Paul Hammerschmidt

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Management Data Series Number 48
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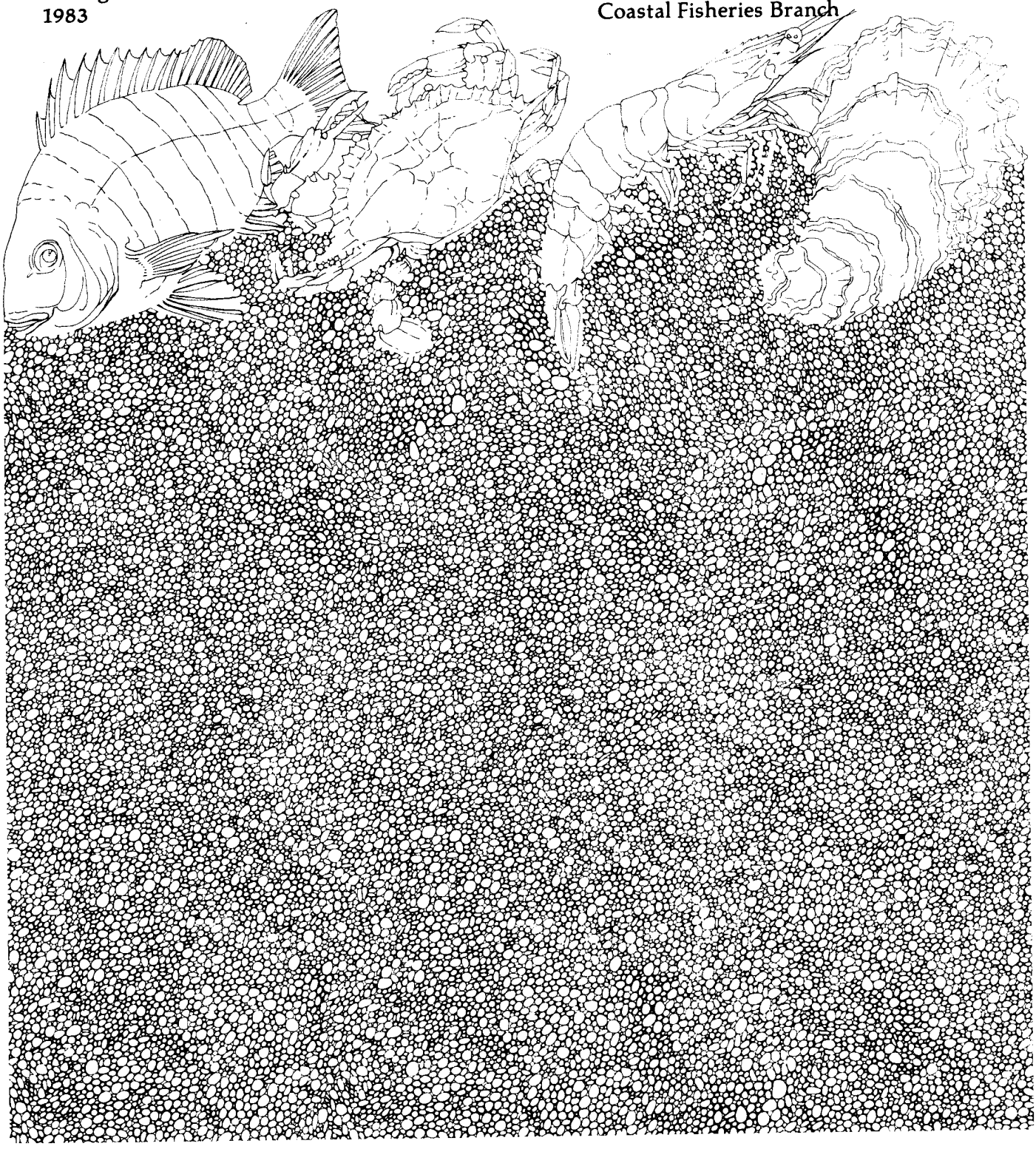

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4200 Smith School Road
Austin, Texas 78744

ABSTRACT

Gulf "snapper" headboats (>10 people/boat) were surveyed from September 1980-August 1981 and bay headboats and bay and Gulf party boats were surveyed during summer (June-August 1981) only. Species composition of catch varied greatly between areas of fishing and boat type.

The annual Gulf "snapper" headboat harvest in the Gulf areas of Texas was ∿331,000 fish. During summer Gulf party boat fishermen harvested ∿105,000 fish; and bay party boat and bay headboat fishermen harvested ∿89,000 fish each. Red snapper (Lutjanus campechanus) constituted the majority (77%) of the Gulf "snapper" headboat landings; king mackerel (Scomberomorus cavalla), red snapper and dolphin (Coryphaena hippurus) constituted the majority (68%) of the Gulf party boat landings. Spotted seatrout (Cynoscion nebulosus) constituted the majority (94%) of the bay party boat landings and sand seatrout (C. arenarius) and Atlantic croaker (Micropogonias undulatus) constituted the majority (62%) of the bay headboat landings. Approximately 53% of the yearly Gulf party boat trips were made during summer. Bay party boats made ∿22% of their yearly trips during summer in the upper and middle coastal areas and ∿57% of the yearly trips during summer in the lower coastal areas.

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INTRODUCTION

The Texas charter fishery is economically and biologically important. Woods and Ditton (1979) reported that $1.3 million were spent on charter fees coastwide in 1975. McEachron and Matlock (1982) estimated that chartered fishermen harvested over 900,000 fish during September 1978-August 1979. A short overview of the publications on the charter industry in Texas was presented by McEachron and Matlock (1982).

The Texas Parks and Wildlife Department (TPWD) surveyed all segments of the charter fishery during September 1978-August 1979 (McEachron 1980 and McEachron and Matlock 1982). Based on both budget and manpower constraints and when the majority of charter fishing took place (Ditton et al. 1978) the TPWD elected to survey Gulf "snapper" and bay headboats year around and bay and Gulf party boats (carrying $\leq$10 people/boat) during summer (June-August). This sampling scheme would enable TPWD to obtain harvest and catch/effort data needed to manage effectively the fishery resource. This paper provides estimates of fish harvest by Gulf "snapper" headboats for 1 year (September 1980-August 1981) and estimates of fish harvest by bay headboats and small bay and Gulf party boats for summer 1981.

The objectives of the survey were to:

1. Determine the harvest, species composition, size and catch per effort of economically important finfishes caught by sport fishermen on Gulf "snapper" headboats operating from Texas.

2. Determine the harvest, species composition, size and catch per effort of economically important finfishes caught in Texas bay waters by sport fishermen on bay headboats.

3. Determine the harvest, species composition, size and catch per effort of economically important finfishes caught in the Gulf off Texas and in bay waters by sport fishermen on party boats.

MATERIALS AND METHODS

From September 1980 through August 1981, charter fishing boats on the upper (Galveston Bay/Freeport area) middle (Aransas Bay, Corpus Christi Bay, upper Laguna Madre) and lower (lower Laguna Madre) Texas coast (Figure 1) were surveyed. Boats were inventoried prior to the survey using the Fish Guide License sales data of TPWD and by canvassing each area for fish guides (Appendix A, Tables 1 and 2) according to the classifications:

A. Capacity (Maximum number of fishermen carried):

1. Party boat: a boat operated by a guide and crew, that carries ≤10 people for a fee;

2. Headboat: a boat, operated by a guide and crew, that carries >10 people for a fee.

B. Location of fishing (relative to barrier islands and Gulf entrance of passes):

1. Gulf: that area seaward of the barrier islands and the pass entrances;

2. Bay: that area shoreward of barrier islands and the pass entrances.

Only headboats that fished Gulf reefs consistently throughout the year were considered to be Gulf "snapper" headboats. Inventories were updated as boats entered or left the fishery.

Gulf "snapper" headboat surveys were conducted on each of 2 randomly selected days/month during September 1980-August 1981 on the middle and lower coast and on 3 randomly selected days/month on the upper coast. Bay headboats were surveyed on each of 2 randomly selected days/month during summer 1981 in each area. Bay and Gulf party boat surveys were conducted on each of 12 randomly selected days during summer 1981 on the middle and lower coast and on 15 randomly selected days on the upper coast.

Headboat surveys were conducted aboard the vessel during the fishing trip; party boats were intercepted at the dock after the trip. All fish retained were counted and identified to species (Hoese and Moore 1977) when possible. A list of the common and scientific names of fishes (Robins et al 1980) identified in this study is found in Appendix B. Also on each trip, the number of fishermen and the trip time for party boats and the actual fishing time for headboats (to the nearest 0.5 h) were recorded. Retention rates (synonymously called catch rates) were calculated on a trip basis by dividing the total fish retained by the number of fishermen and the fishing time (for headboats) or the trip length (for party boats). Mean catch rates for each boat type, in each area for each day were calculated as arithmetic means of the catch rates on each trip. Mean total lengths for each species were calculated by adding the individual total lengths and then dividing by the total number of fish measured. Histograms of red snapper (Lutjanus campechanus) and vermillion snapper (Rhomboplites aurorubens), presented by month, were constructed using the midpoint of 15 mm groups.

Significant differences ($P = 0.01$) among mean catch rates for red snapper, vermillion snapper and for total catch by fishermen on Gulf "snapper" headboats were determined using factorial analysis of variance

(Overall and Spiegel 1969). Significant differences (P = 0.01) among mean catch rates for red snapper, king mackerel (Scomberomorus cavalla) and total fish on Gulf party boats and for spotted seatrout (Cynoscion nebulosus) and total fish on bay party boats were determined utilizing a two-level nested analysis of variance (Sokal and Rohlf 1969). If more than one party boat was surveyed on the same day then catch rates among boats by day were tested for significant differences (P = 0.01) by utilizing a two-level nested analysis of variance (Sokal and Rohlf 1969). If no significant differences were found then each boat catch rate was used in the harvest calculation; if significant differences were found then each days' data were pooled into one mean daily catch rate. Significant differences (P = 0.01) among mean number of fishermen/boat trip, mean number of trips/boat for bay party boats and mean catch rates for sand seatrout (C. arenarius), Atlantic croaker (Micropogonias undulatus), kingfish sp. (Menticirrhus americanus and M. littoralis) and for total fish on bay headboats were determined utilizing a one-way analysis of variance (Sokal and Rohlf 1969). If differences were found among area catch rates or among number of fishermen/boat trip a weighted coastwide mean was determined using the number of boat trips for each boat type in each area. A Sum of Squares Simultaneous test procedure was used to determine similarities between bay headboat catch rates among areas (Sokal and Rohlf 1969). Catch rates were transformed to common logarithms, where needed, to reduce variance heterogeneity before analyses. When no differences were found among areas, 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/boat by the total number of boat trips. The number of trips made by the boats was determined by contacting each boat operator and obtaining the number of trips that each boat made. For party boats the total number of trips made was adjusted upward for those boat operators that could not be contacted by using the mean number of trips/boat for those boat operators that were contacted. Area harvests were calculated using a percentage based on the effort expended in each area. If no significant differences were found between mean number of people/boat trip then the percentage was determined by dividing each area effort (trips) by the total effort in all three areas. If significant differences were found in the number of people/boat trip the effort (man-trips) were calculated by multiplying the number of boat trips by the number of people/boat trip in each area and dividing each area effort by the total effort for all three areas to obtain the percentage. Standard error of harvest estimates were calculated according to Cochran (1967).

RESULTS

During September 1980-August 1981, 10 Gulf "snapper" headboats made 1196 trips in the Gulf of Mexico off the Texas coast (Table 1). The number of fishermen/trip ranged from 23 $\pm$ 1.6 fishermen/trip in the lower area to 47 $\pm$ 3.2 fishermen/trip in the upper area (Table 1); there was a significant difference in the mean number of fishermen/trip among areas (Appendix C, Table 1).

Gulf "snapper" headboat fishermen caught 331,000 ± 27,400 fish during the 1-year period (Table 2). Red snapper constituted the majority (77%) of the catch; 46 other species constituted the rest of the estimated landings (Table 2; Appendix D, Table 1). The mean catch rate for red snapper ranged from 0.51 ± 0.11 fish/man-h off the middle area to 2.51 ± 0.29 fish/man-h off the lower area (Table 3); significant differences were found among Gulf areas and among months (Appendix C, Table 2). Most of the red snapper in the upper area were 215-390 mm in length (TL); none were <185 mm and few were >435 mm (Figure 2). In the middle area the majority of the red snapper were 245-470 mm in length; none were <185 mm and few were >500 mm (Figure 3). The majority of the red snapper in the lower area were 260-515 mm in length; none were <200 mm (Figure 4). Red snapper >575 mm were more common in the catch off the lower coast area than off the upper or middle coasts. The mean catch rate for vermillion snapper ranged from 0.02 ± 0.02 fish/man-h off the lower area to 1.26 ± 0.33 fish/man-h off the middle area; significant differences were found among Gulf areas and among months (Appendix C, Table 2). Most of the vermillion snapper in the upper area were ≤305 mm (TL); none were <185 mm nor >485 mm (Figure 5). In the middle area the majority of the vermillion snapper were ≤380 mm (TL); none were <200 mm nor >530 mm (Figure 6). The mean catch rate for all fish by snapper headboat fishermen was 2.40 ± 0.18 fish/man-h; there was no significant difference among Gulf areas but there was a significant difference among months (Appendix C, Table 2). Red snapper mean lengths were 310 ± 2 mm off the upper area, 365 ± 3 mm off the middle area and 405 ± 3 mm off the lower area; all other species lengths varied among species and among areas (Appendix E, Table 1).

Inventoried Gulf party boats made 3990 trips during summer 1981 (Table 4); total trips were adjusted upward for one boat whose operator was not contacted in the upper area and for 13.5 boats in the lower area. The mean number of fishermen/trip was higher in the upper area than in the middle or lower areas (Table 4); there was a significant difference in the mean number of fishermen/trip among the areas (Appendix C, Table 1). There was no significant difference between the middle and lower areas (Appendix C, Table 3). There was no significant difference in the mean number of trips/boat among the upper (27 ± 3.1 trips/boat), middle (41 ± 3.6 trips/boat) or lower (35 ± 2.6 trips/boat) areas (Appendix C, Table 4); the combined mean was 36 ± 2.4 trips/boat.

During summer 1981, Gulf party boat fishermen landed 105,000 ± 19,000 fish (Table 5). Of these, king mackerel constituted 43%, red snapper constituted 15% and dolphin (Coryphaena hippurus) constituted 10%; 16 other species constituted the rest of the estimated landings (Table 5; Appendix D, Table 2). The mean catch rate for king mackerel by all Gulf party boat fishermen was 0.33 ± 0.05 fish/man trip-h (Table 6); no significant differences were found among Gulf areas but there was a significant difference among days (Appendix C, Table 5). Red snapper mean catch rates ranged from <.01 fish/man trip-h in the middle area to 0.30 ± 0.30 fish/man trip-h in the lower area; significant differences were found among Gulf areas and among days (Appendix C, Table 5). There was no significant

difference between the upper and lower mean catch rates (Appendix C, Table 6). The mean catch rate for total fish landed by Gulf party boat fishermen was 0.70 ± 0.11 fish/man trip-h; no significant differences were found among Gulf areas or among days (Appendix C, Table 5). Mean sizes of fishes retained in the middle and lower areas varied between bays and among species; a sailfish (Istiophorus platypterus) 11,826 mm long (TL) was the largest fish retained (Appendix E, Table 2). No measurements were available for the upper area.

During summer 1981, bay headboats made 1492 trips with 24 ± 3.8 fishermen/trip (Table 4). No significant difference was found in the mean number of fishermen/trip among the three bay areas (Appendix C, Table 1).

Recreational fishermen on bay headboats landed 89,000 ± 24,000 fish (Table 7). Sand seatrout (36%) and Atlantic croaker (26%) dominated the landings; 17 other species constituted the rest of the estimated landings (Table 7; Appendix D, Table 3). The mean catch rate for sand seatrout was 0.31 ± 0.11 fish/man-h (Table 8); no significant difference was found among areas (Appendix C, Table 7). Atlantic croaker mean catch rates ranged from <.01 fish/man-h in the lower area to 1.03 ± 0.31 fish/man-h in the upper area; a significant difference was found among the three areas (Appendix C, Table 7). Catch rates in the middle and lower areas were similar ($P > 0.01$) and the catch rate in the upper area was significantly different ($P < 0.01$) from that in the middle and lower areas. Kingfish sp. mean catch rates were 0.02 ± 0.02 fish/man-h in both the upper and middle areas and 0.24 ± 0.07 fish/man-h in the lower area; a significant difference was found among the three areas (Appendix C, Table 7). Catch rates in the upper and middle areas were similiar ($P > 0.01$) and the catch rate in the lower area was significantly different ($P > 0.01$) from that in the upper and middle areas. The mean catch rates for total fish landed by bay headboat fishermen was 0.94 ± 0.23 fish/man-h; no significant difference was found among the three areas (Appendix C, Table 7). Mean sizes of fishes retained varied among species and among bays; few of the fishes mean lengths were >375 mm (Appendix E, Table 3).

Inventoried bay party boats made 2571 trips during summer 1981 (Table 4); total trips were adjusted upward for one boat whose operator was not contacted in the upper area, for 18.5 boats in the middle area and for 21.5 boats in the lower area. No significant difference was found in the mean number of fishermen/trip (Table 4) among areas (Appendix C, Table 1). The mean number of trips/boat differed significantly among the upper (20 ± 2.6 trips/boat), middle (24 ± 4.7 trips/boat) and lower (57 ± 6.0 trips/boat) areas (Appendix C, Table 4). No significant difference was found between the number of trips/boat in the upper and middle areas (Appendix C, Table 3); the combined mean was 22 ± 3.0 trips/boat.

Bay party boat fishermen harvested 89,000 ± 5400 fish (Table 7). Spotted seatrout constituted the majority (94%) of the catch; 10 other

species constituted the rest of the estimated landings (Table 7; Appendix D, Table 3). The mean catch rate for spotted seatrout for all bay party boat fishermen was 1.74 $\pm$ 0.14 fish/man trip-h (Table 8); no significant difference was found among bay areas (Appendix C, Table 8). The mean catch rate for total fish landed by all fishermen was 1.83 $\pm$ 0.14 fish/man trip-h; no significant difference was found among bay areas (Appendix C, Table 8). Mean sizes of fishes retained varied among species and among bays; spotted seatrout mean length ranged from 335 $\pm$ 5 mm in the lower area to 415 $\pm$ 5 mm in the upper area (Appendix E, Table 4).

DISCUSSION

The estimated harvest by Gulf "snapper" headboats is based on day trips only. Two boats made 39 night trips during the year. Manpower constraints made it impossible to survey these trips. If it is assumed the night catch rates are similiar to the day catch rates then the total harvest estimate would be ∿3% greater. In addition, one Gulf "snapper" headboat in the lower coastal area was not surveyed due to lack of owner cooperation. If it is assumed the catch rates and number of boat trips to be similiar to the surveyed headboats, then the estimated harvest could be ∿9% greater. The bay headboat harvest is also based on day trips only. One headboat made 92 night trips during summer. If it is assumed the night catch rates are similiar to the day catch rates then the total summer bay headboat harvest may be ∿6% greater. In order to determine whether the assumption that the night catch rates are similiar to day catch rates night trips would have to be surveyed.

The estimated Gulf "snapper" headboat harvest during this study is ∿50% of the estimated harvest reported by McEachron and Matlock (1982) for the upper and middle areas of the Texas coast during September 1978-August 1979. This large difference may be the result of the headboats making fewer trips during this study or it may be due to the method used by McEachron and Matlock to determine the number of trips made by the headboats. Their estimate of number of trips is ∿1.8 times > than the actual number of trips reported in this survey. If it is assumed the number of trips in 1978-79 to be ∿ equal to those made in 1980-81 then the harvest estimates would be similiar between the 2 years. It is apparent that every effort should be made to determine as accurately as possible the number of trips made by these boats in order to make assessments of changes in the landings. An alternate method of calculating harvest similiar to that used by McEachron and Green (1982) may provide more precise harvest estimates with less effort. Their technique to estimate harvest essentially corresponds to procedures described by Kish (1965) for selecting samples from clusters proportional to size.

The dominant fishes retained in this survey are generally the same species reported by previous authors (McEachron and Matlock 1982 and Trent et al.1976). McConnel et al.(1981) stated that the species and number of fish caught is largely determined by the place the angler fishes.

The consistency of retaining the same species over a number of years by the Texas charter boat fishermen may reflect the distribution of the fishes off Texas. However, it may also reflect the edibility or trophy preferences of the captains or clients. Ditton et al. (1978) reported that the primary species sought by charter operators in decreasing order were kingfish (S. cavalla), ling (Rachycentron canadum), red snapper, dolphin (Coryphaena hippurus), warsaw (Epinephelus nigritus), bonito (Sarda sarda), sailfish, grouper (Serranidae), jackfish (Caranx hippos), tarpon (Megalops atlanticus), tuna (Thunnus sp.) and marlin (Makaira nigricans and Tetrapturus albidus). Therefore, it is reasonable to assume that these fishes would be the ones retained by the boats. Generally, these fishes were the same species retained by charter operators in this study. "Other" species landed by the charter fishermen might be released and caution should be used when making inferences of fish distribution or abundance from party boat landings.

The number of fishermen/trip on party boats in Texas was similiar to those reported by Ditton et al. (1978) and Woods and Ditton (1979). Ditton et al. (1978) reported that in 1975 the mean size of Gulf party boats was ∿10.36 m long and the mean size of bay party boats was ∿7.32 m long. Therefore, if the carrying capacity is related to the size of the boat, it does not appear that the party boat operators are utilizing longer boats to carry more fishermen to offset the higher cost of running a charter operation. Woods and Ditton (1979) reported on the economics of running a party boat operation during 1975. Since then inflation has driven costs and prices up dramatically (Bureau of Labor Statistics 1982). Therefore, since the party boat operators are carrying about the same number of fishermen/trip in 1981 as in 1975, they have had to increase their fees to offset the rising price of their operation. It is recommended that additional research be conducted on the economics of Texas charter operations to determine if current deflated costs are similiar to those reported by Woods and Ditton (1979) and to determine the current economic impact of charter fishing in Texas.

Woods and Ditton (1979) reported that Texas Gulf party boats averaged 68 trips/year and that bay party boats averaged 100 trips/year. During summer 1981 the Gulf party boats averaged 36 trips/boat; bay party boats averaged 22 trips/boat in the upper and middle areas and 57 trips/boat in the lower area. Therefore, ∿53% of the yearly Gulf trips were made during summer and ∿22% of the yearly bay trips in the upper area and ∿57% of the yearly bay trips in the lower area. These percentages can be used to estimate the yearly harvest if it is assumed the catch rates during the rest of the year are similiar to those in summer. The yearly harvests for Gulf party boats would be an estimated 184,000 fish. The bay party boats yearly estimates would be ∿264,000 fish. McEachron and Matlock (1982) reported no significant difference between weekday and weekend Gulf party boat catch rates. There was a significant difference in the bay party boat weekday and weekend catch rates with the highest catch rate reported on weekdays. Since almost all the surveys on the party boats were conducted on weekdays the estimated yearly bay party boat harvest was probably greater than the actual harvest.

LITERATURE CITED

Bureau of Labor Statistics. 1982. CPI detailed report for January 1982. U. S. Dept. Labor, Wash., D. C. 149 p.

Cochran, 1967. Sampling techniques, 3rd. ed., John Wiley and Sons, New York. 428 p.

Ditton, R. B., R. N. Jarman, and S. A. Woods. 1978. An analysis of the charter boat fishing industry on the Texas Gulf coast. Mar. Fish. Rev. 49(8):1-7.

Hoese, H. D. and R. H. Moore. 1977. Fishes of the Gulf of Mexico, Texas, Louisiana and adjacent waters. Tex. A&M Univ. Press, College Station. 327 p.

Kish, L. 1965. Survey sampling. John Wiley and Sons, New York. 643 p.

McConnell, K. E., T. P. Smith and J. F. Farrell. 1981. Marine sport fishing in Rhode Island, 1978. NOAA/Sea Grant, Univ. R.I. Tech. Rept. 83, 26 p.

McEachron, L. W. 1980. Headboat and charterboat finfish catch statistics for the bays and Gulf waters of Texas, September 1978-August 1979. Tex. Parks and Wildl. Dept., Coast. Fish. Branch Mgmt. Data Ser. No. 10. 38 p.

_____ and A. W. Green. 1982. Weekend sport boat fishermen finfish catch statistics for Texas bay systems, May 1974-May 1981. Tex. Parks and Wildlf. Dept., Coastal Fish. Branch Mgmt. Data Ser. No. 35. 123 p.

_____ and G. C. Matlock. 1982. An estimate of harvest by the Texas chartered boat fishery. Mar. Fish. Rev. (In press). 39 p.

Overall and Spiegel. 1969. Concerning least square analysis of experimental data. Psychol. Bull. 72(5):311-322.

Robins, R. C., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1980. A list of common and scientific names of fishes from the United States and Canada. 4th ed. Amer. Fish. Soc. Spec. Pub. No. 12. Bethesda, Md. 174 p.

Sokal, R. R. and J. Rohlf. 1969. Biometry. W. H. Freeman and Co., San Francisco. 776 p.

Trent, L. 1976. Evaluation of the marine recreational fisheries in the Northwestern Gulf of Mexico from Port Aransas to Port Isabel, Texas, 1975-76. In: Environmental studies of the south Texas outer continental shelf, 1975. Addendum to: Vol. I, Plankton and fisheries, NOAA final Rept. to B. L. M., Interagency agreement No. 08550-IA5-19. 236 p.

Woods, S. A. and R. B. Ditton, 1979. Texas charter fishing-bay and Gulf. Tex. A&M Univ., Sea Grant College Program TAMU-SG-80-504. 3 p.

Table 1. Number of trips and mean number of fishermen/trip (± 1S.E.) of Gulf "snapper" headboats inventoried on the upper, middle and lower Texas coast during September 1980-August 1981.

Area	Boats	Trips	Fishermen/trip
Upper	8	876	47 ± 3.2
Middle	1	140	38 ± 3.4
Lower	1	159	23 ± 1.6
Total	10	1196	42 ± 1.5[a]

[a] Mean and S.E. were calculated as a weighted average due to significant difference among areas.

Table 2. Total fish harvest (No. ± 1S.E.) by recreational fishermen on Gulf "snapper" headboats in the Gulf of Mexico off the upper, middle and lower Texas coast during September 1980-August 1981.

Species	Area			Total
	Upper	Middle	Lower	
Red snapper[a]	211,151 ± 32,344	11,858 ± 2908	31,839 ± 3905	254,848 ± 19,280
Vermillion snapper[a]	25,263 ± 9673	27,552 ± 6519	<500	53,000 ± 6748
Greater amberjack	5089 ± 1323	682 ± 177	<500	6207 ± 1585
Sharks sp.	2060 ± 371	<500	<500	2512 ± 454
Lane snapper	5002 ± 2351	671 ± 315	<500	6100 ± 2889
Triggerfish sp.	3472 ± 868	<500	<500	4234 ± 1072
Sea basses	2246 ± 562	<500	<500	2739 ± 679
Tomtate	1766 ± 459	<500	<500	2153 ± 570
Other	9013 ± 1983	1209 ± 266	769 ± 169	10,991 ± 2430
Total	271,414 ± 21,713	36,409 ± 2913	23,169 ± 1854	330,993 ± 27,411

[a] Summation of harvest calculated independently in all three areas.

Table 3. Mean catch rate (No./man-h ± 1S.E.) of fish by Gulf "snapper" headboat fishermen in the Gulf of Mexico off the upper, middle and lower Texas coast during September 1980-August 1981. (Number in parenthesis indicates number of interview days).

Species	Area			Total
	Upper	Middle	Lower	
Red snapper	1.89 ± 0.29 (22)	0.51 ± 0.11 (16)	2.51 ± 0.29 (17)	1.77 ± 13[a] (55)
Vermillion snapper	0.24 ± 0.09 (22)	1.26 ± 0.33 (16)	0.02 ± 0.02 (17)	0.33 ± 0.05[a] (55)
Greater amberjack	0.02 ± 0.01 (22)	0.08 ± 0.01 (16)	0.01 ± 0.01 (17)	0.03 ± 0.01 (55)
Sharks sp.	0.02 ± 0.01 (22)	<.01 (16)	0.02 ± 0.01 (17)	0.02 ± 0.01 (55)
Lane snapper	0.07 ± 0.03 (22)	<.01 (16)	0.04 ± 0.02 (17)	0.04 ± 0.01 (55)
Triggerfish sp.	0.06 ± 0.01 (22)	0.01 ± 0.01 (16)	<.01 (17)	0.03 ± 0.01 (55)
Sea basses	0.02 ± 0.01 (22)	<.01 (16)	0.05 ± 0.01 (17)	0.02 ± 0.01 (55)
Tomtate	0.03 ± 0.01 (22)	0.01 ± 0.01 (16)	0.00 ± 0.00 (17)	0.01 ± 0.01 (55)
Other	0.11 ± 0.02 (22)	0.02 ± 0.01 (16)	0.04 ± 0.01 (17)	0.06 ± 0.01 (55)
Total	2.48 ± 0.31 (22)	1.94 ± 0.31 (16)	2.71 ± 0.30 (17)	2.40 ± 0.18 (55)

[a] Mean and S.E. were calculated as a weighted average due to significant difference among mean catch rates off the three areas of the Texas coast.

Table 4. Number of trips and mean number of fishermen/trip (± 1S.E.) of bay headboats and party boats inventoried on the upper, middle and lower Texas coast during June-August 1981.

	Bay headboats			Party boats					
				Bay			Gulf		
Area	Boats	Trips	Fishermen/ trip	Boats[a]	Trips	Fishermen/ trip	Boats[a]	Trips	Fishermen/ trip
Upper	2	326	34 ± 8.5	13	296	3 ± 0.3	30	886	6 ± 0.3
Middle	5	807	22 ± 4.4	35.5	809	4 ± 0.2	53.5	2258	4 ± 0.4
Lower	4	359	18 ± 3.6	25.5	1466	4 ± 0.2	23.5	846	3 ± 0.2
Total	11	1492	24 ± 3.8	74	2571	4 ± 0.1	107	3990	4 ± 0.1[b]

[a] Boats fishing in both the bay and Gulf were allocated equally to each area

[b] Mean and S.E. were calculated as a weighted average due to significant difference among areas.

Table 5. Total fish harvest (No. ± 1S.E.) by recreational fishermen on Gulf party boats in the Gulf of Mexico off the upper, middle and lower Texas coast during June-August 1981.

Species	Area			Total
	Upper	Middle	Lower	
King mackerel	14,381 ± 2128	22,546 ± 3337	8438 ± 1249	45,366 ± 6714
Spanish mackerel	1518 ± 1340	2380 ± 2102	891 ± 787	4788 ± 4228
Red snapper[a]	8045 ± 4457	<500	7682 ± 4256	15,817 ± 8763
Cobia	733 ± 270	1150 ± 424	<500	2314 ± 854
Dolphin	3339 ± 1225	5235 ± 1921	1959 ± 719	10,534 ± 3866
Atlantic bonito	2530 ± 1070	3966 ± 1678	1484 ± 628	7980 ± 3376
Sharks sp.	1075 ± 470	1686 ± 737	631 ± 276	3392 ± 1482
Crevalle jack	1050 ± 799	1646 ± 1253	616 ± 469	3312 ± 2520
Other	1404 ± 643	2201 ± 1008	824 ± 377	4429 ± 2028
Total	32,969 ± 6000	51,689 ± 9407	19,344 ± 3521	104,738 ± 19,062

[a] Summation of red snapper harvest calculated independently in all three areas.

Table 6. Mean catch rate (No./man trip-h ± 1S.E.) of fish by Gulf party boat fishermen in the Gulf of Mexico off the upper, middle and lower Texas coast during June-August 1981. (Number in parenthesis indicates number of interview days.

Species	Area			Total
	Upper	Middle	Lower	
King mackerel	0.28 ± 0.04 (15)	0.34 ± 0.09 (8)	0.43 ± 0.16 (9)	0.33 ± 0.05 (32)
Spanish mackerel	0.05 ± 0.05 (15)	0.01 ± 0.01 (8)	<.01 (9)	0.03 ± 0.02 (32)
Red snapper	0.16 ± 0.10 (15)	<.01 (8)	0.30 ± 0.30 (9)	0.10 ± 0.04[a] (32)
Cobia	0.02 ± 0.01 (15)	0.01 ± 0.01 (8)	0.00 ± 0.00 (9)	0.01 ± 0.01 (32)
Dolphin	0.08 ± 0.03 (15)	0.01 ± 0.01 (8)	0.02 ± 0.02 (9)	0.05 ± 0.01 (32)
Atlantic bonito	0.08 ± 0.03 (15)	0.01 ± 0.01 (8)	0.02 ± 0.02 (9)	0.05 ± 0.01 (32)
Sharks sp.	0.01 ± 0.01 (15)	0.08 ± 0.04 (8)	0.02 ± 0.02 (9)	0.03 ± 0.01 (32)
Crevalle jack	0.01 ± 0.01 (15)	<.01 (8)	0.01 ± 0.01 (9)	0.01 ± 0.01 (32)
Other	0.03 ± 0.01 (15)	<.01 (8)	0.01 ± 0.01 (9)	0.02 ± 0.01 (32)
Total	0.74 ± 0.14 (15)	0.48 ± 0.08 (8)	0.84 ± 0.33 (9)	0.70 ± 0.11 (32)

[a] Mean and S.E. were calculated as a weighted average due to significant difference between mean catch rate off the middle (<.01 fish/man-trip h) and upper and lower (0.22 ± 0.13 fish/man-trip h) areas.

Table 7. Total fish harvest (No. ± 1S.E.) by recreational fishermen on headboats and party boats in the bays on the upper, middle and lower Texas coast during June-August 1981.

Species	Area			Total
	Upper	Middle	Lower	
HEADBOAT				
Atlantic croaker[a]	21,255 ± 5711	1340 ± 1417	595 ± 445	23,190 ± 3488
Sand seatrout	7313 ± 3291	17,950 ± 8077	7978 ± 3590	33,242 ± 14,838
Kingfish sp.[a]	528 ± 301	1307 ± 962	3888 ± 1122	5723 ± 877
Other	2485 ± 1019	6099 ± 2500	2711 ± 1112	11,294 ± 4639
Total	19,622 ± 5102	48,163 ± 12,522	21,406 ± 5565	89,192 ± 23,555
PARTY BOAT				
Spotted seatrout	9633 ± 2374	26,385 ± 4290	46,654 ± 7567	83,763 ± 5464
Red drum	<500	<500	513 ± 380	900 ± 262
Southern flounder	<500	<500	<500	823 ± 290
Sheepshead	<500	<500	557 ± 461	977 ± 319
Black drum	<500	<500	<500	<500
Other	<500	733 ± 208	733 ± 433	1286 ± 294
Total	10,251 ± 2449	28,078 ± 4383	50,808 ± 7398	89,136 ± 5417

[a]Summation of harvest calculated independently in all three areas.

Table 8. Mean catch rate of fish by headboat (No./man-h ± 1S.E.) and party boat (No./man-trip h ± 1S.E.) fishermen in the bays on the upper, middle and lower Texas coast during June-August 1981. (Number in parenthesis indicates number of interview days.

Species	Area			Total
	Upper	Middle	Lower	
HEADBOAT				
Atlantic croaker	1.03 ± 0.31 (5)	0.05 ± 0.02 (3)	<.01 (6)	0.25 ± 0.04[a] (14)
Sand seatrout	0.20 ± 0.09 (5)	0.53 ± 0.38 (3)	0.28 ± 0.20 (6)	0.31 ± 0.11 (14)
Kingfish sp.	0.02 ± 0.01 (5)	0.02 ± 0.02 (3)	0.24 ± 0.07 (6)	0.07 ± 0.01[b] (14)
Other	0.32 ± 0.13 (5)	0.04 ± 0.01 (3)	0.02 ± 0.01 (6)	0.13 ± 0.05 (14)
Total	1.59 ± 0.40 (5)	0.64 ± 0.40 (3)	0.55 ± 0.27 (6)	0.94 ± 0.23 (14)
PARTY BOAT				
Spotted seatrout	1.13 ± 0.25 (12)	2.06 ± 0.23 (14)	1.67 ± 0.22 (16)	1.74 ± 0.14 (42)
Red drum	0.01 ± 0.01 (12)	0.02 ± 0.01 (14)	0.01 ± 0.01 (16)	0.01 ± 0.01 (42)
Southern flounder	0.01 ± 0.01 (12)	0.02 ± 0.02 (14)	0.01 ± 0.01 (16)	0.01 ± 0.01 (42)
Sheepshead	0.07 ± 0.07 (12)	0.01 ± 0.01 (14)	0.01 ± 0.01 (16)	0.02 ± 0.01 (42)
Black drum	0.01 ± 0.01 (12)	0.01 ± 0.01 (14)	0.00 ± 0.00 (16)	0.01 ± 0.01 (42)
Other	0.03 ± 0.02 (12)	0.02 ± 0.01 (14)	0.01 ± 0.01 (16)	0.02 ± 0.01 (42)
Total	1.28 ± 0.24 (12)	2.17 ± 0.22 (14)	1.71 ± 0.22 (16)	1.83 ± 0.14 (42)

[a] Mean and S.E. were calculated as a weighted average due to significant difference between mean catch rate in upper (1.03 ± 0.31 fish/man-h) and middle and lower (0.02 ± 0.01 fish/man-h) areas.

[b] Mean and S.E. were calculated as a weighted average due to significant difference between mean catch rate in lower (0.24 ± 0.07 fish/man-h) and upper and middle (0.02 ± 0.01 fish/man-h) areas.

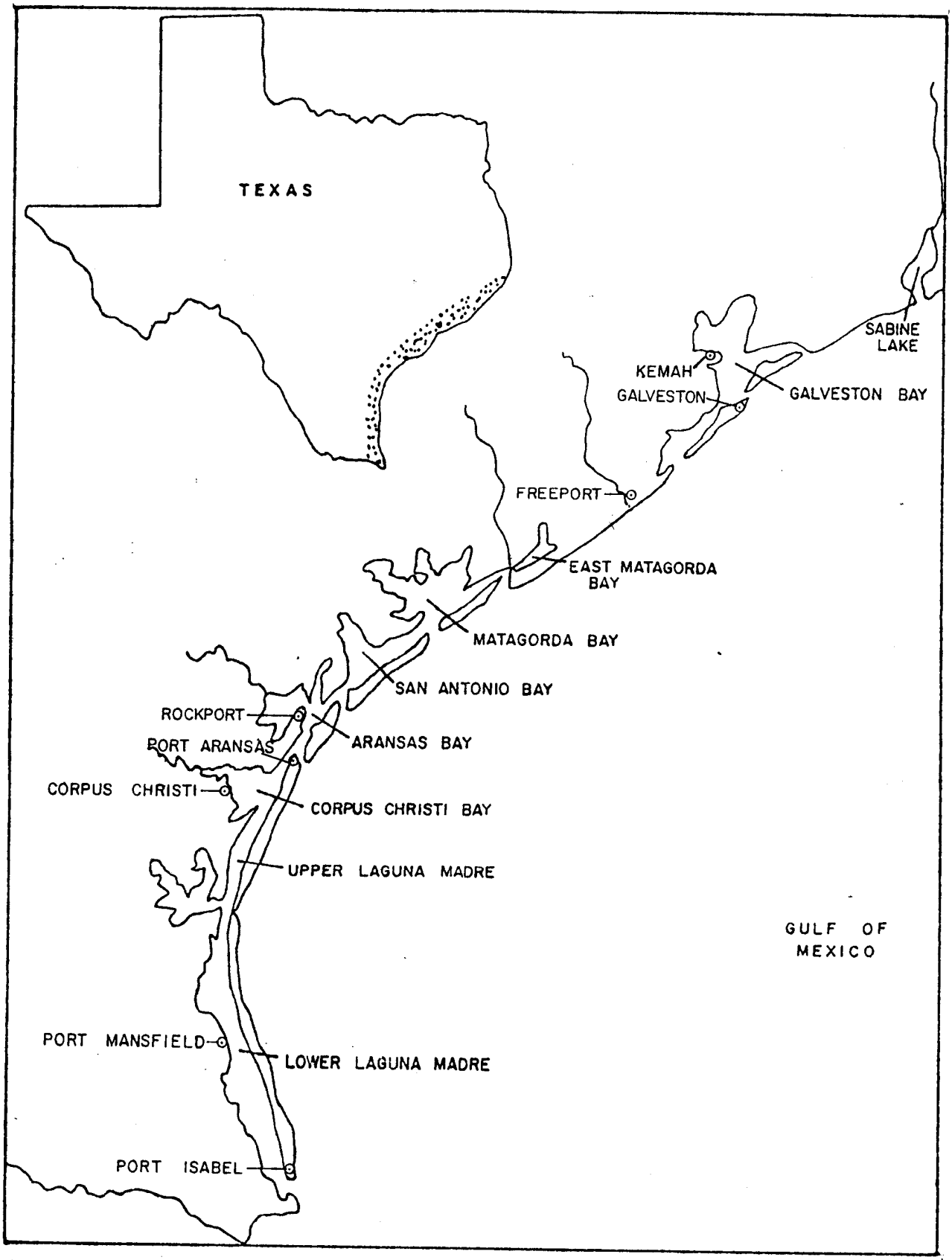


Figure 1. Map of Texas coast with main centers of headboat and party boat activity (September 1980-August 1981).

Figure 2. Percentage of red snapper (Lutjanus campechanus) in each 15 mm size class retained by fishermen on Gulf "snapper" headboats off the upper Texas coast during September 1980-August 1981. (Number in parenthesis = number of interview days).

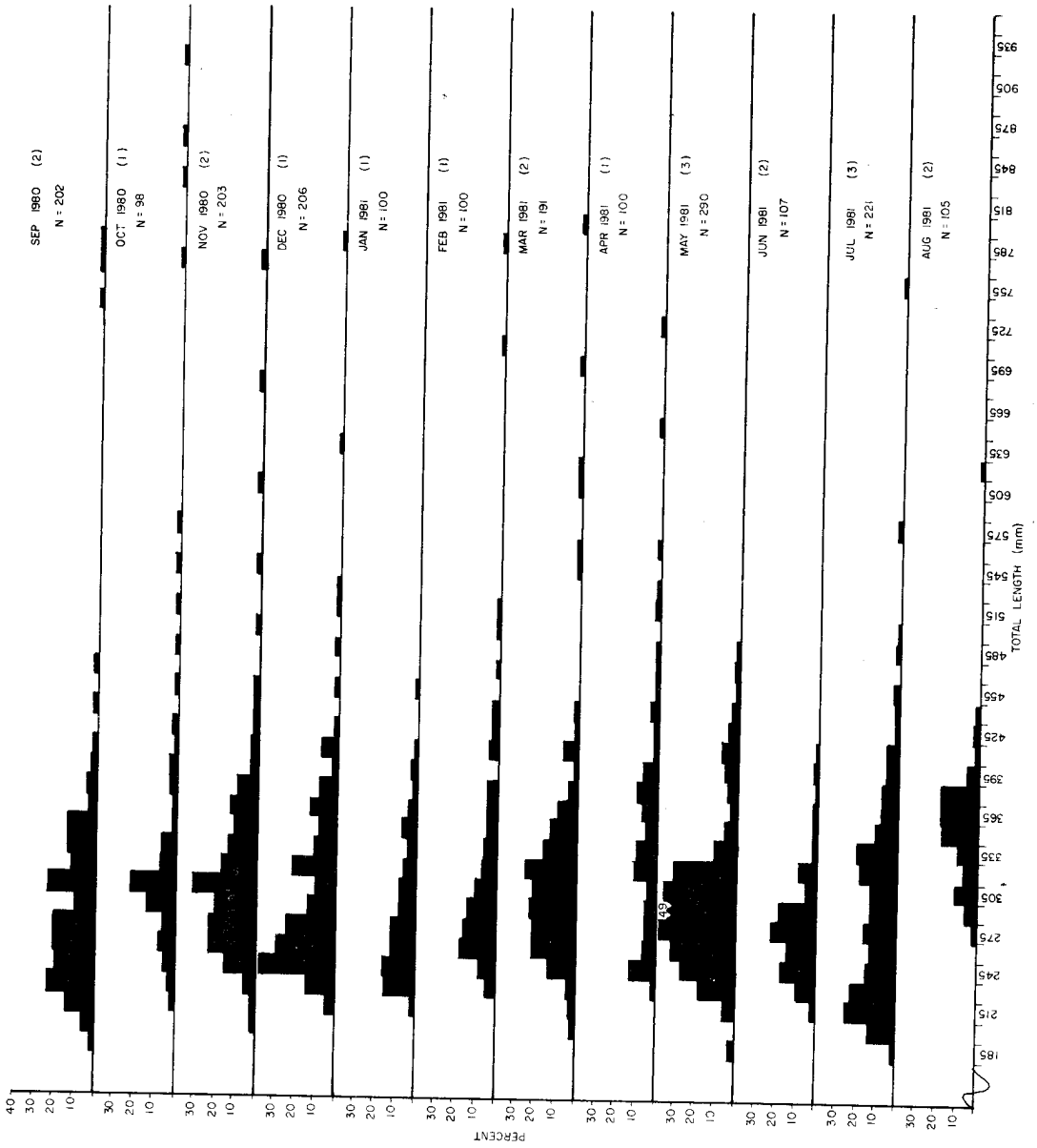

SEP 1980 (2)
N = 202
OCT 1980 (1)
N = 98
NOV 1980 (2)
N = 203
DEC 1980 (1)
N = 206
JAN 1981 (1)
N = 100
FEB 1981 (1)
N = 100
MAR 1981 (2)
N = 191
APR 1981 (1)
N = 100
MAY 1981 (3)
N = 290
JUN 1981 (2)
N = 107
JUL 1981 (3)
N = 221
AUG 1981 (2)
N = 105
PERCENT
TOTAL LENGTH (mm)

Figure 3. Percentage of red snapper (Lutjanus campechanus) in each 15 mm size class retained by fishermen on Gulf "snapper" headboats off the middle Texas coast during September 1980-August 1981. (Number in parenthesis = number of interview days).

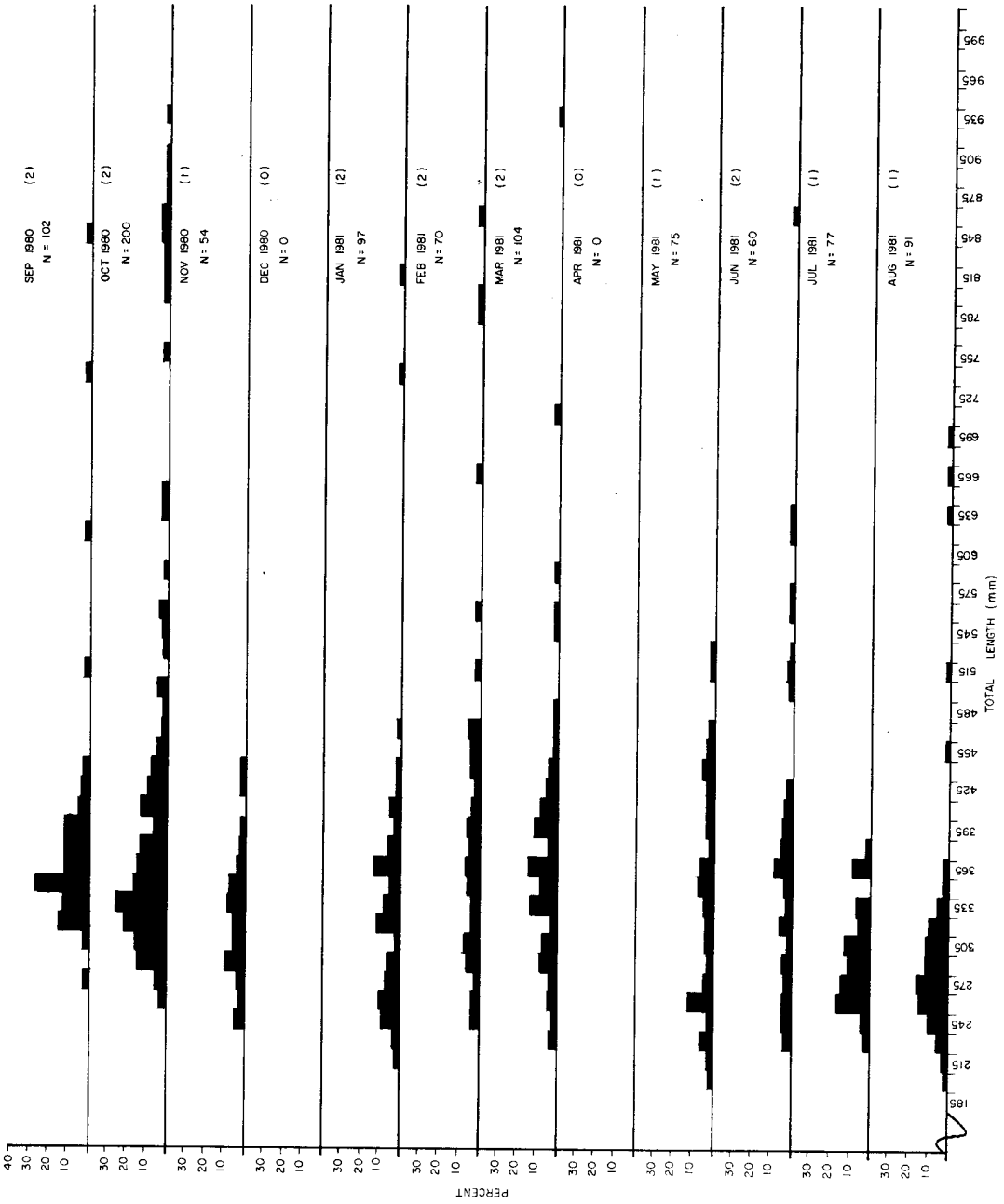

SEP 1980 (2) N = 102
OCT 1980 (2) N = 200
NOV 1980 (1) N = 54
DEC 1980 (0) N = 0
JAN 1981 (2) N = 97
FEB 1981 (2) N = 70
MAR 1981 (2) N = 104
APR 1981 (0) N = 0
MAY 1981 (1) N = 75
JUN 1981 (2) N = 60
JUL 1981 (1) N = 77
AUG 1981 (1) N = 91
PERCENT
TOTAL LENGTH (mm)

Figure 4. Percentage of red snapper (Lutjanus campechanus) in each 15 mm size class retained by fishermen on Gulf "snapper" headboats off the lower Texas coast during September 1980-August 1981. (Number in parenthesis = number of interview days).

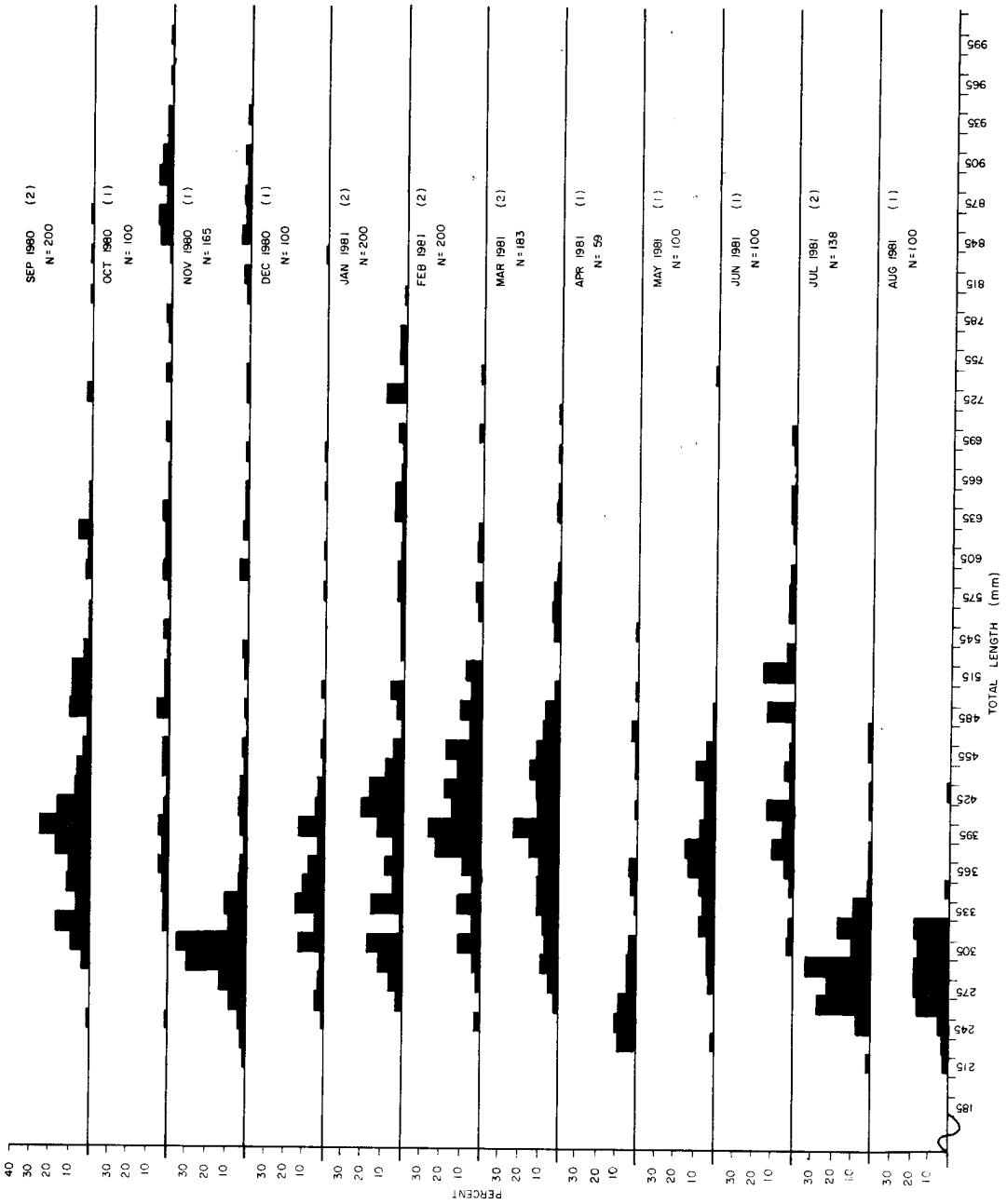

SEP 1980 (2)
N= 200
OCT 1980 (1)
N= 100
NOV 1980 (1)
N= 165
DEC 1980 (1)
N= 100
JAN 1981 (2)
N= 200
FEB 1981 (2)
N= 200
MAR 1981 (2)
N= 183
APR 1981 (1)
N= 59
MAY 1981 (1)
N= 100
JUN 1981 (1)
N= 100
JUL 1981 (2)
N= 138
AUG 1981 (1)
N= 100
PERCENT
TOTAL LENGTH (mm)

Figure 5. Percentage of vermillion snapper (Rhomboplites aurorubens) in each 15 mm size class retained by fishermen on Gulf "snapper" headboats off the upper Texas coast during September 1980-August 1981. (Number in parenthesis = number of interview days).

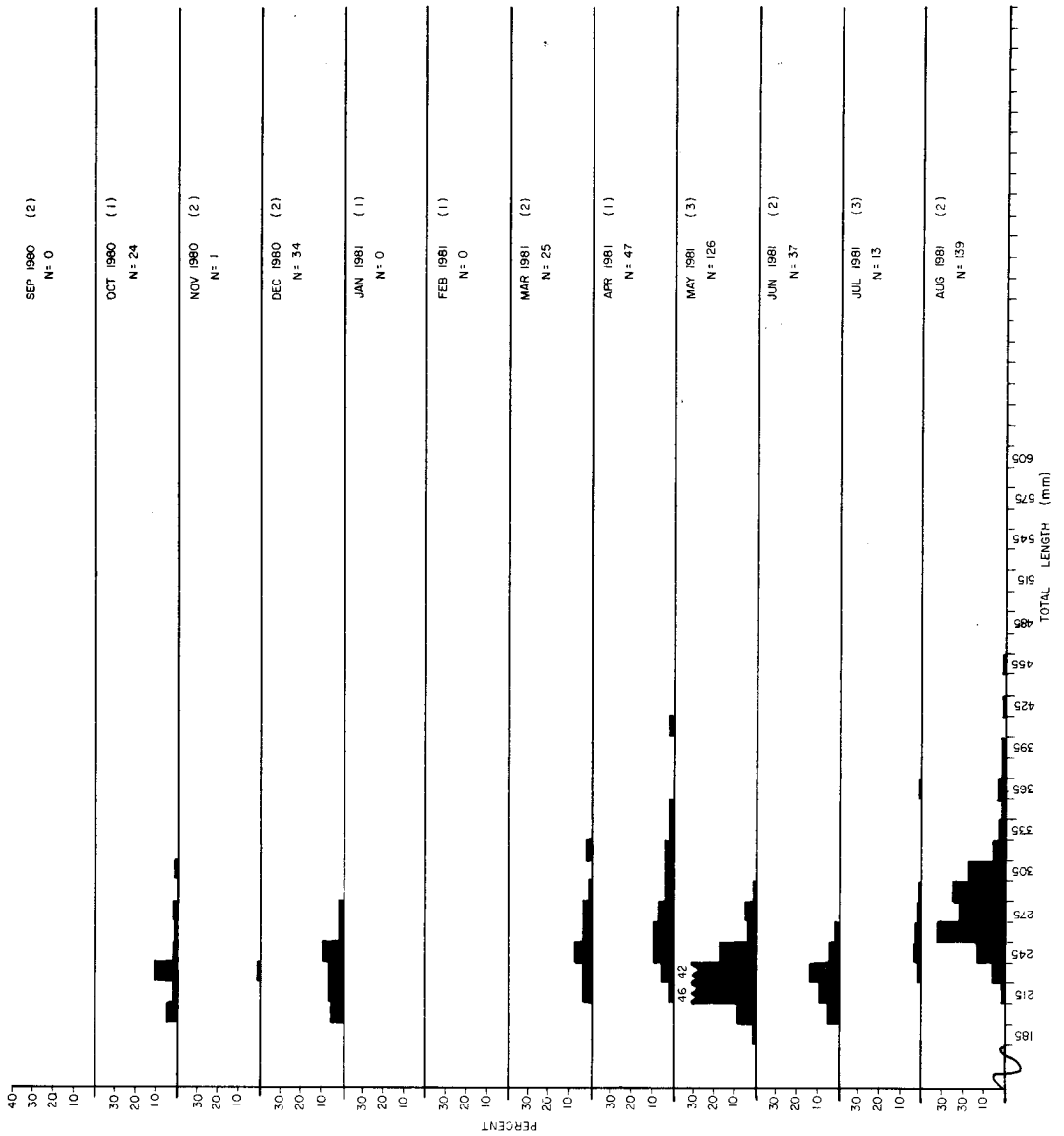
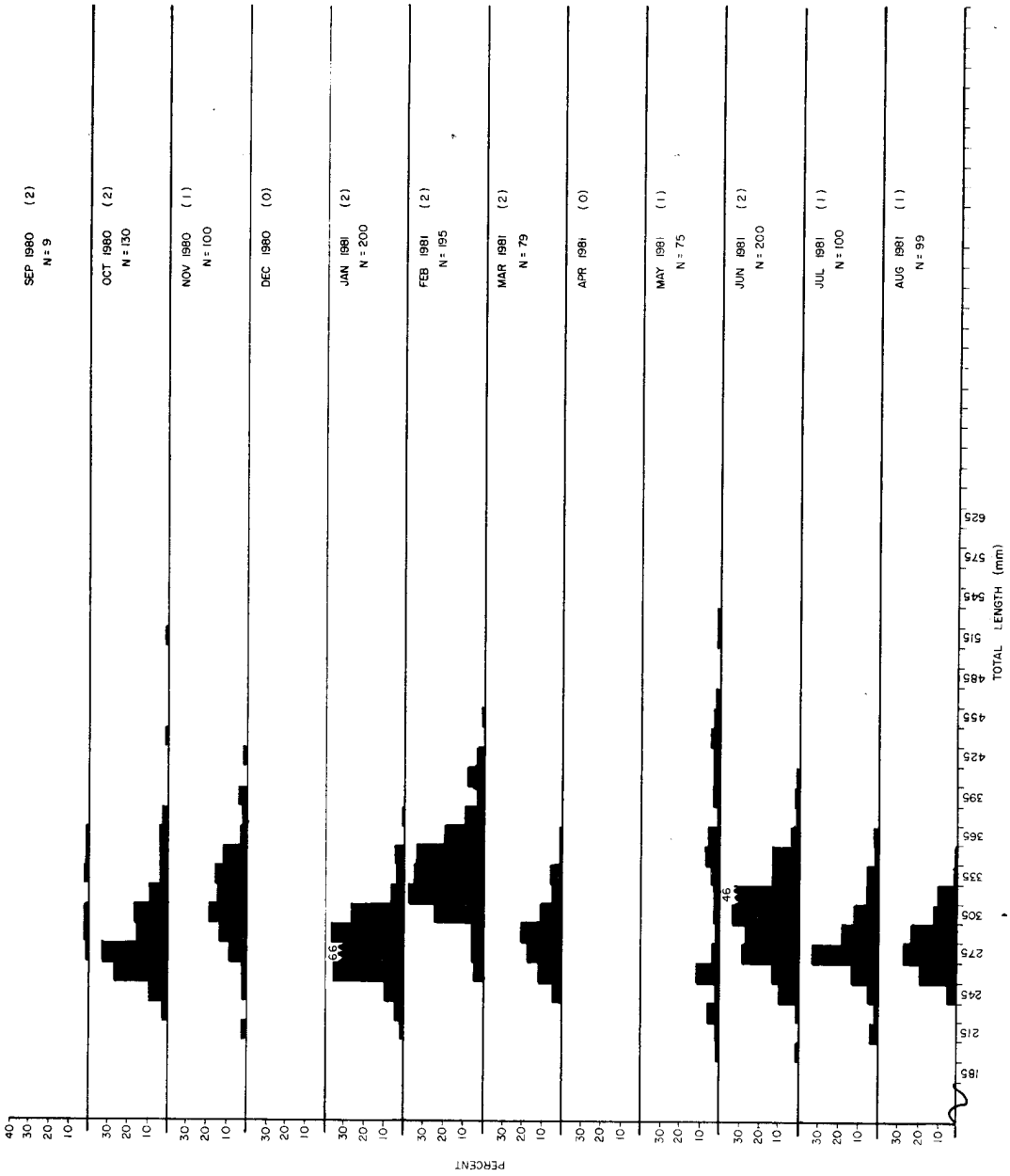

SEP 1980 (2)
N= 0
OCT 1980 (1)
N= 24
NOV 1980 (2)
N= 1
DEC 1980 (2)
N= 34
JAN 1981 (1)
N= 0
FEB 1981 (1)
N= 0
MAR 1981 (2)
N= 25
APR 1981 (1)
N= 47
MAY 1981 (3)
N= 126
JUN 1981 (2)
N= 37
JUL 1981 (3)
N= 13
AUG 1981 (2)
N= 139
PERCENT
TOTAL LENGTH (mm)
46 42

Figure 6. Percentage of vermillion snapper (Rhomboplites aurorubens) in each 15 mm size class retained by fishermen on Gulf "snapper" headboats off the middle Texas coast during September 1980-August 1981. (Number in parenthesis = number of interview days).


SEP 1980 (2)
N = 9
OCT 1980 (2)
N = 130
NOV 1980 (1)
N = 100
DEC 1980 (0)
JAN 1981 (2)
N = 200
FEB 1981 (2)
N = 195
MAR 1981 (2)
N = 79
APR 1981 (0)
MAY 1981 (1)
N = 75
JUN 1981 (2)
N = 200
JUL 1981 (1)
N = 100
AUG 1981 (1)
N = 99
99
46
PERCENT
TOTAL LENGTH (mm)

Appendix A. List of inventoried headboats and party boats.

Table 1. List of inventoried "snapper" (September 1980-August 1981) and bay headboats (June-August 1981) on the upper, middle and lower Texas coast. (Name in parenthesis is area where boat is docked).

Boat type	Area	Headboat name	Headboat Code No.
Snapper			
	Upper	New Buccaneer (Galveston)	84
		Old Buccaneer (Galveston)	85
		Texsun II (Galveston)	87
		Ranger V (Galveston)	93
		Bearcat (Freeport)	88
		Lady Lori (Freeport)	89
		Capt. Casey (Freeport)	90
		Miss Vickie (Freeport)	94
	Middle	Scat Cat (Port Aransas)	92
	Lower[a]	Thunderbird (Port Isabel)	82
Bay			
	Upper	Kemah Clipper (Kemah)	81
		Dixie Queen (Galveston)	83
	Middle[b]	Capt. Clark (Corpus Christi)	89
		Sally D. (Corpus Christi)	90
		Star Trek (Corpus Christi)	91
		Whooping Crane (Rockport)	81
		Mary Lou (Rockport)	82
	Lower	Laguna Queen (Port Isabel)	81
		Albatross (Port Isabel)	83
		Donny B. (Port Isabel)	84
		Jan (Port Isabel)	85

[a] The boat "Laguna Queen" (81) is not included in this survey because of lack of owner cooperation.

[b] The boat "Buccaneer" (93) is not included in this survey because it made no trips during June-August 1981.

Table 2. List of inventoried bay and Gulf party boats on the upper, middle and lower Texas coast during June-August 1981.

Area	Party boat[a] identification	Party boat code No.	Major fishing area
Upper	Jimmy Goddard	4	Bay
	Lillymae Pepper	5	Bay
	Forrest West (6 Boats)	7	Bay
	Marshall Deal	10	Bay
	Duke Wellington	17	Bay
	Kirk Elliott	23	Bay
	Jeff Heath	27	Bay
	Glen Erwin	24	Bay
	Ronald Jones	1	Gulf
	Skip Legge	13	Gulf
	Gerald Needham	14	Gulf
	John Oliveras III	15	Gulf
	Larry Simmons	16	Gulf
	Nina Ruth	18	Gulf
	Louis Fechner	19	Gulf
	Princess Patsy	20	Gulf
	Bill Donald	21	Gulf
	Anchor Deep Sea Fishing (5 Boats)	1	Gulf
	Capt. Elliotts (2 Boats)	2	Gulf
	Dorothy L	3	Gulf
	Novacain	4	Gulf
	Cherokee	11	Gulf
	Billy Neel	6	Gulf
	Ann and Doug Johnston	7	Gulf
	E. M. Biggs	8	Gulf
	Monroe Krumnow (5 Boats)	10	Gulf
	David Waters	12	Gulf
	Ralph Hamilton	13	Gulf
	Gene and Roy Newman	15	Gulf
Middle	Ted Appel (Shearwater)	1	Bay
	L. A. Hagey	2	Bay
	Charlie Hale (Becky Ann)	3	Bay
	W. D. Heldenfels	4	Bay
	Robert Johnstone	5	Bay
	Roy Latham (Happy Days)	7	Bay
	Miss Margie	60	Bay
	Larry Washington	11	Bay
	Jake Cambell (Sea Jay)	9	Bay
	Jim Anderson	101	Bay
	Roger Sherman	10	Bay
	B & S Charter (Willie C)	53	Bay
	Gary Stryker (Stryker II)	40	Bay

Table 2. (Cont'd).

Area	Party boat[a] identification	Party boat code No.	Major fishing area
Middle (cont'd)	Hubert Johnson (Aggie J)	16	Bay and Gulf
	Wayne Lindsey (Kimberly Sue)	17	Bay and Gulf
	Ken Calloway (My Melissa)	102	Bay and Gulf
	My Diane	103	Bay and Gulf
	James Fox (Bastante)	21	Bay and Gulf
	Ron Reed (Francine II)	104	Bay and Gulf
	Floyd Smith	105	Bay
	Allan DuBose (Nina D)	63	Bay
	Virgil Alexander (Amberjack)	58	Gulf
	Ira Loveday (Tinker Toy)	106	Gulf
	Doug McCallum (Nellie Belle)	107	Gulf
	Jerry Parker (Expectation)	108	Gulf
	E. W. Frank (Breaker I)	109	Gulf
	Pelican	110	Gulf
	Doc McCallum (Miss Justice)	111	Gulf
	Rick Ogle (Sum Fun)	112	Bay and Gulf
	Tom Buckner (Samaki)	113	Bay and Gulf
	Will Mayfield (Summer Lee)	114	Bay and Gulf
	Leonard Randow (Miss Kelli)	115	Bay and Gulf
	Cloud Nine	54	Bay and Gulf
	Ted Simerson (Teaser)	116	Bay and Gulf
	Randy Coffen (Frenchie)	74	Bay and Gulf
	Larry Mayfield (Jana K)	117	Bay and Gulf
	Gilbert Jackson (Water Lillie)	118	Bay and Gulf
	Diablo	22	Gulf
	Lil' Hustler	119	Gulf
	Hustler I	26	Gulf
	Hustler II	120	Gulf
	Hustler III	24	Gulf
	Hustler IV	65	Gulf
	Hustler V	25	Gulf
	Hustler VI	66	Gulf
	Hustler VII	67	Gulf
	Shotsie II	121	Gulf
	Dam Yankee	122	Gulf
	Go For Broke	123	Gulf
	Beachcomber	38	Gulf
	El Tiburon	43	Gulf
	Black Jack	124	Gulf
	Poco Mas	125	Gulf
	Old Rusty	126	Gulf
	Sun Chaser	34	Gulf
	Misty	127	Gulf
	Susie T	128	Gulf
	Gary Einkauf (Tambucien)	75	Gulf
	Paul Dick (Shark Hunter)	78	Gulf
	Bill Cofield (Fantasea)	57	Gulf
	Jerry Fisher (King Fisher)	55	Gulf

Table 2. (Cont'd).

Area	Party boat[a] identification	Party boat code No.	Major fishing area
Middle (cont'd)	Sammy Gustafson (Shana Lee)	59	Gulf
	Makai	129	Gulf
	Scamp II	130	Gulf
	John Bible (Jay Hawker)	131	Gulf
	Doug Bird (Sea Serpent III)	132	Gulf
	Bill Easum (Island Delights)	45	Gulf
	Larry Eddins (Polly Marjean)	133	Gulf
	Jim Harmon (Touché)	35	Bay and Gulf
	Jay Lancaster (Hot Tamale)	29	Bay and Gulf
	Darrell LeJeune (Hahna)	134	Bay and Gulf
	Bob Kelly (Mojo)	44	Bay and Gulf
	Honey Do	135	Bay and Gulf
	George Vance (Pasa)	48	Bay and Gulf
	Mike Nugent (Big Red Machine)	136	Bay and Gulf
	Mañana	33	Gulf
	Pasado Mañana	31	Gulf
	Alan Latham (Liza II)	137	Bay
	J. B. Greeson	138	Bay
	Crosswinds	139	Gulf
	Byrd Minter (One Step Closer)	141	Gulf
	Jim Darnell	140	Bay
	Terry Carter	142	Bay
	Robert Park (Liberty Call)	143	Bay
	David Pilgrim (Lafete)	144	Bay
	Howard Brown (Angel)	145	Bay
	Gary Stanford (Janet E)	146	Bay and Gulf
	Jackie Pace	147	Bay
	Bill Bardwell	13	Bay
Lower	Silver King	4	Gulf
	Sweet Misty	6	Gulf
	TX2736WS	12	Bay
	TX6784WK	13	Gulf
	TX1779XP (Chula)	14	Bay and Gulf
	TX1727XB	16	Gulf
	TX9283	17	Bay
	Sweet Baby	18	Bay and Gulf
	Baby Doll	19	Bay and Gulf
	b	21	Bay
	TX2933XS	23	Bay
	No Mas	24	Bay and Gulf
	TX2736XS	25	Bay
	Harbor Light	27	Gulf
	TX2661XS	29	Bay
	TX3876XX	30	Bay
	El Pescador	31	Gulf

Table 2. (Cont'd)

Area	Party boat[a] identification	Party boat code No.	Major fishing area
Lower (cont'd)	TX1905XS	32	Bay
	TX1857AA	33	Bay
	TX5925XX	35	Bay
	TX2720XS	36	Bay
	TX2637XS	38	Bay
	TX6517CM	39	Bay
	Shi Poke	40	Bay and Gulf
	Pepe	41	Bay
	TX2690XS	42	Bay
	TX2187CV	43	Bay
	Sunrise	44	Bay and Gulf
	TX3504YE	45	Bay
	Misty Dawn	46	Bay and Gulf
	Rin Con	47	Bay and Gulf
	TX8998WM	48	Bay
	TX2705XS	49	Bay
	Hell Yes	50	Gulf
	Trophy	51	Gulf
	Margaret Ann	52	Gulf
	Marble Queen	53	Gulf
	Collisa	54	Gulf
	Poppa Rod	55	Gulf
	Miss Linda	56	Gulf
	TX1234WP	57	Bay and Gulf
	Wampus Cat	58	Gulf
	Master Plan	59	Gulf
	Gay Lady	60	Gulf
	Char Girl	61	Gulf
	No Sweat	62	Gulf
	TX2335XS	63	Bay
	TX6541WV	64	Bay
	TX3819XS	65	Bay
	Why Knot	66	Gulf

[a] All boat names are underlined

[b] No name or TX number available

Appendix B. List of common and scientific names of fishes identified on headboats and party boats.

Table 1. List of common and scientific names of species identified on bay and Gulf headboats and party boats in Texas during September 1980-August 1981[a].

Common name	Scientific name
Red snapper	*Lutjanus campechanus*
Vermillion snapper	*Rhomboplites aurorubens*
Lane snapper	*Lutjanus synagris*
Gray snapper	*Lutjanus griseus*
Silk snapper	*Lutjanus vivanus*
Dog snapper	*Lutjanus jocu*
Unidentified snapper	Lutjanidae
Tomtate	*Haemulon aurolineatum*
Triggerfish sp.	
Gray triggerfish	*Balistes capriscus*
Ocean triggerfish	*Canthidermis sufflamen*
Queen triggerfish	*Balistes vetula*
Unidentified triggerfish	Balistidae
Greater amberjack	*Seriola dumerili*
King mackerel	*Scomberomorus cavalla*
Spanish mackerel	*Scomberomorus maculatus*
Cobia	*Rachycentron canadum*
Sea basses	
Scamp	*Mycteroperca phenax*
Warsaw grouper	*Epinephelus nigritus*
Rock hind	*Epinephelus adscensionis*
Rock sea bass	*Centropristis philadelphica*
Jewfish	*Epinephelus itajara*
Dwarf sand perch	*Diplectrum bivittatum*
Yellowedge grouper	*Epinephelus flavolimbatus*
Black grouper	*Mycteroperca bonaci*
Little tunny	*Euthynnus alletteratus*
Blackfin tuna	*Thunnus atlanticus*
Atlantic bonito	*Sarda sarda*
Knobbed porgy	*Calamus nodosus*
Pigfish	*Orthopristis chrysoptera*
Blue runner	*Caranx crysos*
Crevalle jack	*Caranx hippos*
Horse-eye jack	*Caranx latus*
Bluefish	*Pomatomus saltatrix*
Bigeye	*Priacanthus arenatus*
Wenchman	*Pristipomoides aquilonaris*
Squirrelfish	*Holocentrus ascensionis*
Unidentified squirrelfish	Holocentridae

Table 1. (Cont'd).

Common name	Scientific name
Sand seatrout	Cynoscion arenarius
Silver seatrout	Cynoscion nothus
Red drum	Sciaenops ocellatus
Black drum	Pogonias cromis
Atlantic croaker	Micropogonias undulatus
Kingfish sp.	
Southern kingfish	Menticirrhus americanus
Gulf kingfish	Menticirrhus littoralis
Sheepshead	Archosargus probatocephalus
Gafftopsail catfish	Bagre marinus
Silver perch	Bairdiella chrysoura
Spotted seatrout	Cynoscion nebulosus
Spot	Leiostomus xanthurus
Southern flounder	Paralichthys lethostigma
Gulf flounder	Paralichthys albigutta
Atlantic spadefish	Chaetodipterus faber
Smooth puffer	Lagocephalus laevigatus
Hardhead catfish	Arius felis
Sharksucker	Echenesis naucrates
Sharks sp.	
Nurse shark	Ginglymostoma cirratum
Atlantic sharpnose shark	Rhizoprionodon terraenovae
Smooth dogfish	Mustelus canis
Sand tiger shark	Odontaspis taurus
Dusky shark	Carcharhinus obscurus
Sandbar shark	Carcharhinus milberti
Lemon shark	Negaprion brevirostris
Blacktip shark	Carcharhinus limbatus
Scalloped hammerhead	Sphyrna lewini
Shortfin mako shark	Isurus oxyrinchus
Dolphin	Coryphaena hippurus
Great barracuda	Sphyraena barracuda
Pinfish	Lagodon rhomboides
Cero	Scomberomorus regalis
Wahoo	Acanthocybium solanderi
Blue marlin	Makaira nigricans
Sailfish	Istiophorus platypterus
Bearded brotula	Brotula barbata
Florida pompano	Trachinotus carolinus

Table 1. (Cont'd).

Common name	Scientific name
Sand tilefish	Malacanthus plumieri
Southern stingray	Dasyatis americana
Unidentified stingray	Dasyatidae
Unidentified toadfish	Batrachoididae
Unidentified porgy	Sparidae

[a] Common and scientific names provided by Robbins et al (1980).

Appendix C. Results of analyses of variance.

Table 1. Summary of results of one-way analysis of variance of mean number of fishermen/boat trip on Gulf "snapper" headboats, bay headboats and bay and Gulf party boats in three Texas Gulf and bay areas.

Area	Source of variation	Party boats Mean square (Degrees of freedom)	F	Headboats Mean square (Degrees of freedom)	F
Gulf	Total	2.076 (31)		0.036 (54)	
	Gulf area	18.378 (2)	19.310 *	0.463 (2)	23.826 *
	Error	0.951 (29)		0.019 (52)	
Bay	Total	1.517 (66)		207.912 (13)	
	Bay area	1.584 (2)	1.045 NS	361.028 (2)	2.004 NS
	Error	1.514 (64)		180.072 (11)	

* P <0.01
NS = Not significant at P = 0.01

Table 2. Summary of results of two-way analysis of variance of mean monthly catch rates of selected species by fishermen on Gulf "snapper" headboats in three areas of the Gulf off Texas.

Species	Source of variation	Mean square (Degrees of freedom)	F
Red snapper	Total	1.867 (53)	
	Gulf area	17.819 (2)	14.346 *
	Months	24.022 (9)	19.340 *
	Gulf area x months	0.935 (19)	0.753 NS
	Error	1.242 (22)	
Vermillion snapper	Total	0.738 (53)	
	Gulf area	6.218 (2)	15.494 *
	Months	3.3369 (9)	8.314 *
	Gulf area x months	0.605 (19)	1.509 NS
	Error	0.401 (22)	
Total fish	Total	0.032 (53)	
	Gulf area	0.086 (2)	2.666 NS
	Months	1.532 (9)	47.319 *
	Gulf area x months	0.034 (19)	1.060 NS
	Error	0.032 (22)	

* P <0.01
NS = Not significant at P = 0.01

Table 3. Summary of results of one-way analysis of variance of mean number of fishermen/boat trip on party boats in two Texas bay and Gulf areas.

Area	Source of variation	Mean square (Degrees of freedom)	F
Middle and lower	Total	0.561 (16)	
	Gulf area	1.171 (1)	2.248 NS
	Error	0.520 (15)	
Upper and middle	Total	255.527 (28)	
	Bay area	85.449 (1)	0.326 NS
	Error	261.826 (27)	

NS = Not significant at P = 0.01

Table 4. Summary of results of one-way analysis of variance of mean number of trips/boat for Gulf and bay party boats in three Texas Gulf and bay areas.

Area	Source of variation	Mean square (Degrees of freedom)	F
Gulf	Total	559.866 (94)	
	Gulf area	2046.667 (2)	3.879 NS
	Error	527.544 (92)	
Bay	Total	369.562 (32)	
	Bay area	2159.845 (2)	8.632 *
	Error	250.210 (30)	

NS = Not significat at P = 0.01
* P <0.01

Table 5. Summary of results of two-level nested analysis of variance of mean daily catch rates of selected species by fishermen on party boats in three areas of the Gulf.

Species	Source of variation	Mean square (Degrees of freedom)	F
King mackerel	Total	0.008 (59)	
	Gulf area	0.005 (3)	1.127 NS
	Days	0.013 (28)	2.808 *
	Error	0.004 (28)	
Red snapper	Total	0.010 (59)	
	Gulf area	0.011 (3)	6.388 *
	Days	0.018 (28)	10.000 *
	Error	0.001 (28)	
Total fish	Total	0.017 (59)	
	Gulf area	0.011 (3)	0.610 NS
	Days	0.018 (28)	2.272 NS
	Error	0.110 (28)	

* P <0.01
NS = Not significant at P = 0.01

Table 6. Results of one-way analysis of mean daily catch rates of red snapper on party boats in the upper and lower area of the Gulf.

Source of variation	Mean square (Degrees of freedom)	F
Total	0.020 (23)	
Gulf area	0.001 (1)	0.066 NS
Error	0.021 (22)	

NS = Not significant at P = 0.01

Table 7. Summary of results of one-way analysis of variance of mean catch rates of selected species by fishermen on bay headboats in three Texas bays.

Species	Source of variation	Mean square (Degrees of freedom)	F
Sand seatrout	Total	0.190 (13)	
	Bay area	0.105 (2)	0.510 NS
	Error	0.206 (11)	
Atlantic croaker	Total	0.869 (13)	
	Bay area	3.417 (2)	8.404 *
	Errors	0.406 (11)	
Kingfish sp.	Total	0.335 (13)	
	Bay area	1.434 (2)	10.594 *
	Error	0.135 (11)	
Total fish	Total	0.759 (13)	
	Bay area	1.640 (2)	2.734 NS
	Error	0.599 (11)	

NS = Not significant at P = 0.01
* P <0.01

Table 8. Summary of results of two-level nested analysis of variance of mean daily catch rates of selected species by bay party boat fishermen in three Texas bays.

Species	Source of variation	Mean square (Degrees of freedom)	F
Spotted seatrout	Total	0.033 (66)	
	Bay area	0.083 (2)	2.574 NS
	Day type	0.037 (39)	1.547 NS
	Error	0.024 (25)	
Total fish	Total	0.035 (66)	
	Bay area	0.114 (2)	3.440 NS
	Day type	0.038 (39)	1.594 NS
	Error	0.024 (25)	

NS = Not significant at P = 0.01

Appendix D. Percent of "other" fishes retained on headboats and party boats.

Table 1. Percent of "other" fishes retained by "snapper" headboat fishermen within each Gulf of Mexico area off the upper, middle and lower Texas coast during September-August 1981. (Blanks indicate none seen).

Species	Area			Total (%)
	Upper (%)	Middle (%)	Lower (%)	
King mackerel	24	12	4	20
Sand seatrout	15			11
Knobbed porgy	11	4	35	12
Spadefish	11			8
Pigfish	7			5
Cobia	5	1	12	5
Gray snapper	5		2	4
Red drum	4			3
Blue runner	3		13	3
Atlantic croaker	3			2
Bluefish	2			2
Atlantic bonito	1	23		5
Silky snapper	1			1
Spanish mackerel	1			<1
Southern flounder	<1			<1
Blackfin tuna	<1	7		1
Southern stingray	<1			<1
Gulf flounder	<1			<1
Crevalle jack	<1			<1
Hardhead catfish	<1			<1
Black drum	<1			<1
Silver seatrout	<1		4	<1
Squirrelfish	<1	13	6	3
Smooth puffer	<1			<1
Bigeye	<1	1		<1
Dolphin	<1	5	4	2
Sharksucker	<1			<1
Little tunny	<1	3	12	2
Batrachoididae	<1			<1
Sparidae	<1	6		1
Horse-eye jack		15		3
Holocentridae		4		<1
Dog snapper		4		<1
Great barracuda		1		<1
Sand tilefish		1		<1
Pinfish			2	<1
Bearded brotula			2	<1
Lutjanidae			2	<1
Unidentified fish			2	<1

Table 2. Percent of "other" fishes retained by Gulf party boat fishermen within each Gulf of Mexico area off the upper, middle and lower Texas coast during June-August 1981. (Blanks indicate none seen).

Species	Area			Total (%)
	Upper (%)	Middle (%)	Lower (%)	
Wahoo	29			24
Cero	29			24
Bluefish	12			11
Spadefish	10	20		10
Pigfish	6			5
Sea basses	6			5
Greater amberjack	4			4
Blue runner	2			2
Blackfin tuna		60	100	11
Blue marlin	2			2
Sailfish		20		2

Table 3. Percent of "other" fishes retained by bay headboat and party boat fishermen within each bay on the upper, middle and lower Texas coast during June-August 1981. (Blanks indicate none seen).

Species	Area			Total (%)
	Upper (%)	Middle (%)	Lower (%)	
HEADBOAT				
Black drum	38			32
Silver perch	23			20
Spotted seatrout	7	13	32	8
Hardhead catfish	10			8
Pigfish	8			7
Sharks sp.	4			4
Pinfish	3	13		4
Dasyatidae	2			2
Gafftopsail catfish	1	74		7
Sheepshead	1		17	2
Spot	1			1
Florida pompano	1			1
Silver seatrout	1			1
Gulf flounder			17	1
Crevalle jack			17	1
Spanish mackerel			17	1
PARTY BOAT				
Sand seatrout	54	17		29
Atlantic croaker	38	11		21
Gafftopsail catfish		72		38
Spanish mackerel	8			3
Sharks sp.			33	3
Gray snapper			67	6

Appendix E. Size range and mean total lengths of fishes retained by headboat and party boat fishermen.

Table 1. Mean total length (nearest 5 mm ± 1S.E.) and size range of fishes retained by fishermen and measured on "snapper" headboats in the Gulf of Mexico off the upper, middle and lower Texas coast during September 1980-August 1981. (Number in parenthesis = No. of fish measured; NA = ≤2 fish measured).

Species	Size range	Length
UPPER		
Red snapper	180-915 (1923)	310 ± 2
Vermillion snapper	180-455 (447)	255 ± 2
Tomtate	175-340 (83)	215 ± 3
Gray triggerfish	220-615 (144)	355 ± 6
Lane snapper	195-495 (195)	295 ± 4
Gray snapper	490-675 (17)	575 ± 10
Silk snapper	315-330 (5)	325 ± 5
Ocean triggerfish	275-420 (10)	355 ± 15
Greater amberjack	270-1265 (62)	630 ± 30
King mackerel	640-1220 (85)	890 ± 10
Spanish mackerel	610-720 (3)	685 ± 35
Cobia	565-1460 (18)	975 ± 50
Scamp	270-740 (8)	495 ± 75

Table 1. (Cont'd).

Species	Size range	Length
Warsaw grouper	310-495 (6)	390 ± 30
Rock hind	235-360 (8)	315 ± 15
Rock sea bass	255 (1)	NA
Little tunny	575-620 (3)	595 ± 15
Blackfin tuna	510 (1)	NA
Atlantic bonito	530-685 (2)	NA
Knobbed porgy	235-395 (40)	305 ± 5
Pigfish	170-320 (28)	235 ± 5
Blue runner	320-520 (8)	405 ± 25
Crevalle jack	955-985 (2)	NA
Bluefish	265-490 (7)	355 ± 30
Bigeye	225-310 (2)	NA
Wenchman	295 (1)	NA
Squirrelfish	310-360 (2)	NA
Sand seatrout	265-390 (56)	325 ± 3
Silver seatrout	280 (1)	NA

Table 1. (Cont'd).

Species	Size range	Length
Red drum	930-1045 (16)	980 ± 10
Black drum	465 (1)	NA
Southern flounder	475 (1)	NA
Gulf flounder	345-365 (2)	NA
Atlantic spadefish	200-310 (39)	265 ± 5
Atlantic croaker	185-285 (10)	252 ± 10
Atlantic sharpnose shark	375-1090 (68)	895 ± 15
Smooth puffer	445 (1)	NA
Hardhead catfish	280-295 (2)	NA
Sharksucker	665-705 (2)	NA
MIDDLE		
Red snapper	200-940 (1030)	365 ± 3
Vermillion snapper	200-445 (1068)	295 ± 1
Lane snapper	345-425 (3)	380 ± 23
Dog snapper	585-725 (4)	655 ± 32
Tomtate	220-410 (27)	260 ± 8

Table 1. (Cont'd).

Species	Size range	Length
Gray triggerfish	415-610 (6)	505 ± 33
Queen triggerfish	325-695 (12)	490 ± 34
Greater amberjack	310-1600 (191)	620 ± 14
King mackerel	910-1900 (14)	1170 ± 77
Cobia	1315 (1)	NA
Scamp	345-635 (10)	435 ± 54
Warsaw grouper	700-1010 (5)	920 ± 56
Jewfish	440 (1)	NA
Dwarf sand perch	240 (1)	NA
Little tunny	620-705 (3)	660 ± 24
Blackfin tuna	800-870 (4)	845 ± 16
Atlantic bonito	550-675 (20)	610 ± 8
Knobbed porgy	260-465 (4)	340 ± 44
Horse-eye jack	340-620 (13)	515 ± 18
Bigeye	271 (1)	NA
Squirrelfish	280-350 (18)	315 ± 7

Table 1. (Cont'd).

Species	Size range	Length
Atlantic sharpnose shark	880-1300 (17)	995 ± 29
Smooth dogfish	795-1120 (2)	NA
Sand tiger shark	2100 (1)	NA
Dolphin	365-410 (5)	385 ± 7
Great barracuda	840 (1)	NA
LOWER		
Red snapper	210-995 (1554)	405 ± 3
Vermillion snapper	280-445 (30)	375 ± 7
Lane snapper	210-430 (58)	285 ± 6
Gray snapper	310 (1)	NA
Gray triggerfish	330-550 (3)	465 ± 68
Greater amberjack	290-1470 (20)	805 ± 79
King mackerel	1075-1110 (2)	NA
Cobia	1000-1065 (2)	NA
Scamp	285-785 (14)	490 ± 37
Jewfish	210 (1)	NA

Table 1. (Cont'd).

Species	Size range	Length
Rock sea bass	280 (1)	NA
Rock hind	290 (1)	NA
Yellowedge grouper	280-535 (27)	410 ± 13
Warsaw grouper	685-1350 (8)	950 ± 97
Black grouper	455 (1)	NA
Little tunny	725-730 (4)	725 ± 1
Knobbed porgy	275-410 (19)	335 ± 9
Blue runner	280-535 (7)	415 ± 34
Squirrelfish	260-305 (3)	285 ± 13
Silver seatrout	310 (1)	NA
Dusky shark	1130-1740 (3)	1360 ± 190
Sandbar shark	925-1585 (9)	1095 ± 84
Lemon shark	895-1080 (6)	995 ± 29
Blacktip shark	900-1020 (7)	980 ± 14
Scalloped hammerhead	1285-1310 (2)	NA
Sand tiger	940-1050 (4)	985 ± 26

Table 1. (Cont'd).

Species	Size range	Length
Dolphin	825-945 (2)	NA
Pinfish	125 (1)	NA

Table 2. Mean total length (nearest 5 mm ± 1S.E.) and size range of fishes retained and measured on party boats on the Gulf of Mexico off the middle and lower Texas coast during June-August 1981. (Number in parenthesis = No. of fish measures; NA = ≤2 fish measured).

Species	Size range	Length
MIDDLE		
King mackerel	675-1305 (80)	945 ± 13
Spanish mackerel	495-685 (4)	590 ± 39
Red snapper	345 (1)	NA
Atlantic bonito	630 (1)	NA
Atlantic sharpnose shark	920-985 (9)	950 ± 8
Crevalle jack	950 (1)	NA
Sailfish	11,826 (1)	NA
LOWER		
King mackerel	785-1175 (25)	915 ± 16
Spanish mackerel	695 (1)	NA
Atlantic bonito	610-730 (4)	660 ± 30
Crevalle jack	885 (1)	NA
Blackfin tuna	830-860 (3)	850 ± 9
Dolphin	450 (1)	NA

Table 3. Mean total length (nearest 5 mm ± 1S.E.) and size range of fishes retained by fishermen and measured on headboats in the bays on the upper, middle and lower Texas coast during June-August 1981. (Number in parenthesis = No. of fish measured; NA = ≤2 fish measured).

Species	Size range	Length
UPPER		
Atlantic croaker	145-320 (326)	210 ± 1
Sand seatrout	210-335 (95)	265 ± 2
Kingfish sp.	170-295 (7)	215 ± 16
Spotted seatrout	300-560 (4)	375 ± 62
Black drum	260-470 (35)	350 ± 12
Sheepshead	325 (1)	NA
Gafftopsail catfish	555 (1)	NA
Hardhead catfish	160-395 (9)	295 ± 22
Silver perch	155-205 (21)	180 ± 3
Pinfish	150-215 (3)	190 ± 20
Pigfish	145-230 (7)	170 ± 25
Spot	130 (1)	NA
Silver seatrout	415 (1)	NA

Table 3. (Cont'd).

Species	Size range	Length
Florida pompano	175 (1)	NA
Atlantic sharpnose shark	370-685 (2)	NA
Scalloped hammerhead shark	535-545 (2)	NA
MIDDLE		
Atlantic croaker	170-250 (7)	190 ± 10
Sand seatrout	220-400 (115)	290 ± 3
Kingfish sp.	240-305 (6)	270 ± 8
Spotted seatrout	320 (1)	NA
Gafftopsail catfish	295-560 (6)	385 ± 40
LOWER		
Atlantic croaker	180 (1)	NA
Sand seatrout	115-350 (68)	255 ± 5
Kingfish sp.	160-355 (65)	275 ± 4
Spotted seatrout	300-370 (2)	NA
Sheepshead	380 (1)	NA
Spanish mackerel	510 (1)	NA

Table 3. (Cont'd).

Species	Size range	Length
Gulf flounder	275 (1)	NA
Crevalle jack	195 (1)	NA

Table 4. Mean total length (nearest 5 mm ± 1S.E.) and size range of fishes retained and measured on party boats in the bays on the upper, middle and lower Texas coast during June-August 1981. (Number in parenthesis = No. of fish measures; NA = ≤2 fish measured).

Species	Size range	Length
UPPER		
Spotted seatrout	305-610 (121)	415 ± 5
Red drum	505-540 (4)	530 ± 8
Black drum	470 (1)	NA
Sheepshead	495 (1)	NA
Sand seatrout	250-325 (7)	285 ± 8
Atlantic croaker	240-305 (5)	260 ± 12
MIDDLE		
Spotted seatrout	235-535 (211)	335 ± 2
Red drum	400-550 (16)	465 ± 12
Black drum	305-415 (7)	350 ± 17
Sheepshead	275-375 (2)	NA
Sand seatrout	295 (1)	NA
Atlantic croaker	275 (1)	NA

Table 4. (Cont'd).

Species	Size range	Length
Southern flounder	320-485 (11)	400 ± 11
Gafftopsail catfish	405-575 (5)	510 ± 30
LOWER		
Spotted seatrout	295-595 (95)	345 ± 5
Sheepshead	230-390 (3)	335 ± 51
Southern flounder	360-450 (4)	395 ± 20

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