replaced live shrimp as a major bait.

In the Galveston jetty-Pelican Island and Colorado River tidal areas the majority ($\geq$ 90%) of the fishermen interviewed were Texas residents. In the Port Aransas pass area 69% of the fishermen interviewed were Texas residents and 31% were residents of other states.

INTRODUCTION

The southern flounder (Paralichthys lethostigma) is utilized by both the recreational and commercial fisheries in Texas coastal waters. From August 1979 through September 1980 they accounted for 18% by weight (338,500 kg) and 13% by numbers (594,500 fish) of the lighted pier, wade/bank and private boat recreational finfish harvest (McEachron et al. 1981). During 1980 they accounted for 4% by weight (88,591 kg) of the commercial finfish harvest (Hamilton 1981). In addition to these landings there is a secondary impact on southern flounder. Matlock (1982) estimated ∿9,700,000 southern flounder were caught as a by-catch of bay shrimping activities during 1978. Most were juveniles and no estimates of discard rate were presented.

Adult southern flounder migrate from the bays during November-January to spawn in the Gulf of Mexico. During this migration, the fish are concentrated for a brief period in the passes that connect the bays with the Gulf. The result is a fall recreational "southern flounder run" fishery. Generally southern flounder spawn for the first time when they are 2 years old (Stokes 1973, 1977).

A recreational creel survey being conducted by the Texas Parks and Wildlife Department (TPWD) is designed to estimate a minimum total harvest of fish by recreational fishermen from Texas bays (McEachron and Green 1982). A random sampling procedure is used to determine catch rates, harvest and pressure. It is possible that the routine creel survey may not fully monitor the fall southern flounder harvest because of sample size constraints and the brevity of the southern flounder run.

The purpose of this study was to determine if additional sampling of the southern flounder harvest during the fall run should be incorporated into the standard creel survey.

Specific objectives included:

1. Estimate the harvest (No. and kg) of southern flounder by recreational fishermen during the day at three major bay-Gulf passes between October and December 1980 and compare it to published estimates for wade/bank fishermen from McEachron et al.(1982);

2. Determine the catch per unit effort of southern flounder and other fishes retained and compare it to published estimates for wade/bank fishermen from McEachron et al.(1982);

3. Determine the size and sex ratio of southern flounder retained;

4. Determine the species preferred to be caught by the recreational fishermen;

5. Determine the bait types used; and

6. Determine the geographic origin of the recreational fishermen.

MATERIALS AND METHODS

The beginning of the fall southern flounder run in each area was determined by using information reported in Stokes (1977), reports from bait camp operators and daily visits to the areas by TPWD personnel.

In the Galveston jetty-Pelican Island area interviews were conducted on 8 weekdays and 2 weekend days from 1 October through 30 November 1980. In the Colorado River tidal area interviews were conducted on 8 weekdays and 2 weekend days from 23 October through 30 November 1980. In the Port Aransas pass area interviews were conducted on 12 weekdays and 4 weekend days from 15 October through 23 December 1980.

Interviews were conducted from 1000 to 1800 CST. All fishermen at each wade/bank survey site were counted prior to a survey. The decision to survey at a high count site or select a site at random was made before the rove. Five high count and 5 random sites were selected in the Galveston jetty-Pelican Island area; 6 high count and 4 random sites were selected in the Colorado River tidal area and 9 high count and 7 random sites were selected in the Port Aransas pass area. Fishermen were interviewed upon completion of their fishing trip to determine trip time, state (and county of origin if from Texas), bait used and number and species (Hoese and Moore 1977, Bailey et al, 1970) of fish retained. Each southern flounder was measured to the nearest mm (total length) and all southern flounder in each creel were weighed together to the nearest 0.05 kg. The mean weight of southern flounder was calculated by dividing the total weight of all southern flounder weighed by the total number of fish weighed in each area. Sex of all southern flounder seen was determined by slitting the abdomen and examining the gonads.

The estimated minimum daylight harvest of southern flounder by wade/bank rod and reel fishermen in the surveyed areas was determined by calculating the mean daily harvest (the sum of the daily harvests divided by the number of survey days) for the period and then multiplying by the number of days in the period during which surveys were conducted (Kish 1965).

Catch rates (synonymous with retention rates) were calculated for each area by dividing the number of southern flounder retained (No. and kg) by the actual number of man-h (trip time) expended by all the interviewed fishermen in each area. The total estimated pressure (man-h) was then calculated by dividing the estimated harvest (No. of southern flounder) by the No. of southern flounder/man-h.

Bait use data was based on fishermen actively fishing for southern flounder. The percent of fishermen that used a particular bait type was calculated by dividing the number of southern flounder fishermen that used each bait by the total number of southern flounder fishermen in each area. The percent of fishermen that were successful (caught at least one southern flounder) with a particular bait type was calculated by dividing the number of successful southern flounder fishermen using each bait type by the total number of southern flounder fishermen in each area. The percent of southern flounder caught on a particular bait type was calculated by dividing the number of fish caught on each bait by the total number caught in each area.

A two-way analysis of variance (Sokal and Rohlf 1969) was used to compare mean weekday and weekend day daily harvest among bay systems. A two-way analysis of variance was used to compare the mean percent of fishermen from adjacent counties between bay systems and also the mean percent of fishermen from other states. To reduce heteroscedasticity percents were converted to arcsine before analysis.

A three-way analysis of variance using regression techniques to account for unequal sample sizes (Overall and Spiegel 1969) was used to compare the mean number of fishermen seen at high count and random survey sites on weekday and weekend days among pass areas and also to compare the mean daily catch per unit of effort and the mean length of southern flounder caught. To reduce heteroscedasticity the catch per unit of effort values were transformed to common logrithms before analysis.

RESULTS

A total of 852 interviews were conducted at wade/bank sites in the three areas; ~61% of the interviews were conducted in the Port Aransas pass area (Table 1). The mean number of fishermen per party in each area was ~ two. The mean trip time ranged from 2.7 h in the Port Aransas pass area to 4.0 h in the Colorado River tidal area. Generally, more fishermen were seen on weekend days than on weekday days (Table 2). There was a significant difference among the mean number of fishermen seen per day on weekday and weekend days, among high count sites and random sites and among the three areas (Appendix B, Table 2).

Estimates of the fishing pressure and harvest of southern flounder fishermen ranged from 17,580 man-h and 2637 fish (1582 kg) in the Colorado River tidal area to 35,168 man-h and 5275 fish (3165 kg) in the Port Aransas pass area (Table 2). Of all southern flounder sexed >79% were female in each area (Table 3). There was no significant difference in the mean daily harvest of southern flounder on weekday and weekend days among the three areas (Appendix B, Table 1). For the period September 1979 through August 1980 the regular random creel survey estimated a harvest of 50,800 southern flounder for Galveston Bay, 5100 southern flounder for Matagorda Bay and 6200 southern flounder for Corpus Christi Bay (McEachron et al. 1981).

The mean catch rate for southern flounder in all three areas was 0.15 ± 0.02 fish/man-h. There was no significant difference in the catch rate for southern flounder between weekday and weekend days, between high count sites and random sites, or among the three areas (Appendix B, Table 3). For the period September 1979 through August 1980 the catch rates for southern flounder for Galveston Bay wade/bank fishermen was 0.03 fish/man-h, for Matagorda Bay wade/bank fishermen was 0.01 fish/man-h and for Corpus Christi Bay wade/bank fishermen was 0.02 fish/man-h (Table 4).

There was no significant difference in the mean weight of southern flounder caught in the three areas. The mean weight of southern flounder in all three areas combined was 0.60 kg. The mean weight of southern flounder harvested at wade/banks during the high use period (15 May-20 November 1980) coastwide was 0.43 ± 0.23 kg (TPWD unpublished data). Since 0.60 kg falls within this interval there is probably no significant difference between the mean weight of southern flounder harvested during the special "southern flounder run" survey and the regular creel survey.

The length of southern flounder retained by fishermen in the three areas ranged from 195 to 585 mm (Figures 1, 2 and 3). At least 54% of the southern flounder retained in each area were females ≥ 305 mm in length.

The predominant species caught incidentally to southern flounder were sand seatrout (Cynoscion arenarius) and "other" fishes (Table 5). Catch rates varied among bays.

The mean length of male southern flounder retained by fishermen in the Colorado River tidal and Port Aransas pass areas appeared smaller (274 ± 4 mm and 328 ± 8 mm, respectively) than female southern flounder (384 ± 4 mm and 396 ± 5 mm, respectively)(Table 3). In the Galveston jetty-Pelican Island area the mean lengths of male (350 ± 4 mm) and female (351 ± 16 mm) southern flounder were similar. There was a significant interaction between the day type (weekday vs weekend day) and the survey type (high count site vs random) in the mean daily lengths of southern flounder (Appendix B, Table 4). The survey type that resulted in the largest mean length was dependent upon the day type; on weekday days the largest mean lengths were at random sites while on weekend days the largest mean lengths were at high count sites (Appendix C).

The majority (≥75%) of the fishermen in the Galveston jetty-Pelican Island and Colorado River tidal areas used dead shrimp, live shrimp or live fish for bait; at least 77% of the southern flounder in these areas were caught on these baits (Table 6). In the Port Aransas pass area 78% of the fishermen used "other" baits (mainly lead headed jigs with a strip of fish attached to the hook - known as a flounder belly), dead shrimp and dead fish; 55% of the southern flounder were caught on these baits.

The percent of the fishermen interviewed who came from counties adjacent to a bay system ranged from 13% ± 2% in the Port Aransas Pass

area to 78% ± 7% in the Galveston jetty-Pelican Island area (Table 7). There was a significant difference in the percent of fishermen interviewed from adjacent counties among the three areas (Appendix B, Table 5). More out of state fishermen were interviewed in the Port Aransas Pass area (33% ± 5%) than in the Galveston jetty-Pelican Island and Colorado River tidal area (7% ± 3% and 2% ± 1%, respectively). There was a significant difference in the percent of fishermen interviewed from other states among the three areas (Appendix B, Table 6).

Between 40% and 60% of the fishermen interviewed in each area stated they were fishing for southern flounder (Table 8). Approximately 32-47% of the fishermen in each area stated they had no fishing preference.

DISCUSSION

It appears that special surveys during October through December are probably not warranted to monitor the southern flounder harvest on a coastwide basis. While a special survey of fishermen during October through December may improve the harvest estimate of southern flounder, a more cost effective approach would be to increase the sample size of the routine creel survey to improve the reliability of harvest estimates of southern flounder and all other species.

The catch rates observed during the southern flounder survey are greater than those reported in the routine TPWD survey. This may be due to fishermen using baits and methods during the southern flounder run that are selective for southern flounder or it may be that the fish are concentrated in the passes during the fall migration making them more vulnerable to capture. In addition, catch rates in the southern flounder survey were calculated using trip time of fishermen in a small area of a bay system during 2 months, whereas catch rates in the routine TPWD survey were calculated using trip time of fishermen at all wade/bank areas in a bay system during 6-month periods.

In all three areas fishermen retained more female than male southern flounder. Male southern flounder were generally smaller than the females. Most male southern flounder may leave the bay before the females, perhaps as much as 3 weeks before (Simmons 1951, 1962; Stokes 1973,1977). Stokes (1977) reported that male southern flounder rarely exceed 305 mm and that most sport fishermen are selective for fish larger than this. In this study few male southern flounder were seen. Therefore, it appears that the harvest of male southern flounder does not constitute a large percentage of the total southern flounder landings.

Female southern flounder ≥ 305 mm dominated the harvest in all three areas. Stokes (1977) reported that 74% of the sport gig fishery for southern flounder in Aransas Bay from January 1974-September 1975 were "female southern flounder in their second and third years of life (fish 305 mm to 457 mm long)". It appears, therefore, that both the daylight wade/bank fishermen and the night gig fishermen are generally harvesting the same size of fish.

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Table 1. Mean number of fishermen seen per day (± 1 S.E.), mean number of fishermen per party (± 1 S.E.) and mean trip time of southern flounder (*Paralichthys lethostigma*) fishermen in the Galveston jetty-Pelican Island, the Colorado River tidal and the Port Aransas pass areas (October-December 1980).

Area	Interviews (No.)	Mean No./day (No.)	Mean No./party (No.)	Mean trip time (h)
Galveston jetty-Pelican Island	210	42.5 ± 18	2.0 ± 0.09	3.7 ± 0.16
Colorado River tidal	124	27.5 ± 11	2.2 ± 0.11	4.0 ± 0.25
Port Aransas pass	518	58.6 ± 19	1.8 ± 0.04	2.7 ± 0.09

Table 2. Mean number of fishermen seen (± 1 S.E.) at random sites and high count sites by day type in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass area (October-December 1980). Number in parenthesis = No. of interview days.

	Weekend		Weekday	
Bay	Random	High	Random	High
Galveston jetty-Pelican Island	59 (1)	55 (1)	35 ± 17 (4)	43 ± 13 (4)
Colorado River tidal	49 (1)	38 (1)	16 ± 11 (3)	28 ± 5 (5)
Port Aransas pass	55 ± 20 (2)	98 ± 8 (2)	21 ± 9 (5)	75 ± 13 (7)

Table 3. Fishing pressure, harvest catch per effort (No. man-h ± 1 S.E.) and mean size (mm ± 1 S.E.) of southern flounder (Paralichthys lethostigma) caught by sport fishermen in the Galveston jetty-Pelican Island, the Colorado River tidal and the Port Aransas pass areas (October-December 1980). Number in parentheses = No. of fish measured.

Area	Pressure (man-h)	Harvest No.	Harvest Kg	Catch/effort No./h	Mean length (mm) ♀	Mean length (mm) ♂	Mean length (mm) Combined
Galveston jetty-Pelican Island							
10/1/80-11/30/80	28,513	4277 (2747-5807)[a]	2560	0.12 ± 0.04	350 ± 4 (238)	351 ± 16 (16)	350 ± 4 (254)
Colorado River tidal							
10/23/80-11/30/80	17,580	2637 (1693-3581)[a]	1582	0.16 ± 0.07	384 ± 4 (175)	274 ± 4 (47)	356 ± 4 (222)
Port Aransas pass							
10/15/80-12/23/80	35,166	5275 (3388-7162)[a]	3165	0.17 ± 0.04	396 ± 5 (187)	328 ± 8 (50)	362 ± 4 (237)

[a] 95% confidence interval

Table 4. Comparison of harvest of southern flounder (Paralichthys lethostigma) landed by recreational fishermen in three Texas bays estimated from the special survey and the TPWD routine survey (September 1979-August 1980).

Bay	Harvest (No.)			Catch rate (No./man-h)		
	Special	Routine		Special	Routine	
		High use season[a]	Low use season[b]		High use season[a]	Low use season[b]
Galveston	4277	16,800	34,000	0.12	0.03	0.18
Matagorda	2637	2400	2700	0.16	0.01	0.01
Corpus Christi	5275	4400	1800	0.17	0.02	0.01
All bays	12,189	23,600	38,500	0.15		

[a]High use season = 15 May through 20 November.

[b]Low use season = 21 November through 14 May.

Table 5. Catch per effort (No./man-h) for species caught incidentally to southern flounder by fishermen in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass areas (October-December 1980).

Species	Galveston (No./h)	Colorado River (No./h)	Port Aransas (No./h)
Red drum	<.01	<.01	<.01
Black drum	0.02	0.06	<.01
Sheepshead	0.01	0.13	0.01
Atlantic croaker	0.05	0.02	0.03
Sand seatrout	0.20	0.01	<.01
Spotted seatrout	<.01	<.01	<.01
Gafftopsail	0.00	0.00	<.01
Other[a]	0.15	0.01	0.09

[a]Other includes pinfish (*Lagodon rhomboides*), sea catfish (*Arius felis*), pigfish (*Orthopristis chrysoptera*), silver perch (*Bairdiella chrysura*), and whiting (*Menticirrhus* sp.)

Table 6. Bait preference, % successful fishermen and % of southern flounder caught by bait type by sport fishermen in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass areas (October-December 1980).

Bay system	Bait					
	Artificial (%)	Live shrimp (%)	Dead shrimp (%)	Live fish (%)	Dead fish (%)	Other (%)
Galveston						
Fishermen use	0	16	41	32	5	2
Successful southern flounder fishermen	0	46	15	41	9	<1
Southern flounder caught	0	28	12	47	1	0
Colorado River						
Fishermen use	1	30	35	10	6	18
Successful southern flounder fishermen	25	43	15	52	69	30
Southern flounder caught	<1	49	7	16	16	11
Port Aransas						
Fishermen use	11	4	21	10	14	41
Successful southern flounder fishermen	39	52	4	26	26	26
Southern flounder caught	20	7	4	11	11	47

Table 7. Angler origin (%) of fishermen from adjacent counties, other counties, and other states in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass areas (October-December 1980).

Area	Adjacent counties	Other counties	Other states
Galveston jetty - Pelican Island[a]	78 ± 7	15 ± 4	7 ± 3
Colorado River tidal[b]	41 ± 10	57 ± 10	2 ± 1
Port Aransas pass[c]	13 ± 2	55 ± 5	33 ± 5

[a]Adjacent counties to Galveston Bay are Harris, Galveston, Chambers and Brazoria.

[b]Adjacent counties to Matagorda Bay are Victoria, Calhoun, Jackson and Matagorda.

[c]Adjacent counties to Corpus Christi Bay are Aransas, San Patricio and Nueces.

Table 8. Fish preference of fishermen in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass areas. (October-December 1980).

Fish preference	Percent		
	Galveston	Colorado River	Port Aransas
Southern flounder	40.9	52.2	66.5
Southern flounder & Spotted seatrout	3.0	0.0	0.0
Southern flounder & Atlantic croaker	0.0	0.0	0.3
Southern flounder & Red drum	1.0	0.0	0.0
Southern flounder, Spotted seatrout & Red drum	0.0	1.0	0.0
Southern flounder & Sand seatrout	1.0	0.0	0.0
No preference	47.0	42.0	32.0
Spotted seatrout	0.0	1.0	0.1
Red drum	0.0	2.0	0.0
Atlantic croaker	1.0	0.0	0.0
Sheepshead	0.0	1.0	0.0
Whiting	0.0	0.0	0.1
Sand seatrout	6.0	0.0	0.0
Red drum & Gafftopsail catfish	0.0	0.0	0.3
Eel	0.0	0.0	0.3

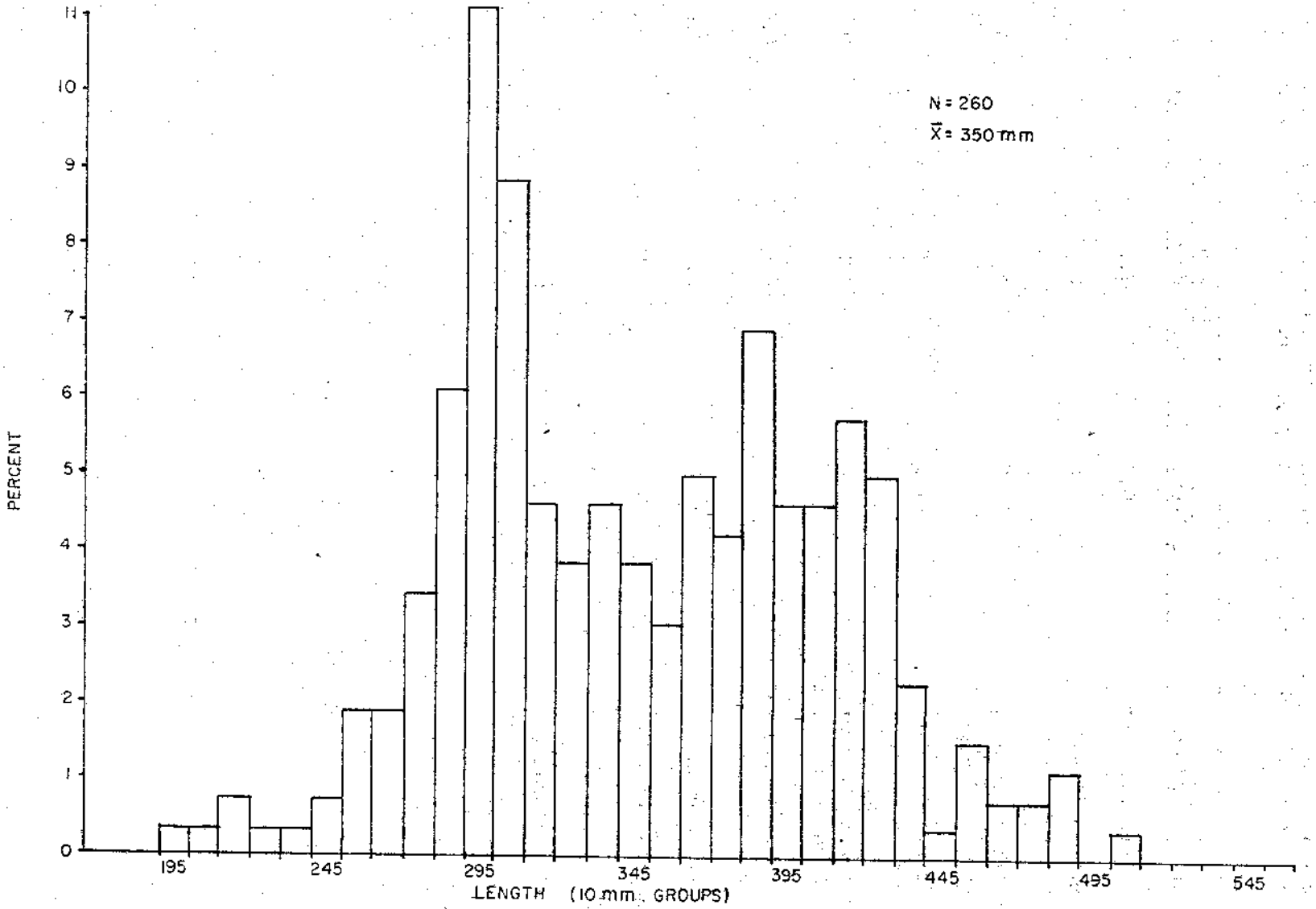


Figure 1. Percentage of southern flounder (Paralichthys lethostigma) in each 10-mm size group caught by Galveston jetty-Pelican Island southern flounder fishermen (October-December 1980).

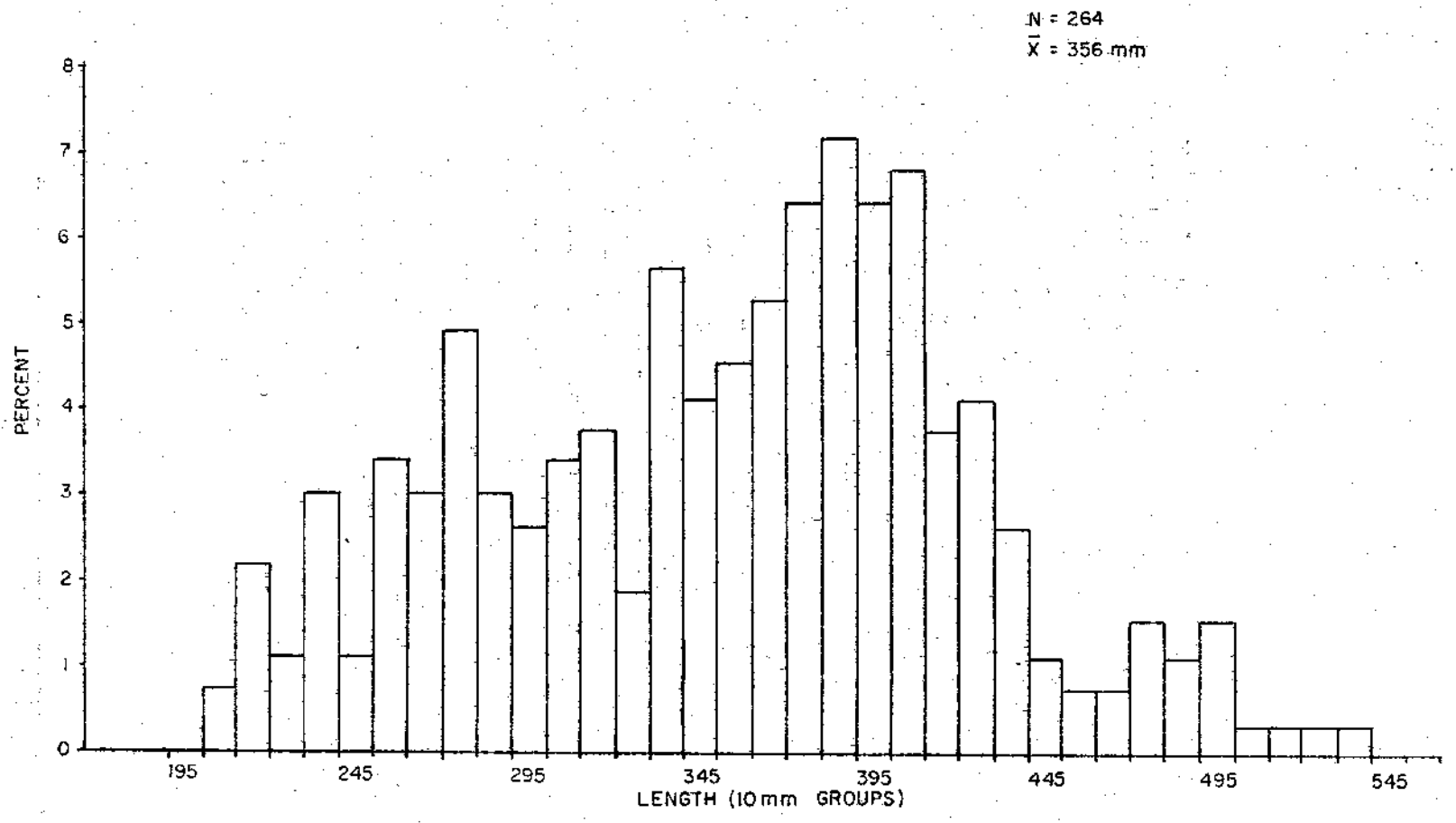


Figure 2. Percentage of southern flounder (Paralichthys lethostigma) in each 10-mm size group caught by Colorado River tidal area southern flounder fishermen (October-December 1980).

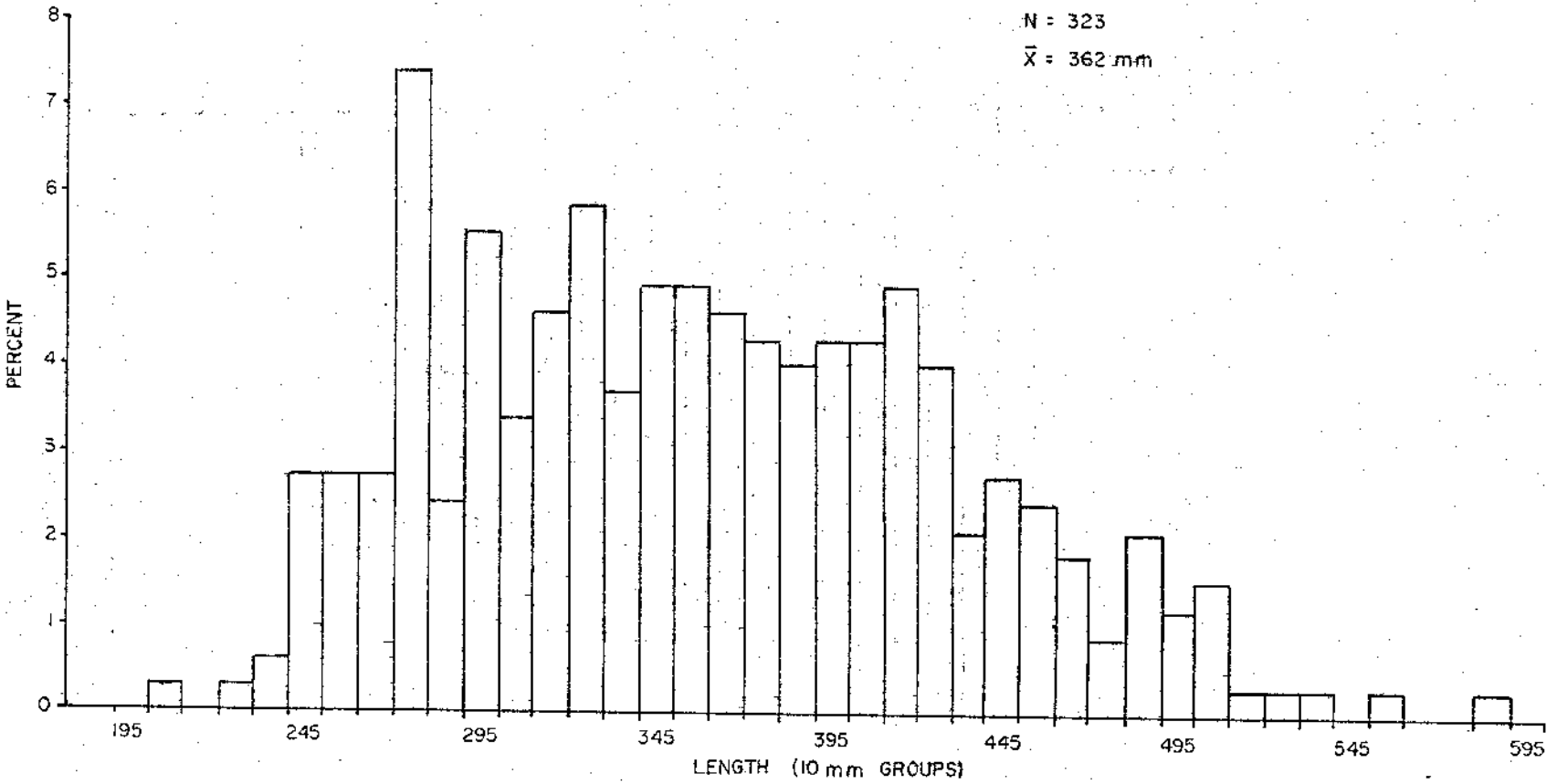
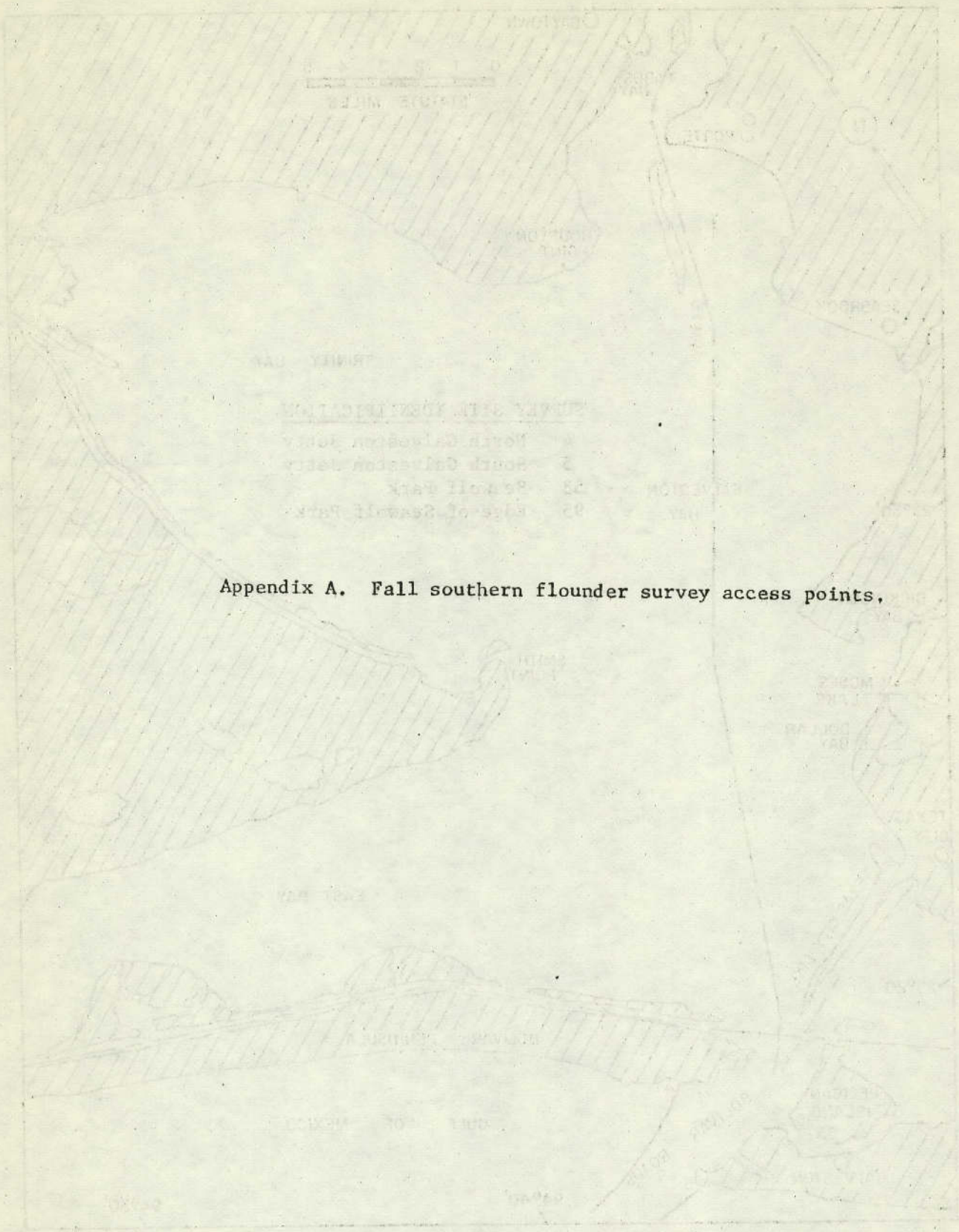


Figure 3. Percentage of southern flounder (Paralichthys lethostigma) in each 10-mm size group caught by Aransas Pass southern flounder fishermen (October-December 1980).



Appendix A. Fall southern flounder survey access points.

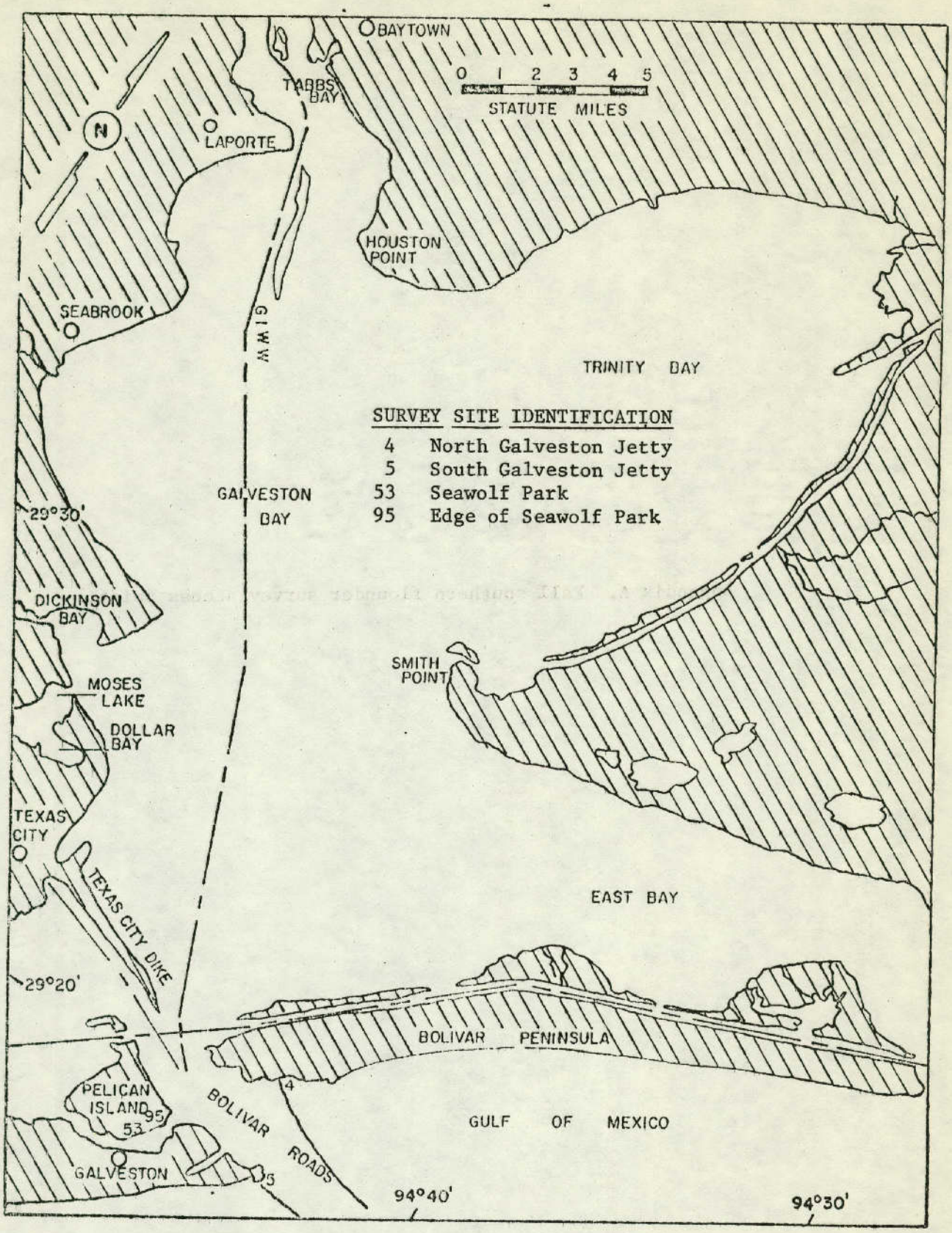


Figure 1. Fall southern flounder (Paralichthys lethostigma) survey sites in Galveston Bay (October-December 1980).

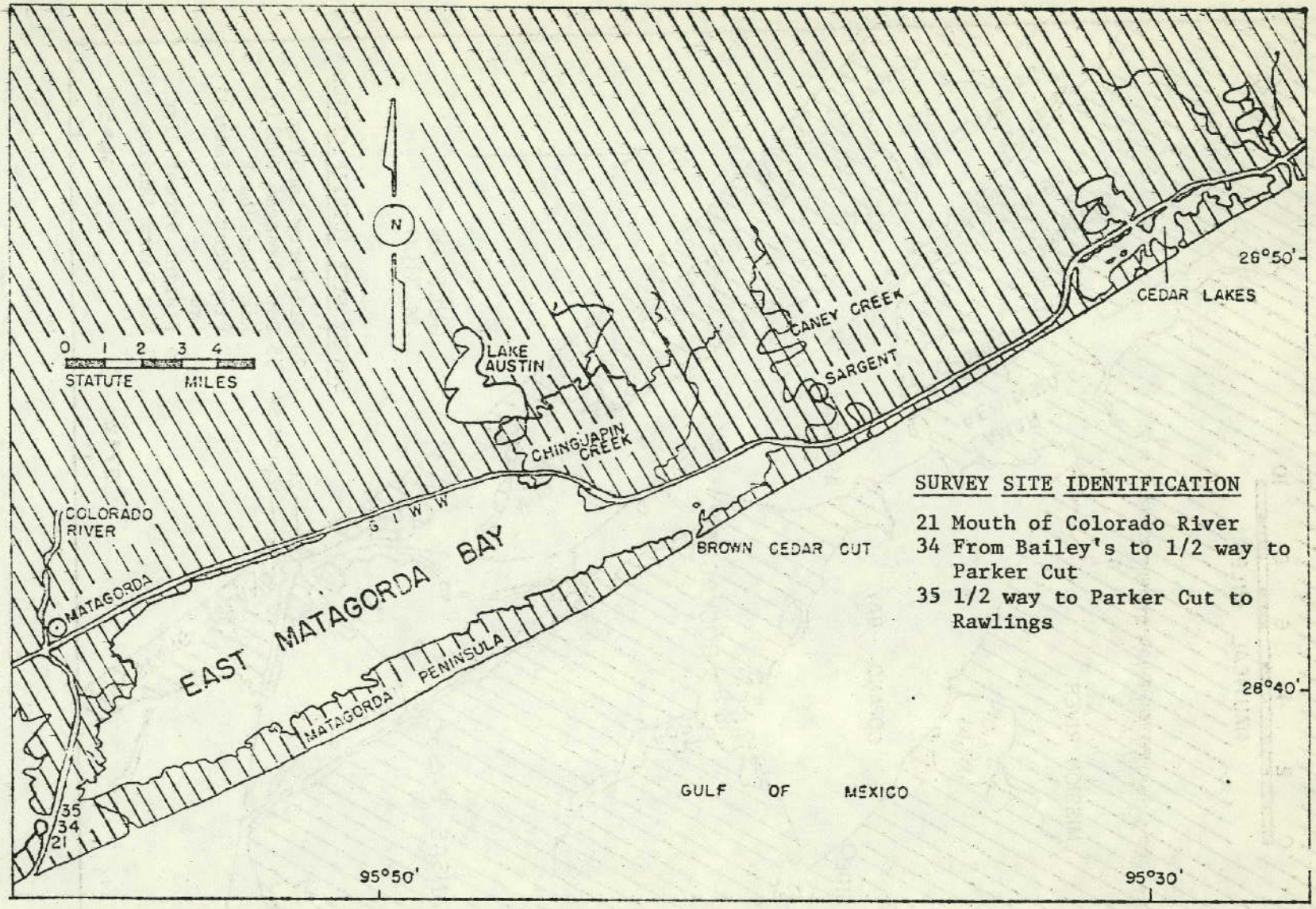


Figure 2. Fall southern flounder (Paralichthys lethostigma) survey sites in Matagorda Bay (October-December 1980).

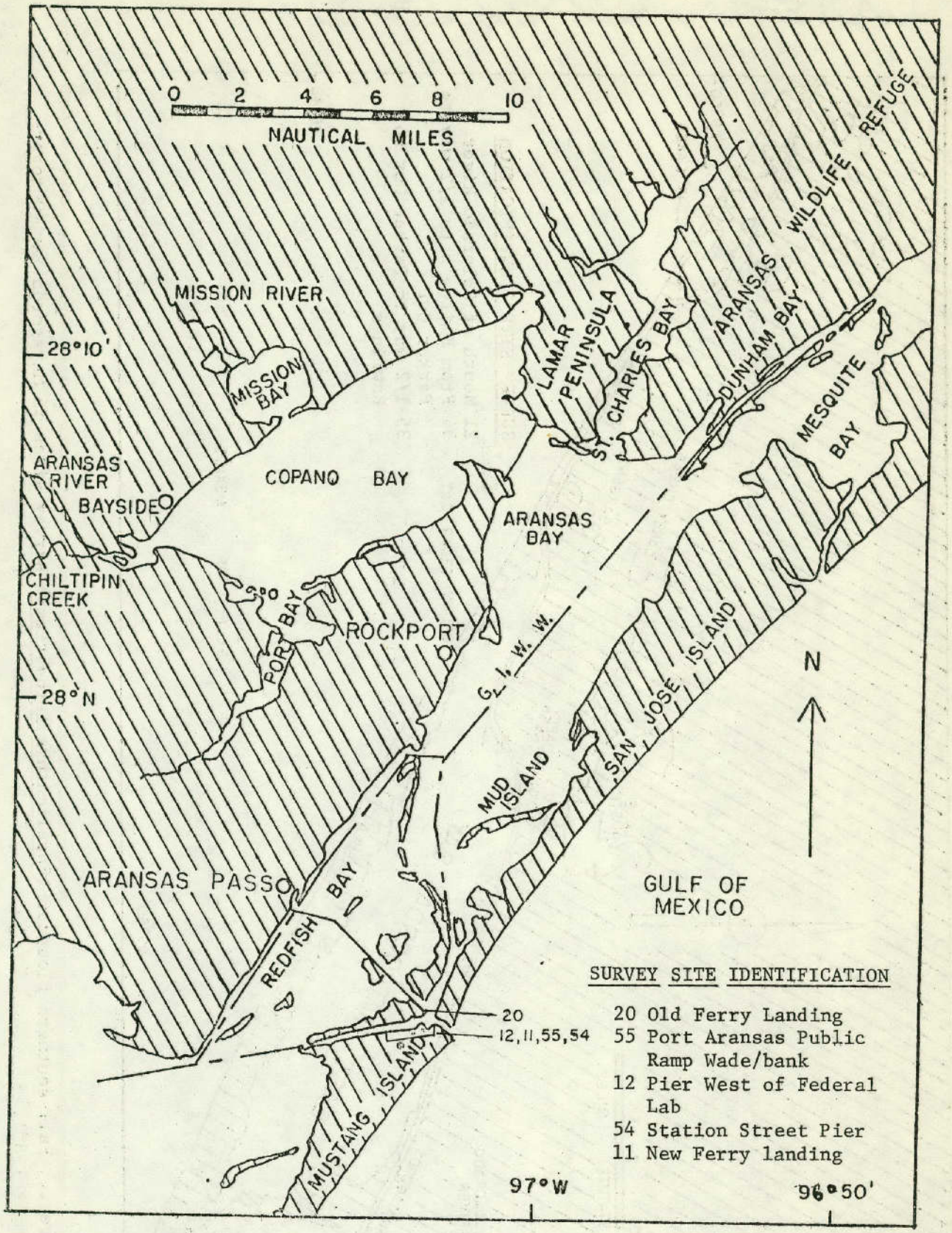


Figure 3. Fall southern flounder (Paralichthys lethostigma) survey sites in Port Aransas (October-December 1980).

Appendix B. Analysis of variance tables.

Table 1. Result of two-way analysis of variance of mean daily harvest of southern flounder (Paralichthys lethostigma) by fishermen on weekdays and weekend days in Galveston jetty-Pelican Island, Colorado River tidal, and Port Aransas pass areas (October-December 1980)

Source of variation	Degrees of Freedom	Sum of squares	Mean squares	F-statistic
Groups	5	17384.44	3476.89	0.423 NS
Day type (Weekend vs Weekday)	1	35.85	35.85	0.004 NS
Bay system	2	7971.90	3985.95	0.485 NS
Inter-action	2	9376.69	4688.34	0.570 NS
Error	24	197259.42	8219.14	
Total	29	214643.87		

NS = Not significant at P = 0.05

Table 2. Result of three-way analysis of variance of the mean number of fishermen seen per day on weekday and weekend days in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass area (October-December 1980).

Source of variation	Degrees of Freedom	Sum of squares	Mean squares	F-statistic
Day type (Weekend vs Weekday)	1	3754.38	3754.38	6.394 *
Survey type (High count vs Random)	1	5834.69	5834.69	9.938 *
Bay system	2	5833.81	2916.91	4.968 *
Day type X Survey type	1	299.19	299.19	0.510
Day type X Bay system	2	474.56	237.28	0.404
Survey type X Bay system	2	1691.69	845.84	1.441
Inter-action	2	288.69	144.34	0.246
Error	23	13503.62	587.11	
Total	35	34358.62		

* P <0.05

Table 3. Result of three-way analysis of variance of the mean catch per unit of effort of southern flounder (Paralichthys lethostigma) by fishermen on weekday and weekend days in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass area (October-December 1980).

Source of variation	Degrees of Freedom	Sum of squares	Mean squares	F-statistic
Day type (Weekend vs Weekday)	1	0.03	0.03	0.127 NS
Survey type (High count vs Random)	1	0.92	0.92	3.542 NS
Bay system	2	0.19	0.09	0.364 NS
Day type X Survey type	1	0.08	0.08	0.308 NS
Day type X Bay system	2	0.70	0.35	1.349 NS
Survey type X Bay system	2	1.40	0.70	2.702 NS
Inter-action	2	0.17	0.08	0.328 NS
Error	23	5.97	0.25	
Total	35	9.43		

NS = Not significant at P = 0.05

Table 4. Result of three-way analysis of variance of mean length of southern flounder (Paralichthys lethostigma) by fishermen on weekday and weekend days in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass area (October-Decmeber 1980).

Source of variation	Degrees of Freedom	Sum of squares	Mean squares	F-statistic
Day type (Weekend vs Weekday)	1	454.00	454.00	0.195
Survey type (High count vs Random)	1	36.00	36.00	0.016
Bay system	2	20124.00	10062.00	4.330
Day type X Survey type	1	10443.00	10443.00	4.494 *
Day type X Bay system	2	4412.00	2206.00	0.949
Survey type X Bay system	2	1754.00	877.00	0.377
Inter-Action	2	7773.00	3886.50	1.672
Error	17	39504.00	2323.76	
Total	29	85447.00		

* $P < 0.05$

Table 5. Result of two-way analysis of variance of mean percent of fishermen from adjacent counties seen on weekday and weekend days in the Galveston jetty-Pelican Island, Colorado River tidal, and Port Aransas pass area (October-December 1980).

Source of variation	Degrees of Freedom	Sum of squares	Mean squares	F-statistic	
Groups	5	14062.38	2812.48	10.618	*
Day type (Weekend vs Weekday)	1	14.42	14.42	0.054	
Bay system	2	13934.05	6967.02	26.302	*
Inter-action	2	114.44	57.22	0.216	
Error	24	6357.46	264.89		
Total	29	20420.38			

* P <0.05

Table 6. Result of two-way analysis of variance of mean percent of fishermen from other states seen on weekday and weekend days in the Galveston jetty-Pelican Island, Colorado River tidal and Port Aransas pass area (October-December 1980).

Source of variation	Degrees of Freedom	Sum of squares	Mean squares	F-statistic	
Groups	5	2979.74	595.95	10.887	*
Day type (Weekend vs Weekday)	1	204.37	204.37	3.734	
Bay system	2	2472.41	1236.20	22.583	*
Inter-action	2	302.97	151.48	2.767	
Error	24	1313.88	54.74		
Total	29	4293.62			

* P <0.05

Appendix C. Interaction of mean daily lengths

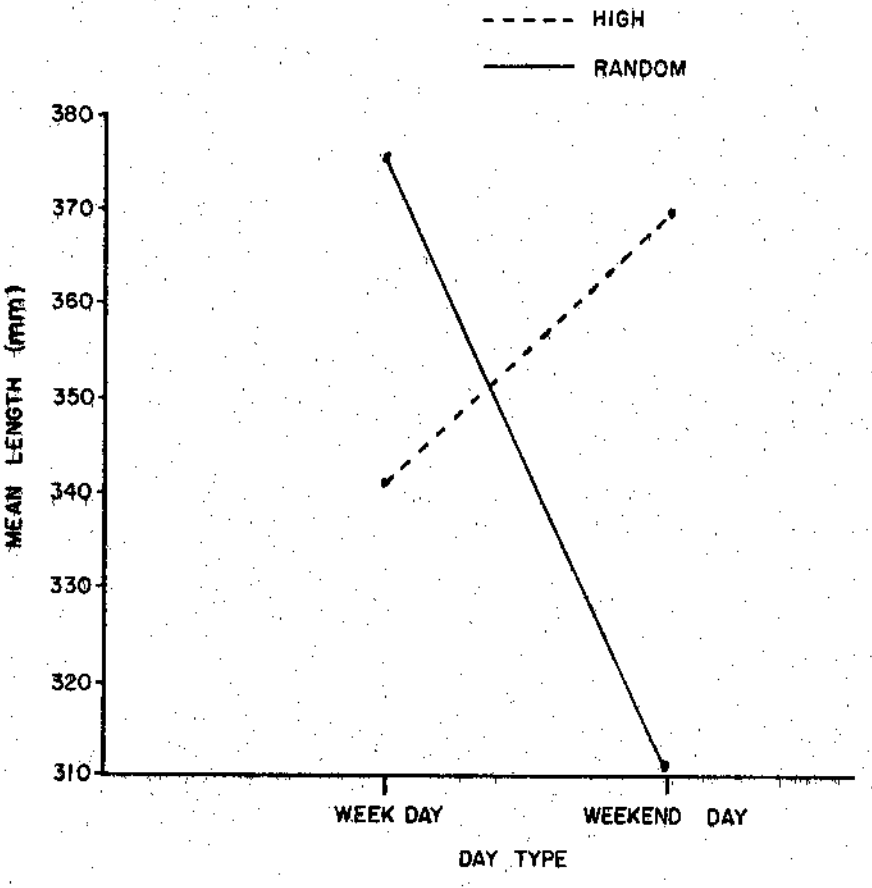


Figure 1. Interaction found in the mean daily lengths of southern flounder (Paralichthys lethostigma) between day types and survey types.

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