

# An Estimate of Harvest by the Texas Charter Boat Fishery

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## Introduction

The charter boat fishery from the Florida west coast to Texas received over \$20 million in fees alone in 1970 (Bureau of Sport Fisheries and Wildlife, 1972). In 1975, Texas fishermen spent \$1.3 million on charter fees (Woods and Ditton, 1979). Although economically important, the Texas charter boat fishery was essentially ignored by fisheries scientists until late 1974. Heffernan et al. (1976) estimated that 29,937 fish were landed from the Aransas Bay system by 1,460 fishermen in fiscal year 1975 (September 1974-August 1975). Almost 99 percent of this harvest was spotted seatrout, *Cynoscion nebulosus*. Mean size of spotted seatrout (259 mm TL) and mean seasonal catch rates ( $\leq 5.50$  fish/man-hour) were also estimated.

Trent (1976) reported that  $\sim 50,500$  man-days were spent by headboat

fishermen in the Gulf of Mexico off the Texas coast from Port Aransas to Port Isabel during April 1975-April 1976. These fishermen landed primarily red snapper, *Lutjanus campechanus*. Woods and Ditton (1979) estimated  $\sim 35,200$  man-days were spent along the Texas coast in calendar year 1975 on small Gulf ( $\bar{x} = 6$

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persons/party) and bay ( $\bar{x} = 4$  persons/party) charter boats. No estimates of harvest were made, but they reported that spotted seatrout and red drum, *Sciaenops ocellatus*, were sought by bay fishermen and that red snapper, mackerel, *Scomberomorus* sp.; and cobia, *Rachycentron canadum*, were sought by Gulf fishermen. The characteristics, participation patterns, and motivation of charter boat clients and the organization and business characteristics of the Texas boat owners and operators were described by Ditton et al. (1978a,b). They reported that the charter boat industry was composed of "small independent businesses which operate at moderate to high profit margins but which do not yield sufficient cash to keep a large number of operators in business full time," and that charter fishermen were an important group "to which goals of fisheries management must be addressed." Use of arti-

**ABSTRACT**—The charter boat fishery in surveyed areas of the Texas coast harvested over 900,000 fish in fiscal year 1979; 71 percent were taken from the Gulf and 29 percent from the bays. Red snapper, *Lutjanus campechanus*; king mackerel, *Scomberomorus cavalla*; and Spanish mackerel, *S. maculatus*, constituted the majority (78 percent) of the Gulf catch. Sand seatrout, *Cynoscion arenarius*; spotted seatrout, *C. nebulosus*; Atlantic croaker, *Micropogonias undulatus*; and kingfish, *Menticirrhus* sp., constituted the majority of the bay catch. Catch composition within the Gulf and bay varied greatly between party boats ( $\leq 10$  people) and headboats ( $> 10$  people). Catch rates by charter boat fishermen were generally higher than catch rates for private boat fishermen. The knowledge and experience of charter boat captains and the species preference of their clients may have influenced the success of fishermen. Characteristics of fishermen and their guides may influence catch rates as much as fluctuations in fish stocks.

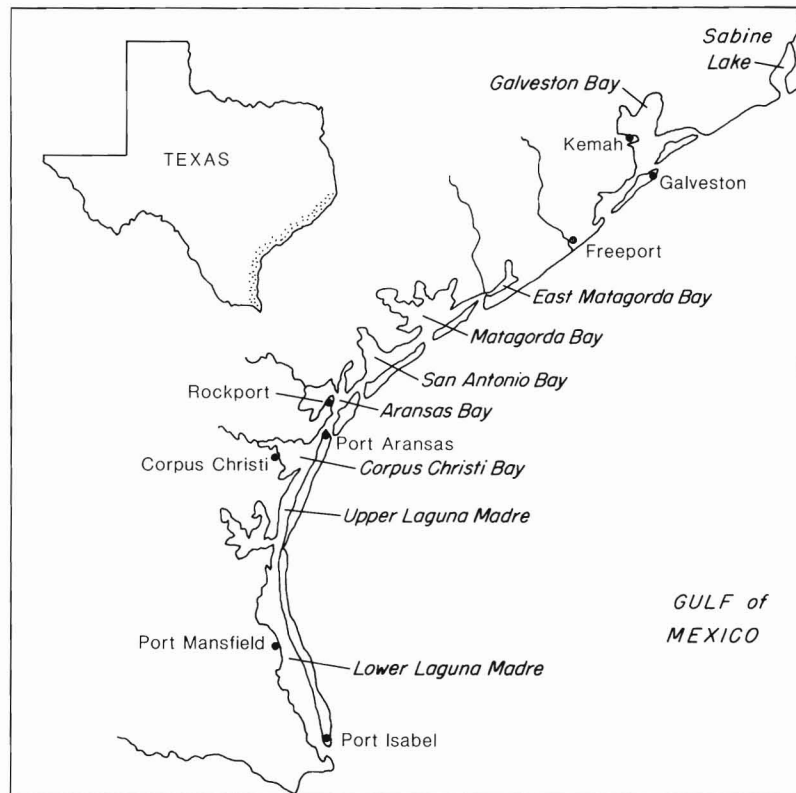


Figure 1.—The Texas coastal area.

ficial submerged Gulf reefs by charter boats has been examined by Vetter and Roels (1977), Ditton and Graefe (1978), and Ditton et al. (1979). They found that the charter fishing industry utilized the Gulf reefs much more off the upper Texas coast than off the lower coast.

The harvest of fish by charter boats from Texas' salt water has not been previously determined. This fishery operates in inside (bay) waters, the territorial sea (within 16.7 km of the barrier islands), and the Fishery Conservation Zone (16.7-322 km). The species targeted also support other fisheries, both recreational and commercial. The continued success of the charter boat fishery in Texas is dependent upon effective management of the fishery resources allocated to competing user groups.

Information on the amount of fish currently harvested by the charter boat fishery is needed to determine total harvest and fishing pressure estimates for bay and Gulf fishery management. McEachron (1980) summarized the data collected from charter boat fishermen in fiscal year 1979 (September 1978-August 1979) but did not estimate harvest. This paper provides an estimate of fish harvest by charter boats from Texas' salt water from September 1978 through August 1979.

### Materials and Methods

From September 1978 through August 1979, charter boats in three areas along the Texas coast were surveyed. Boats on the upper (Galveston/Freeport), middle (Rockport/Port Aransas/Corpus Christi), and lower (Port Mansfield/Port Isabel coastal areas were inventoried prior to the survey using fish guide license sales data (Table 1) and according to a classification as follows:

- 1) Capacity (maximum number of fishermen carried)
  - a) Party boat (a boat operated by a guide and crew which carries  $\leq 10$  people for a fee);
  - b) Headboat (a boat operated by a guide and crew which carries  $> 10$  people for a fee).



Figure 2.—A typical headboat used on Texas bays.

Table 1.—Number of charter boats inventoried on the Texas coast and average number of trips made per boat per year during September 1978-August 1979.

Coastal area	Gulf				Bay			
	Headboat		Party <sup>1,2</sup>		Headboat		Party <sup>1,2</sup>	
	Boats	Trips <sup>3</sup>	Boats	Trips	Boats	Trips <sup>4</sup>	Boats	Trips
Upper	7	225	14.5	68	3	264	6.5	100
Middle	5 <sup>6</sup>	225	55.5	68	4	264	23.5	100
Lower	2	ND <sup>6</sup>	22	ND	3	264	17	100
Total	13	225	70.0	68	10	264	47	100

<sup>1</sup>Trips by boats fishing in both the bay and Gulf were allocated equally to each area.

<sup>2</sup>Trip estimates obtained from Woods and Ditton (1979).

<sup>3</sup>Estimated by: Number of days of interviews completed/number of days of interviews scheduled.

<sup>4</sup>Based on 116 trips/boat in winter/spring and 148 trips/boat in summer/fall. Estimated by: Number of days of interviews completed/number of days of interviews scheduled.

<sup>5</sup>Four boats made short (<8 hours) trips only and generally operated 6 months.

<sup>6</sup>ND = no data.

- 2) Location of fishing (relative to barrier islands and Gulf entrance of passes)
  - a) Gulf (that area seaward of the barrier islands and the pass entrances);
  - b) Bay (that area shoreward of barrier islands and the pass entrances).

Inventories were updated as boats entered or left the fishery.

During each quarter of the year (beginning in September) surveys were scheduled on each of 15 randomly selected weekdays and 7 weekend days in each area except the lower area where 13 weekdays and 5 weekend days were randomly selected. The type of boat selected on each survey day was determined by the interview-

er. If no survey could be conducted, an alternate day of the same type scheduled was randomly selected. When possible, 25 percent of the surveys for each day type were allocated to each boat type.

Headboat surveys were conducted aboard the vessel during the fishing trip; party boats were intercepted at the dock after the trip. Each fish retained on each trip was counted and identified to species (Hoese and Moore, 1977; Robins et al., 1980) when possible. Also on each trip, the number of fishermen and the trip time for party boats or the actual fishing time for headboats (to the nearest 0.5 hour) were recorded. Retention rates (synonymously called catch rates) were calculated on a trip basis by

Table 2.—Total fish harvest (no.  $\pm$  1 SE) by recreational fishermen on headboats and party boats in the Gulf of Mexico off the upper and middle Texas coast during September 1978-August 1979. (Blanks indicate no analysis conducted.)

Boat type	Gulf area	Red snapper	King mackerel	Spanish mackerel	Total
Headboat	Upper	341,507 $\pm$ 62,293			433,125 $\pm$ 73,631
	Middle	97,574 $\pm$ 17,798			123,750 $\pm$ 21,038
	Both	439,081 $\pm$ 80,092			556,875 $\pm$ 96,021
Party boat	Upper <sup>1</sup>	5,748 $\pm$ 2,255	5,235 $\pm$ 1,728	3,922 $\pm$ 1,686	16,190 $\pm$ 3,076
	Middle <sup>2</sup>	566 $\pm$ 558	20,849 $\pm$ 6,844	15,689 $\pm$ 6,746	61,969 $\pm$ 11,556
	Both	6,314 $\pm$ 3,1086	26,084 $\pm$ 8,562	19,611 $\pm$ 8,406	78,159 $\pm$ 14,575

<sup>1</sup>Fourteen party boats operated in the Gulf only and one party boat operated in the Gulf and bay from the Galveston area.

<sup>2</sup>Fifty party boats operated in the Gulf only and eleven party boats operated in the Gulf and bay from the Port Aransas area.

<sup>3</sup>Summation of harvest calculated independently for party boats in Galveston and Port Aransas.

dividing the total fish retained by the number of fishermen and the fishing time or the trip length. Mean catch rates for each boat type, in each area for each day type were calculated as arithmetic means of the catch rates on each trip.

Significant ( $P = 0.01$ ) differences among mean catch rates for the major species caught and for total catch by fishermen on each boat type were determined using factorial analysis of variance (Overall and Spiegel, 1969). Catch rates were transformed to common logarithms before analyses. The mean catch rates for both red snapper and total fish by Gulf headboat fishermen in the upper and middle areas on weekdays and weekend days were tested. No weekend headboat or party boat surveys were conducted in the lower Gulf area because of lack of cooperation from boat operators. The mean catch rates for each of red snapper, king mackerel, *S. cavalla*; Spanish mackerel, *S. maculatus*; and total fish by Gulf party boat fishermen in the two areas for the two day types were also tested. The mean catch rates of spotted seatrout and total fish by bay charter boat fishermen in the three areas for the two day types were tested. The mean catch rates for each of sand seatrout, *C. arenarius*; Atlantic croaker, *Micropogonias undulatus*; kingfish, *Menticirrhus* sp.; and total fish by bay headboat fishermen in the three areas for the two day types in the winter/spring and summer/fall were tested. When no differences were found among areas, day types, or seasons, one

mean catch rate was calculated using all of the data combined to estimate total harvest.

Total harvests were calculated by multiplying the mean catch/trip by the mean trips/boat/year by the number of inventoried boats. The mean number of trips/boat/year for party boats was obtained from Woods and Ditton (1979). For headboats, the number of trips/boat was determined by dividing the number of days of completed surveys by the number of survey days scheduled. This figure was multiplied by the number of days in a year. Boats that fished in both the Gulf and bays were assumed to exert 50 percent of their effort in each area. Standard errors of harvest estimates were calculated according to Cochran (1967). Gulf harvest was estimated for the upper and middle coast; bay harvest was estimated for the Galveston, Aransas, and Corpus Christi Bay systems and the lower Laguna Madre system.

## Results

Recreational fishermen fishing from charter boats in the surveyed areas of the Gulf of Mexico off the Texas coast caught 640,784  $\pm$  111,979 fish during September 1978 through August 1979 (Table 2, 3). Red snapper, king mackerel, and Spanish mackerel constituted the majority (78 percent) of the catch. Headboat fishermen caught mainly red snapper at a rate of 1.40  $\pm$  0.30 fish man/hour (Table 4). Party boat fishermen caught mainly mackerel. Thirty-four other species were also

Table 3.—Mean catch rate (no./man hour  $\pm$  1 SE) and total annual harvest of fish (no.  $\pm$  1 SE) by recreational fishermen from headboats in the Gulf of Mexico off the middle Texas coast during short trips (<8 hours) only.

Species	Catch rate	Total harvest
King mackerel	0.03 $\pm$ 0.01	2,125 $\pm$ 634
Total fish	0.08 $\pm$ 0.02	5,750 $\pm$ 1,383

caught by Gulf charter boat fishermen (Table 5).

Red snapper catch rates on party boats were significantly greater in the upper Gulf than in the lower Gulf (Table 6). Otherwise, no significant ( $P = 0.01$ ) differences were found for total fish, king mackerel, Spanish mackerel, or red snapper for either head or party boats.

Recreational fishermen fishing from charter boats in Texas bays caught 264,821  $\pm$  40,350 fish during the year (Table 7, 8). Sand seatrout, spotted seatrout, Atlantic croaker, and kingfish constituted the majority (93 percent) of the catch. Headboat fishermen landed mainly sand seatrout with catch rates generally exceeding 0.2 fish/man-hour (Table 9). Party boat fishermen caught mainly spotted seatrout at about 1 fish/man trip-hour (Table 10). Thirteen other species were also caught by bay charter boat fishermen (Table 5).

Sand seatrout, Atlantic croaker, and total fish catch rates on bay headboats were significantly higher in the summer/fall than in the winter/spring except in the Aransas Bay system where catches of Atlantic croaker were about the same in the two seasons (Table 11). Spotted seatrout and total fish catch rates on bay party boats were significantly lower (by about 50 percent) on weekends than on weekdays (Table 12). No other significant differences were found among catch rates on bay charter boats.

## Discussion

Until recently, the impact of recreational fishing on fish stocks in the Gulf of Mexico and adjacent estuarine systems was essentially ignored.

Since the passage of the Fishery Conservation and Management Act in 1976, fisheries managers in the Gulf have been forced to reexamine the available data on the harvest of fish by recreational fishermen. The realization that there were few reliable

data on recreational harvest was coupled with an awareness that what data were available indicated that the recreational harvest was far from insignificant (Heffernan and Kemp, 1980). This study further supports the need to consider the fish harvest by all

fishermen in the effective management of marine and estuarine fish stocks.

The charter boat fishery in Texas harvested over 900,000 fish in fiscal year 1979; 71 percent were taken from the Gulf and 29 percent from the bays. In the same year commercial fishermen reported landing 2,219,000 kg of fish in Texas (Hamilton, 1980). Assuming the commercially landed fish averaged 1 kg, the charter boat harvest was about 40 percent of the reported commercial fish harvest.

The National Marine Fisheries Service has estimated that charter boat fishermen landed 2,246,000 fish from the Gulf and bay waters of the five Gulf states (NMFS, 1980). If the proportions reported for Gulf subregion applied in Texas (50 percent of the fish caught were landed and 7.4 percent of the landings were accounted for by charter boats), then an estimated 1,315,000 fish were landed in Texas by charter boats. The Texas landings accounted for 60 percent of the total Gulf subregion charter harvest in calendar year 1979. Our study yielded similar results; at least 40 percent of the charter boat harvest in the Gulf subregion occurred in Texas. Any apparent difference between our

Table 4.—Mean catch rate (no./man-hour on headboats and no./man trip-hour on party boats  $\pm$  1 SE) of fish by charter Gulf boat fishermen off the upper and middle Texas coast on weekdays and weekends during September 1978-August 1979. (Blanks indicate no analysis conducted; numbers in parentheses indicate number of interview days; NA = not applicable.)

Boat type	Gulf area	Day type	Red snapper	King mackerel	Spanish mackerel	Total fish
Headboat	Upper	Weekday	1.06 $\pm$ 0.24 (10)			1.30 $\pm$ 0.27 (10)
		Weekend	1.16 $\pm$ 0.28 (8)			1.40 $\pm$ 0.25 (8)
	Middle	Weekday	1.56 $\pm$ 0.28 (3)			2.23 $\pm$ 0.63 (3)
		Weekend	3.30 $\pm$ 3.02 (2)			4.22 $\pm$ 3.20 (2)
	Both areas	Both day types	1.40 $\pm$ 0.30 (23)			1.70 $\pm$ 0.30 (23)
	Party boat	Upper	Weekday	0.08 $\pm$ 0.02 (3)	0.13 $\pm$ 0.09 (3)	0.05 $\pm$ 0.05 (3)
Weekend			0.09 $\pm$ 0.09 (3)	0.15 $\pm$ 0.14 (3)	0.26 $\pm$ 0.25 (3)	0.54 $\pm$ 0.12 (3)
Combined			0.08 $\pm$ 0.04 (6)	NA	NA	NA
Middle		Weekday	0.00 $\pm$ 0.00 (15)	0.19 $\pm$ 0.06 (15)	0.12 $\pm$ 0.09 (15)	0.47 $\pm$ 0.10 (15)
		Weekend	0.02 $\pm$ 0.02 (12)	0.08 $\pm$ 0.02 (12)	0.10 $\pm$ 0.09 (12)	0.62 $\pm$ 0.39 (12)
		Combined	0.01 $\pm$ 0.01 (27)	NA	NA	NA
Both areas		Both day types	NA <sup>1</sup>	0.14 $\pm$ 0.03 (33)	0.12 $\pm$ 0.05 (33)	0.50 $\pm$ 0.10 (33)

<sup>1</sup>Significant difference between mean catch rate off upper (0.08  $\pm$  0.04 fish/man trip-hour) and off middle (0.01  $\pm$  0.01 fish/man trip-hour) Texas coast.

Table 5.—List of species retained by charter boat fishermen along the Texas coast during September 1978-August 1979. (X = presence, blank = absence.)

Species		Bay		Gulf		Species		Bay		Gulf	
Common name	Scientific name	Party	Head	Party	Head	Common name	Scientific name	Party	Head	Party	Head
Spanish mackerel	<i>Scomberomorus maculatus</i>	X		X	X	Sand seatrout	<i>Cynoscion arenarius</i>		X		X
Sheepshead	<i>Archosargus probatocephalus</i>	X			X	Dolphin	<i>Coryphaena hippurus</i>				X
Red drum	<i>Sciaenops ocellatus</i>	X	X			Kingfish	<i>Menticirrhus</i> sp.		X		
Southern flounder	<i>Paralichthys lethostigma</i>	X	X		X	King mackerel	<i>Scomberomorus cavalla</i>			X	X
Black drum	<i>Pogonias cromis</i>		X			Red snapper	<i>Lutjanus campechanus</i>			X	X
Florida pompano	<i>Trachinotus carolinus</i>		X			Rock hind	<i>Epinephelus adscensionis</i>				X
Pigfish	<i>Orthopristis chrysoptera</i>		X			Blacktip shark	<i>Carcharhinus limbatus</i>				X
Greater amberjack	<i>Seriola dumerili</i>			X	X	Longspine porgy	<i>Stenotomus caprinus</i>				X
Gaftopsail catfish	<i>Bagre marinus</i>	X	X			Ocean triggerfish	<i>Canthidermis sufflamen</i>				X
Ladyfish	<i>Elops saurus</i>	X				Gulf toadfish	<i>Opsanus beta</i>				X
Cobia	<i>Rachycentron canadum</i>			X	X	Gray snapper	<i>Lutjanus griseus</i>				X
Hardhead catfish	<i>Arius felis</i>	X	X			Remora	Echeneidae				X
Blue runner	<i>Caranx crysos</i>			X	X	Lane snapper	<i>Lutjanus synagris</i>				X
Hammerhead shark	<i>Sphyrna</i> sp.		X		X	Bluefin tuna	<i>Thunnus thynnus</i>				X
Crevalle jack	<i>Caranx hippos</i>			X	X	Bull shark	<i>Carcharhinus leucas</i>				X
Spotted seatrout	<i>Cynoscion nebulosus</i>	X	X			Scamp	<i>Mycteroperca phenax</i>				X
Shrimp eel	<i>Ophichthus gomesi</i>		X			Tomtate	<i>Haemulon aurolineatum</i>				X
Pinfish	<i>Lagodon rhomboides</i>		X		X	Vermillion snapper	<i>Rhomboplites aurorbens</i>				X
Atlantic sharpnose shark	<i>Rhizoprionodon terraenovae</i>			X	X	Bluefish	<i>Pomatomus saltatrix</i>				X
Atlantic bonito	<i>Sarda sarda</i>			X		Queen triggerfish	<i>Balistes vetula</i>				X
Great barracuda	<i>Sphyraena barracuda</i>			X		Rock sea bass	<i>Centropristis philadelphica</i>				X
Atlantic croaker	<i>Micropogonias undulatus</i>		X	X		Jewfish	<i>Epinephelus itajara</i>				X
						Gray triggerfish	<i>Balistes capriscus</i>				X
						Knobbed porgy	<i>Calamus nodosus</i>				X
						Warsaw grouper	<i>Epinephelus nigritus</i>				X

**Table 6.—Summary of results of two-way analysis of variance of mean catch rates (no./trip-hour for party boats and no./man-hour for headboats) of selected species by fishermen on party boats and headboats in two areas of the Gulf off Texas on weekdays and weekends.**

Species	Source of variation	Party boats		Head boats		Species	Source of variation	Party boats		Head boats	
		Mean square (df)	F	Mean square (df)	F			Mean square (df)	F	Mean square (df)	F
Red snapper	Total	0.001 (32)		0.040 (22)		King mackerel	Total	0.004 (32)		Not analyzed	
	Gulf area	0.004 (1)	8.728 **	0.080 (1)	1.952 NS		Gulf area	0.000 (1)	0.011 NS		
	Day type	0.000 (1)	0.646 NS	0.007 (1)	0.180 NS		Day type	0.008 (1)	1.807 NS		
	Gulf area x day type	0.000 (1)	0.083 NS	0.003 (1)	0.080 NS		Gulf area x day type	0.002 (1)	0.562 NS		
	Error	0.001 (29)		0.041 (19)			Error	0.004 (29)			
Spanish mackerel	Total	0.007 (32)		Not analyzed		Total fish	Total	0.020 (32)		0.037 (22)	
	Gulf area	0.001 (1)	0.186 NS				Gulf area	0.000 (1)	0.001 NS	0.155 (1)	4.618 NS
	Day type	0.001 (1)	0.152 NS				Day type	0.000 (1)	0.003 NS	0.015 (1)	0.441 NS
	Gulf area x day type	0.005 (1)	0.689 NS				Gulf area x day type	0.009 (1)	0.425 NS	0.008 (1)	0.230 NS
	Error	0.008 (29)					Error	0.021 (29)		0.034 (19)	

\*\*  $P < 0.01$

NS = not significant at  $P = 0.01$

estimate and that of the NMFS may be the result of the different time periods sampled (fiscal year vs. calendar year). Additionally, we did not survey the charter boats operating in the Gulf along the lower Texas coast. These boats represented about 25 percent of the total Texas Gulf charter boat fleet. If the harvest per boat for these nonsampled boats was the same as for the sampled boats on the middle and upper coast, then our estimate would be increased to ~1,125,000 fish. Trent (1976) found that fishermen on headboats on the lower Texas coast had catch rates five times greater than those on the middle coast but exerted five times less fishing pressure. This indicates a similar mean harvest per boat between the two areas.

McConnell et al. (1981) stated that the species and number of fish caught is largely determined by the place the angler fishes. The Gulf charter boat fishery off Texas harvested mainly red snapper, king mackerel, and Spanish mackerel. The bay charter boat fishery harvested mainly spotted seatrout, sand seatrout, and Atlantic croaker. McEachron and Green (1982), McEachron et al. (1981), and Trent (1976) reported that private Gulf boat fishermen landed red snapper and king mackerel mainly, and that bay boat, pier, and wade/bank fishermen landed spotted seatrout, sand seatrout, and Atlantic croaker mainly.

**Table 7.—Total harvest (no. ± 1 SE) by fishermen on headboats in Texas bays during September 1978-August 1979.**

Species	Season	Bay system						
		Galveston		Aransas/Corpus Christi		Lower Laguna Madre		Total
Sand seatrout	Winter/spring	5,732 ± 2,142		7,642 ± 2,856		5,732 ± 2,142		
	Summer/fall	34,823 ± 13,101		46,431 ± 17,468		34,823 ± 13,101		116,007 ± 43,669
	Total	40,555 ± 9,387		54,073 ± 12,515		40,555 ± 9,387		135,183 ± 31,288
Atlantic croaker	Winter/spring	696 ± 476		255 ± 211		45 ± 44		996 ± 316
	Summer/fall	17,218 ± 7,800		539 ± 370		311 ± 133		18,068 ± 4,279
	Total	17,914 ± 5,244		794 ± 301		356 ± 104		19,064 ± 3,034
Kingfish	Winter/spring	882 ± 172		1,176 ± 229		882 ± 172		2,940 ± 572
	Summer/fall	1,122 ± 219		1,496 ± 292		1,122 ± 219		3,740 ± 730
	Total	2,004 ± 391		2,672 ± 521		2,004 ± 391		6,680 ± 1,302
Total	Winter/spring	8,014 ± 3,809		10,686 ± 5,078		8,014 ± 4,466		26,714 ± 7,687
	Summer/fall	44,267 ± 13,195		59,022 ± 17,594		44,267 ± 13,195		147,556 ± 43,985
	Total	52,281 ± 19,472		69,708 ± 12,629		52,281 ± 9,472		174,270 ± 31,573

<sup>1</sup>Total harvest does not equal the summation of individual species harvest because of one trip on which 869 sand seatrout were caught, and total harvest is estimated independently of each species harvest estimate.

**Table 8.—Total harvest (no. ± 1 SE) by fishermen on party boats in Texas bays during September 1978-August 1979.**

Species	Bay system						
	Galveston		Aransas/Corpus Christi		Lower Laguna Madre		Total
Spotted seatrout	11,829 ± 559		42,764 ± 4,378		30,935 ± 3,167		
Total fish	12,523 ± 1,214		45,276 ± 4,388		32,753 ± 3,175		90,551 ± 8,777

The charter boat fishery in other areas of the southeastern United States also harvests mackerels and red snapper, but the relative importance of these species varies greatly. Off Louisiana, silver seatrout, *C. nothus*; Atlantic croaker, "bull" red drum,

and king mackerel were dominant fishes in the charter boat landings (Dugas et al., 1979). Alabama's charter boat industry landed mainly amberjack, *S. dumerili*; king mackerel, snapper (Lutjanidae), and little tunny, *Euthynnus aletteratus*



**Table 9.—Mean catch rate (no./man-hour  $\pm$  1 SE) of sand seatrout, Atlantic croaker, kingfish, and total fish by fishermen on headboats in Texas bays during winter/spring and summer/fall.**

Species	Bay system	Winter/spring		Summer/fall	
		Weekday	Weekend	Weekday	Weekend
Sand seatrout	Galveston	0.76 $\pm$ 0.53 (9)	0.39 $\pm$ 0.39 (2)	1.11 $\pm$ 0.94 (7)	3.36 $\pm$ 1.48 (2)
	Aransas/Corpus Christi	0.18 $\pm$ 0.07 (7)	0.16 $\pm$ 0.08 (4)	1.56 $\pm$ 0.25 (6)	2.84 $\pm$ 0.82 (5)
	Lower Laguna Madre	0.27 $\pm$ 0.16 (6)	0.19 $\pm$ 0.19 (2)	0.68 $\pm$ 0.37 (7)	0.22 $\pm$ 0.06 (4)
Atlantic croaker	Galveston	0.06 $\pm$ 0.04 (9)	0.00 $\pm$ 0.00 (2)	0.59 $\pm$ 0.31 (7)	1.20 $\pm$ 1.19 (2)
	Aransas/Corpus Christi	0.01 $\pm$ 0.01 (7)	0.01 $\pm$ 0.01 (4)	0.01 $\pm$ 0.01 (6)	0.03 $\pm$ 0.03 (5)
	Lower Laguna Madre	0.00 $\pm$ 0.00 (6)	0.00 $\pm$ 0.00 (2)	0.01 $\pm$ 0.01 (7)	0.03 $\pm$ 0.01 (4)
Kingfish	Galveston	0.01 $\pm$ 0.01 (9)	0.03 $\pm$ 0.03 (2)	0.05 $\pm$ 0.03 (7)	0.01 $\pm$ 0.00 (2)
	Aransas/Corpus Christi	0.08 $\pm$ 0.06 (7)	0.00 $\pm$ 0.00 (4)	0.13 $\pm$ 0.10 (6)	0.08 $\pm$ 0.06 (5)
	Lower Laguna Madre	0.03 $\pm$ 0.03 (6)	0.10 $\pm$ 0.04 (2)	0.11 $\pm$ 0.06 (7)	0.11 $\pm$ 0.03 (4)
Total fish	Galveston	0.97 $\pm$ 0.57 (9)	0.43 $\pm$ 0.43 (2)	1.92 $\pm$ 0.08 (7)	4.61 $\pm$ 2.69 (2)
	Aransas/Corpus Christi	0.43 $\pm$ 0.15 (7)	0.22 $\pm$ 0.08 (4)	1.74 $\pm$ 0.21 (6)	3.06 $\pm$ 0.85 (5)
	Lower Laguna Madre	0.36 $\pm$ 0.16 (6)	0.29 $\pm$ 0.15 (2)	0.93 $\pm$ 0.38 (7)	0.40 $\pm$ 0.08 (4)

**Table 11.—Summary of results of three-way analysis of variance of mean catch rates (no./man-hour) of selected species by fishermen on headboats in Texas bays on weekdays and weekends in the summer/fall and winter/spring seasons.**

Source of variation	df	Sand seatrout		Atlantic croaker		Kingfish		Total fish	
		Mean square	F	Mean square	F	Mean square	F	Mean square	F
Total	60	0.058		0.011		0.002		0.059	
Seasons	1	0.632	15.906**	0.045	5.327 NS	0.005	2.632 NS	0.915	23.302**
Day types	1	0.045	1.128 NS	0.001	0.175 NS	0.001	0.284 NS	0.007	0.188 NS
Bay systems	2	0.129	3.237 NS	0.057	6.711**	0.002	1.181 NS	0.166	4.221 NS
Seasons x day types	1	0.087	2.185 NS	0.008	0.934 NS	0.000	0.239 NS	0.074	1.894 NS
Seasons x bay systems	2	0.135	3.395 NS	0.044	5.199**	0.000	0.208 NS	0.116	2.941 NS
Day types x bay systems	2	0.059	1.490 NS	0.002	0.235 NS	0.002	0.935 NS	0.030	0.768 NS
Seasons x day types x bay systems	2	0.059	1.478 NS	0.005	0.551 NS	0.000	0.281 NS	0.050	1.264 NS
Error	49	0.040		0.009		0.002		0.039	

\*\*P < 0.01  
NS = not significant at P = 0.01

(Wade, 1977). The Florida Gulf coast and Keys charter boat fishery preferred grouper (Serranidae), snapper, king mackerel, billfish (Istiophoridae), and dolphin, *Coryphaena* sp. (Browder et al., 1981). However, Fable et al. (1981) reported that the Florida charter boat fishery landed primarily king mackerel and Atlantic bonito, *Sarda sarda*, during 1970-1979. In North Carolina, king mackerel, dolphin, bluefish, *Pomatomus*

*saltatrix*; yellowfin tuna, *Thunnus albacares*; and white marlin, *Tetrapturus albidus*, were the most important species for charter fishermen (Manooch et al., 1981). The composition of the charter boat landings may thus reflect the distribution of the fishes throughout the Gulf. Fable et al. (1981) suggested that the catch rate for king mackerel was directly related to the water temperature in the preceding winter. Landings may also

**Table 10.—Mean catch rate (no./man trip-hour  $\pm$  1 SE) of spotted seatrout and total fish by recreational fishermen on party boats in Texas bays during September 1978-August 1979. (Numbers in parentheses represent number of interview days.)**

Species	Bay system	Day type	
		Weekday	Weekend
Spotted seatrout	Galveston	0.92 $\pm$ 0.10 (3)	0.52 $\pm$ 0.27 (3)
	Aransas/Corpus Christi	0.52 $\pm$ 0.52 (2)	1.04 $\pm$ 0.34 (6)
	Lower Laguna Madre	1.47 $\pm$ 0.30 (16)	1.07 $\pm$ 0.32 (8)
	All bays	1.30 $\pm$ 0.24 (21)	0.97 $\pm$ 0.20 (17)
Total fish	Galveston	1.04 $\pm$ 0.14 (3)	0.52 $\pm$ 0.28 (3)
	Aransas/Corpus Christi	0.67 $\pm$ 0.38 (2)	1.04 $\pm$ 0.41 (6)
	Lower Laguna Madre	1.62 $\pm$ 0.29 (16)	1.16 $\pm$ 0.33 (8)
	All bays	1.45 $\pm$ 0.23 (21)	1.01 $\pm$ 0.21 (17)

**Table 12.—Summary of results of two-way analysis of variance of mean catch rates (no./man trip-hour) of spotted seatrout and total fish by fishermen on party boats in Texas bays on weekdays and weekends.**

Species	Source of variation	Mean square (df)	F
Spotted seatrout	Total	0.039 (30)	
	Day type	0.472 (1)	17.729**
	Bay system	0.052 (2)	1.965 NS
	Day type x bay system	0.007 (2)	0.256 NS
Total fish	Total	0.045 (30)	
	Day type	0.580 (1)	19.893**
	Bay system	0.065 (2)	2.241 NS
	Day type x bay system	0.009 (2)	0.299 NS
	Error	0.029 (25)	

\*\*P < 0.01  
NS = not significant at P = 0.01

reflect the preferences of the captains or clients in each area. The importance of considering fishermen preference was noted by Richards (1965) when he concluded that mean catch rates for each species should be calculated based only on fishermen who were successful in catching that species. Additional research should be conducted to determine the importance of motivation, preferences, and experience of the captains and fishermen in explaining fluctuations in the fish stocks.

Fishermen who use charter boats generally have higher catch rates than those fishing without the experience

of a fishing guide. McConnell et al. (1981) found that charter boat fishermen in Rhode Island had higher success rates than those fishing from man-made structures, shore, and private boats. Caillouet and Higman (1978) reported that charter fishermen had higher catch rates because guides had knowledge of fishing areas and methods that exceeded that of the average fisherman. Ditton et al. (1978a) reported that Texas charter captains are experienced charter operators. Texas private Gulf boat fishermen from 15 May-20 November 1979 had lower catch rates for king mackerel (0.01-0.08 fish/man-hour), Spanish mackerel (0.02-0.10 fish/man-hour), and red snapper (<0.01-0.17 fish/man-hour) than did the Gulf charter operators in this study (McEachron and Green, 1982). Bay weekend private boat fishermen during the same period had catch rates that were less than half (0.10-0.47 spotted seatrout/man-hour) the bay charter boat fishermen catch rates. Perhaps because of their experience, Texas charter boat operators are aware of the areas where fish can be caught easily or are knowledgeable of fishes' habits and attempt to place clients where fish are accessible. Graefe (1981) concluded that sport fishermen who fished often for sciaenids were probably more successful at catching fish than those who seldom fished. Additional research is needed to understand fully the influence of fishing experience on catch rates. If the captain is more important than the fishermen in determining the catch rate, the day of the boat trip should not affect catch rate. This study has shown that in Texas there were no differences between catch rates on weekday or weekend for each of the charter boat fisheries except for the bay party boat fishery. No explanation for this difference is readily apparent.

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