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PROJECT TITLE Shrimp and Finfish Investigations in the Northwestern Gulf

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APPROVED BY *[Signature]* DATE March 21, 1979

ABSTRACT

From October 1977 through September 1978 the Texas Parks and Wildlife Department used a systematic shrimp sampling program within 25 fm and mark-recapture studies to monitor juvenile and adult penaeid shrimp growth, movement and abundance. The commercial potential of bottom longlines off the central Texas coast was also evaluated.

Five brown shrimp tagging studies were conducted between May and October 1978 using polyethylene streamer tags. During this time 42,160 shrimp were released in three inshore studies at Port Mansfield and Rockport and 4333 shrimp were released in two offshore operations at Port Aransas. By 30 September 1978, 176 tags were returned - 6 from the inshore tagging and 170 from the offshore tagging in August 1978. Preliminary data from the returns are presented.

The shrimp monitoring program verified the emigration of brown shrimp from the bays at the start of the summer closed season in Texas waters and monitored count sizes and catch rates throughout the summer. Data from shrimp sampling have been used in developing new sampling programs and management plans.

Between December 1977 and September 1978, 34 bottom longline samples were taken from 3-107 fm off the central Texas coast. The greatest catches were from 26-35 fm in March. Atlantic sharpnose shark (Rhizoprionodon terraenovae) was the most abundant species making up 67.1% of the total catch. Sea catfish (Arius felis) and red drum (Sciaenops ocellata) were the next most abundant species caught. During limited sampling in the winter, summer and fall quarters the 3-10 fm zone yielded the highest average catches. In the spring when the majority of the sampling was scheduled the highest average catch rates were in the 21-50 fm area.

SHRIMP AND FINFISH INVESTIGATIONS
IN THE NORTHWESTERN GULF

Terry J. Cody and Kenneth W. Rice

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From October 1977 through September 1978 the Texas Parks and Wildlife Department used a systematic shrimp sampling program within 25 fm and mark-recapture studies to monitor juvenile and adult penaeid shrimp growth, movement and abundance. The commercial potential of bottom longlines off the central Texas coast was also evaluated.

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INTRODUCTION

The commercial fisheries in Texas are dominated by shrimp. For example, in 1976 the value of shrimp landings totaled \$119.8 million while fish landings totaled \$2.9 million. The value of Texas landings from the Gulf of Mexico alone included \$111.2 million for penaeid shrimp and \$625,024 for finfish in 1976 (Farley 1978).

A minimum Gulf shrimp size limit of ≤ 39 whole shrimp per pound is set by Texas law. Seasons are scheduled to correspond with the availability of the larger shrimp preferred by the freezer-oriented processing industry in Texas.

In 1975 the 64th Legislature (HB 1489) amended the Texas Shrimp Conservation Act to provide greater management flexibility of penaeid shrimp resources by the Texas Parks and Wildlife Department (TPWD). Biologists aboard the research vessel Western Gulf took samples along transects off the central Texas coast to monitor the size, abundance and distribution of juvenile and adult shrimp and to evaluate the effect of seasonal closure and other regulations on the commercial fishery.

Many of the recommendations from this study (2-276-R) are currently being considered for inclusion in the "Texas Option" portion of the Draft Shrimp Management Plan being developed for the Gulf of Mexico Fishery Management Council. Due to annual fluctuation in shrimp populations and the need for current information on the fishery, the monitoring of growth, movement and abundance - Job 2 - was continued in the present project. Emphasis was placed on critical zones and the effects of proposed regulations on the fishery.

Preparation of the Shrimp Management Plan for the Gulf of Mexico also pointed out the need for determining how and when shrimp should be harvested to best utilize the annual yield. The development of maximum yield curves, estimates of growth rates, mortality rates and migrations of the penaeid stocks was assigned the highest priority in a list of immediate research needs. Mark-recapture studies along the Texas coast were initiated in Job 1 of this project to help fill these data gaps. The shrimp tagging studies are being coordinated with the National Marine Fisheries Service (NMFS), Texas A & M University and the Instituto Nacional de Pesca of Mexico. Current shrimp tagging studies being conducted off Louisiana, Texas and Mexico should provide much-needed information on the population dynamics of penaeid shrimp stocks in the western Gulf of Mexico.

Discussions with various groups in the shrimping industry have revealed the need for a supplemental income for shrimpers, especially during periods when shrimp production is low. Longlining is a possible alternative fishery but very little information concerning this industry is available from the Texas coast. Job 3 of this study will help determine the kinds, amounts and sizes of finfish which can be harvested with bottom longlines. This data may be useful in determining the commercial potential of a bottom longline fishery off the central Texas coast.

This report is for the first segment of a 4-y project and covers the period 1 October 1977-30 September 1978. Sampling areas and tagging sites are shown in Figure 1.

JOB 1 MARK-RECAPTURE STUDIES

OBJECTIVES

To conduct mark-recapture experiments for movement and growth in the penaeid shrimp stocks along the Texas coast.

MATERIALS AND METHODS

Original project documents required for marked shrimp to be released within a 10 mile radius of the major passes at Port Aransas, Port Mansfield and Pass Cavallo. Cruises were to be made with the research vessel Western Gulf to collect, tag and release brown and white shrimp (Penaeus aztecus and P. setiferus) during their periods of abundance (May-January).

Major efforts using additional manpower were planned for May off Port Mansfield and for June off Port Aransas. Brown shrimp characteristically emigrate from nursery areas during this period. A total of 50,000 shrimp were to be tagged during the year, including 15,000 during each of the major efforts.

During the first part of the project year supplies and equipment were purchased and procedures to be used in tagging operations were developed. The number of tags received by NMFS in late 1977 and early 1978 was barely adequate for ongoing studies in Louisiana and none of the new tags could be given to Texas during this time. Therefore, white shrimp undergoing winter emigration could not be tagged.

Following discussions with NMFS, tagging was restricted to brown shrimp in the areas around Port Aransas and Port Mansfield. Inshore tagging was planned for Port Mansfield in May and Port Aransas in June and July. Offshore tagging was scheduled for August and October. Amendments to the Grant-in-Aid Award reflecting these changes were requested and approved.

In November 1977 approximately 1000 tags were received from NMFS and small-scale studies were conducted in aquaria at the Rockport Marine Laboratory to gain experience in tagging procedures and to attempt to determine mortality rates due to the tagging operation.

All shrimp were tagged with plastic streamer tags provided by NMFS according to techniques described by Marullo et al. (1976). Holding tanks and release methods were similar to those described by Emiliani (1971).

When possible each tagged shrimp was sexed and tail lengths measured to the nearest mm. Individual shrimp weights could not be determined at the time of release since the highly sensitive instruments could not be operated under field conditions. Subsamples for length-weight ratios were taken at least once each tagging day so that length-weight equations could be developed for that particular group of shrimp. Returned shrimp were measured and weighed at the NMFS Galveston Laboratory. NMFS compiled the tag return data as part of their Mexus-Gulf Program.

Manpower for the capture, tagging and release was provided by TPWD, NMFS and Instituto Nacional de Pesca of Mexico. Texas A&M University, through their Marine Advisory Services Program, helped in publicizing the tagging program and recovering tagged shrimp by writing articles for local news media and talking with fishermen and industry groups. An example of an information sheet prepared for local news media by TPWD to publicize and explain the tagging program is included in Appendix 1.

Through a contract with NMFS, Texas A & M University Sea Grant Program was responsible for the awards system. The awards program was patterned after one found to be highly successful during previous studies in Louisiana. In this system everyone returning a tagged shrimp with the needed information receives a letter thanking him for participating in the tagging program and his name is entered into a contest pool. In five separate contests during the year (August, October and December 1978; February and May 1979) four people are randomly selected by computer and cash awards are given to the winners. First prize is \$500.00, second prize is \$200.00, third prize is \$100.00 and fourth prize is \$50.00. This system provides for larger prizes than would be possible if each tag return was rewarded.

RESULTS AND DISCUSSION

Five brown shrimp tagging operations were conducted between May and October 1978 (Table 1). Inshore tagging studies were completed at Port Mansfield and Rockport; 44,601 shrimp were tagged and 42,160 released. In August and October 4572 offshore shrimp were tagged and 4333 released. Altogether, 49,173 shrimp were tagged and 46,493 released off the Texas coast in 1978. Daily tagging and release data is given in Appendixes 2-6.

By 30 September 1978, 176 tags were returned for a preliminary rate of 0.39% (Table 2). Return rates from separate operations ranged from < 0.01% (June) to 5.99% for the offshore study (August). Of the total returns only six were from the inshore tagging studies at Port Mansfield and Rockport while 170 returns were received from the offshore tagging at Port Aransas. Recapture data from the inshore and offshore tagging studies is presented in Table 3 and Table 4, respectively.

A. TAGGING

Port Mansfield Tagging - May 1978

Shrimp capture, tagging and release using the Western Gulf off Port Mansfield were planned for May since historical data from the area showed that small brown shrimp should be offshore during this time.

On the way to Port Mansfield few gulf shrimping vessels were observed offshore. On the first day of work eleven boats were anchored inside the Port Mansfield jetties. Offshore, seas were rough and no shrimp were found out to 7 fm. After dark a return offshore to the area where boats were working resulted in < 5 shrimp per 15-minute drag.

The next day, in Port Mansfield, Terry Simmons, a local bait dealer said that shrimp size and movements were about a month behind previous years but that he could supply shrimp from the Laguna Madre. Arrangements were made for him to supply shrimp for tagging.

Strong winds made tagging on the vessel difficult; however 2113 shrimp were released in 2 days. On the third day the supplier could not find any shrimp so the Western Gulf was taken offshore to try to capture live shrimp. Seas were rough and the only shrimp located were in an area of dense seaweed which made it impossible to keep the shrimp alive. As the Western Gulf was returning to Port Mansfield the supplier radioed that he had found shrimp. The holding tanks were filled and eventually 1757 more shrimp were released.

Daily totals and release information on the Port Mansfield tagging operation are given in Table 5. Two returns have been received as of 30 September 1978 (Table 3); information gained from them is somewhat questionable. One recapture was reported 4 nmi west of the release point indicating movement back into the lower Laguna Madre from the release point near the Gulf of Mexico. This shrimp was free only one day and no growth was expected. The other returned shrimp was reportedly captured off Port Aransas four days after release, 85 nmi to the north.

Two tags from Port Mansfield that had been washed ashore were recovered on Padre Island on 20 June 1978 in a beach survey; one was found near Bob Hall Pier and the other 2 nmi south of Malaquite Beach, 60-65 nmi north of the release point. It is possible that prevailing currents during this time moved northward along the coast carrying emigrating brown shrimp with them.

Rockport Tagging - June and July 1978

Tagging operations at Rockport, Texas in June and July were similar in design. Shrimp were captured in Aransas Bay and transported to the Rockport Marine Laboratory for tagging. Tagged shrimp were then transferred to the research vessel Western Gulf and released at night either in the Gulf of Mexico in an area approximately one mile off the Port Aransas Beach or between the Aransas Pass jetties.

June Tagging 1978: In 10 days 28,646 shrimp were tagged; 27,313 were released (Table 6). The number of tagged shrimp released each day ranged from 1158 to 3693. Tagging mortalities before release ranged from 1.8 to 9.6% and totaled 4.7% for the operation.

As of 30 September 1978 only one shrimp had been returned from the June tagging. This individual was free 16 days and was recaptured 32 nmi south-southeast of the release area (Table 3). It had grown 4 mm.

On 16 June 1978-one day after the end of tagging — students at the University of Texas Marine Science Institute recovered 50 tags from the shore of San Jose Island which lies immediately to the north of the release areas. In addition, approximately 200-300 tags were reported in clumps of seaweed about 2 nmi north of the jetties. Tag recovery teams were immediately sent to survey the Gulf beaches in the Port Aransas area. They recovered the following:

June 16	133 tags	15 pieces of tags
June 17	141 tags	27 pieces of tags
June 19	130 tags	14 pieces of tags
June 20	59 tags	5 pieces of tags
June 21	251 tags	55 pieces of tags
June 22	5 tags	
June 26	4 tags	
TOTAL	723 tags	116 pieces of tags

Beach areas were surveyed until no more tags were found. The total number of tags and pieces represented 3.1% of the tagged shrimp released in June.

July Tagging 1978: During the 10-day period 11,973 shrimp were tagged; 10,977 were released (692-1377/day) (Table 7). Tagging mortalities ranged from 4.8 to 14.1% and totaled 8.3% during July. Fewer shrimp were released in July than in June because shrimp were less available and tagging fewer shrimp prevented overcrowding in the holding tanks.

By 30 September 1978 three shrimp from the July tagging were returned, a return rate of 0.03% (Table 2). Recapture data for the tagged shrimp are presented in Table 3. One shrimp had been free 30 days, grown 17 mm in tail length and was recaptured 21 nmi to the east of its release site. Another shrimp moved 9 nmi to the south in 26 days of freedom and grew 12 mm in tail length. The third shrimp was recaptured after 5 days and had moved 7 nmi before it was recaptured in the Intracoastal Waterway near Corpus Christi Bay.

During and after the tagging operation survey teams were sent to the beach areas around Port Aransas to look for tags that had been washed ashore. The results of these efforts were:

July 18	108 tags
July 22	179 tags
July 23	23 tags
TOTAL	355 tags

This represented 3.2% of the total number of tagged shrimp released in July.

Port Aransas Tagging - August and October 1978

Tagging operations off Port Aransas, Texas in August and October were designed to use the research vessel Western Gulf as a base for the capture, tagging and release of all shrimp. Tagging procedures on the vessel were the same as those used in Port Mansfield and Rockport but shrimp were released at depths of 10-14 fm with disposable release canisters described by Emiliani (1971).

August Tagging 1978: The total number of brown shrimp tagged was 2986; 2837 were released (Table 8). The number released each day ranged from 167 to 1163. After 2 days shrimp were less available and large numbers of crabs and trash fish hampered efforts to capture live shrimp. High winds and rough seas restricted tagging to 6 of the 10 days scheduled.

Tagging mortalities before release ranged from zero to 18.6% per day and totaled 5.0% (Table 8). The higher rate of mortality in the second week of tagging was attributed to the quality of shrimp tagged. Few shrimp could be located and those that were caught were mixed with large quantities of trash. In addition, high seas (5-7 ft) throughout the week caused physical damage to the shrimp in holding tanks and slowed the tagging process.

The offshore tagging in August was more successful than the inshore tagging. By 30 September 1978, 170 shrimp were returned, a return rate of 5.99% (Table 2). Recapture data for the returned shrimp are presented in Table 4.

October Tagging 1978: During the 10-day period 1586 shrimp were tagged; 1496 were released (187-322/day) (Table 9). Daily tagging mortalities ranged from zero to 27.2% and totaled 5.7%.

Live shrimp were scarce so the capture area was increased north to Pass Cavallo and farther south of Port Aransas. Rough seas and trash fish also hampered collection.

The October tagging is included in this segment report only to complete the release information for the Texas coast in 1978. Recapture data after 30 September 1978 is not included.

B. BIOLOGICAL DATA

Only the offshore tagging in August had enough tags returned by the end of the first segment for a preliminary analysis of data. The following sections pertain to the 170 returns from the August study.

Sex and Size

Of the 170 shrimp returned, 27 (15.9%) were males and 143 (84.1%) were females (Table 4). A random sample of about 700 (25%) of the shrimp released in August included 34.2% males and 65.8% females. Length-frequency data on a subsample of 158 released shrimp shows a size difference between sexes (Figure 2). Larger shrimp are preferred in offshore tagging which may partly explain the high ratio of females in the released group. Nevertheless, a higher percentage of females were returned than was originally released suggesting either better survival of female shrimp or, more likely, better survival of larger shrimp. Evidence for the latter hypothesis can be seen in Figure 2 where length-frequency data for the 164 recaptured shrimp that could be measured shows higher percentages of larger males and females were recovered than were originally released.

Movement

The percentage of recaptured shrimp moving in 8 compass directions is shown in Figure 3. Movement was predominantly to the east and south with slightly less movement northeast and southeast; almost 75.8% of the shrimp moved in these 4 directions.

Over 71% of the shrimp were recaptured ≤ 10 nmi from their release point; 69 (40.6%) of the 170 shrimp recaptured were taken within 3-5 nmi (Figure 4). The longest movement of any recaptured shrimp was 145 nmi; this shrimp was reportedly caught 14 miles south of Galveston 22 days after release. Another tagged shrimp recaptured south of Freeport had traveled 82 nmi in 28 days.

One group of 13 tagged shrimp released off Port Aransas was recovered 9 days later near the Matagorda Ship Channel - a distance of 56 nmi. It is possible that some tagged shrimp move at similar rates in the same direction for several days.

Most long-distance shrimp returns moved northeast; 19 of the 21 tagged shrimp recaptured over 20 nmi from the release area moved northeast along the central Texas coast (Table 4). The other two shrimp moved south 66 and 40 nmi, respectively.

Days Free

The largest group of returns (38.8%) came during the first 2 days after release; 66.5% of all recaptured shrimp were caught within 7 days (Figure 5). As of 30 September 1978 (43 days after the final release) the longest time free for a returned shrimp from the August study was 41 days.

Growth

Changes in tail length of individual recaptured shrimp are reported in Tables 3 and 4. The accuracy range of measurements was approximately ± 3 mm. Therefore, small changes in length (either positive or negative) are probably the result of inaccurate measurements during the tagging process or various preservation methods used on the recovered shrimp. The lists have not been edited to determine obvious errors in the reported data which may explain some of the larger negative changes.

Table 10 gives mean tail lengths and tail weights of brown shrimp recaptured in successive 2-week periods after their release. Mean tail length increased 7 mm the second 2-week period and 5 more millimeters the third period. Mean tail weights averaged 8.9, 10.8 and 12.9 g, respectively, in the three 2-week periods following the study. The equivalent number per pound (count) showed a gradual decrease when the returns were divided into 2-week periods.

JOB 2 PENAEID SHRIMP SAMPLING

OBJECTIVES

To monitor juvenile and adult penaeid shrimp for growth, movement and abundance for management purposes.

MATERIALS AND METHODS

Project documents established a monitoring program similar to that conducted in Gulf Research Project 2-276-R. Samples were to be taken along transects off the central Texas coast in the Port Aransas and Pass Cavallo areas. Stations were selected to conform with existing or proposed regulations with special attention to critical zones where additional information is needed to manage shrimp resources effectively.

Brown shrimp samples at night were originally scheduled monthly from May through August along two transects - one each off Port Aransas and Pass Cavallo. One transect off Port Aransas was to be monitored in September and October. This plan was later amended to eliminate shrimp monitoring samples off Pass Cavallo and increase sampling off Port Aransas by an equal amount. The amendment decreased the time lost due to travel and poor weather during the summer and led to increased tagging and longlining efforts. This change also allowed shrimp populations off Port Aransas to be monitored biweekly instead of monthly.

Samples were taken from the 6-10, 11-15, 16-20 and 21-25 fathom zone in each transect. At least two additional samples off Port Aransas (6-10 and 11-15 fm zones) were planned during the brown shrimp emigration in May, June and July to obtain additional data in critical areas.

Six white shrimp samples (daylight trawls) were scheduled within the 15 fm contour each month. Stations were to be located in 3-5, 6-10 and 11-15 fm zones off Port Aransas and Pass Cavallo. This schedule was followed from October 1977 through March 1978. The documents were later amended to eliminate the Pass Cavallo area and add samples off Port Aransas. During November-January two additional samples in each area were scheduled to monitor emigrating white shrimp.

Samples were taken with 13.7 m wide otter trawls with 51 mm stretched mesh. If ≤ 50 shrimp were captured the entire sample was weighed to the nearest 10 g and total lengths measured. A subsample of shrimp was weighed and measured in catches of > 50 shrimp; total catch was calculated from the sub-samples. Bottom water temperatures and salinities were taken with each sample (Tables 11 - 14).

RESULTS AND DISCUSSION

Brown shrimp

The smallest shrimp during the June-August emigration period came from the 6-10 fm zone in June which corresponded to the start of the closed season in Texas waters (Table 15). Shrimp were about three times more numerous at 6-10 fm in June (average 3372/h) than they were in May (1262/h) or July (1112/h). In general the number of shrimp caught per hour decreased and the mean size increased with depth in May and June.

By July brown shrimp were most numerous at 11-15 fm with average count sizes of ≥ 49 heads-on shrimp per pound. Shrimp were larger in the 16-20 and 21-25 fm zones where samples of brown shrimp approached or exceeded the legal count size of 39.

The number caught per hour in August and September was much lower than in July in all depth zones. All brown shrimp samples were above legal count except for those taken inside of 7 fm, an area which remains closed at night throughout the year to protect small shrimp.

A previous project (2-276-R) monitored penaeid shrimp populations and evaluated certain Texas shrimp laws. One recommendation from that study was to provide flexibility in closing and opening the season based on current shrimp sampling. Count size seems to be the most likely standard to use for this purpose but care must be taken to define the methods used in determining count size adequately so that no conflicting conclusions can be made. For example, count size could be figured for a single species (Table 15) or for a mixture of all the species caught (Table 16).

During May-September the count sizes of mixed shrimp beyond 10 fm (Table 16) were identical to brown shrimp counts (Table 15) because almost no other species was caught. However, the count size at 6-10 fm changed in almost every sampling period by the inclusion of all species. Because of the large number of small brown shrimp, the addition of the larger white shrimp into the count size did not reduce the estimate to legal size; however, the count did approach the legal limit (39-count) in the first sampling period in August.

The shrimp monitoring program is proving useful in our management-related activities. While preparing information for the committee reviewing the Draft Shrimp Management Plan for the Gulf of Mexico Fishery Management Council in 1978, the need was seen for information on count sizes off the Texas coast. The brown shrimp monitoring program started in August 1975, provided this data and made it possible to test the effect of averaging the catch rates in different depth zone combinations during the emigration period (Table 17). This information might eventually be used to develop a monitoring strategy to determine when the season should be closed and opened.

White shrimp

The white shrimp monitoring program (daytime shrimp trawls) was also reworked this year to provide new data from separate areas along the central Texas coast. Transects were made within the 15 fm contour off Port Aransas and Pass Cavallo during the winter white shrimp emigration period (Table 18). November count sizes in the two areas were almost the same in each depth zone. Approximately 50% more white shrimp were caught off Pass Cavallo in the 3-5 and 11-15 fm zones while the Port Aransas catch was 80% higher at 6-10 fm.

In December white shrimp averaged 12-16 mm smaller off Pass Cavallo at 3-5 and 6-10 fm and were about the same size as those off Port Aransas at 11-15 fm (Table 18). White shrimp were most abundant at 3-5 fm off Port Aransas and 6-10 fm off Pass Cavallo in December. The 6-10 fm zone off Pass Cavallo had over 10 times more white shrimp by number and 6.5 times more shrimp by weight than the Port Aransas area in December.

The counts for mixed shrimp (Table 19) were very close to those for white shrimp (Table 18) from October through March since white shrimp formed over 80% of the catch during this period. Small brown shrimp began appearing in the day trawls in May and were the major species caught during the summer months.

JOB 3 FINFISH ASSESSMENT

OBJECTIVES

To assess and evaluate the commercial potential of finfish stocks off the central Texas coast.

MATERIALS AND METHODS

Project documents required that bottom longline samples be taken off the central Texas coast in February and March 1978. Additional sets were to be made in April if cruise time could be scheduled around the annual vessel haulout. Amendments during the project year added September to the sampling schedule to provide seasonal information.

Samples were taken from 3 to 107 fm off the central Texas coast. Preliminary bottom longline sets were made in December 1977 and January 1978 to test the available gear; project samples were taken in February, March and April 1978. Additional transects were made in June (unscheduled) and in September (scheduled) providing preliminary data in two quarters of the year that were not originally scheduled and providing a base for the second year of sampling in which bottom longline samples will be taken each quarter.

A diagram of the bottom longline is given in Figure 6. The longline was deployed from the stern or the side of the research vessel Western Gulf. Although the gear could be operated from the side of the vessel using the main winch head, it was much easier and safer to operate off the stern using a smaller winch mounted in the middle of the rear deck. Using this winch the groundline could be wound onto the drum and did not have to be hand-coiled into tubs. Commercially-made longline pullers would probably make the retrieval process even easier.

Brummel hooks were used whenever possible to secure lines so that buoy lines, anchors, groundline sections, etc. could be attached or removed easily. Using Brummel hooks the bottom longline with 100-150 hooks could be deployed in 7-10 minutes. Hooks were prebaited and hung around the edge of wash tubs or garbage cans to prevent tangling.

The procedure used for setting and retrieving bottom longlines involved three main phases:

1. Pre-set preparation.
 - a. Prepare bait (fresh or frozen fishes, squid, crabs or mantis shrimp) for hooks.
 - b. Select and untangle groundlines and buoy lines necessary for the sample.
 - c. Lay out anchors and buoys for setting operation.
 - d. Bait hooks and hang on garbage cans or wash tubs.

2. Setting operation.

- a. Select sample site and establish direction of set.
- b. Release first buoy with buoy line.
- c. Attach no. 1 anchor to buoy line and to groundline.
- d. Attach baited hooks with longline snaps as groundline is played out from winch drum or wash tubs.
- e. Attach no. 2 anchor between end of groundline and buoy line.
- f. Release buoy line attached to flag buoy and catch buoy.

3. Retrieval operation

- a. Hook catch buoy and pull aboard vessel.
- b. Grab pole buoy and attach buoy line to winch or winch head.
- c. Pull buoy line onto winch drum or coil into wash tub.
- d. Remove no. 2 anchor and hook buoy line to groundline.
- e. Continue pulling groundline while one man removes gangions and another hangs hooks on garbage cans or wash tubs.
- f. At end of groundline remove no. 1 anchor and hook groundline to buoy line.
- g. Continue pulling buoy line until no. 1 buoy is secured on board.

While it was possible to set and retrieve the bottom longline with only three men on the vessel, four men are preferred. This allowed one man to remain in the wheelhouse to control speed and direction of the vessel — which was especially important in heavy seas — and to assist the three men on the rear deck if necessary.

In setting the longline one man controlled the speed of the line being released from the winch or wash tubs. Another man handed the prebaited gangions to the third man who snapped them into place at regular intervals on the groundline.

The retrieval operation was the reverse of the setting operation with one man controlling the groundline speed, one man removing gangions from the mainline and handing them to the third man who placed fish in one area of the deck and hooks without fish on the garbage cans or wash tubs.

RESULTS

The data from 34 bottom longline samples taken between December 1977 and September 1978 are presented in Table 20. Bottom temperatures ranged from 11.0 to 29.2 C and bottom salinities ranged from 31.6 to 38.3 o/oo. Numbers of individual fish collected per sample ranged from zero (4 samples) to 42 fish.

The greatest catch by number (42 fish) was taken at 26 fm off Port Aransas on 9 March 1978 (Table 20). The sample included 36 Atlantic sharpnose sharks (Rhizoprionodon terraenovae), 2 red snapper (Lutjanus campechanus), 2 Florida smoothhound (Mustelus norrisi), one great hammerhead (Sphyrna mokarran) and one Warsaw grouper (Epinephelus nigritus). Individual total lengths ranged from 660 mm (Warsaw grouper) to 1900 mm (great hammerhead). Individual weights in the sample ranged from 2.7 kg (Atlantic sharpnose shark) to 29.5 kg (great hammerhead). This 100-hook sample had a soak time of 2.5 h resulting in catch rates of 16.8 fish per 100 hook-h and 82.03 kg per 100 hook-h.

Two other samples in March 1978 had even higher catch rates per 100 hook-h. On 28 March, 20 Atlantic sharpnose sharks weighing 81.99 kg were taken from 28 fm during 100 hook-h fishing (Table 20). The best catch rate of the year consisted of 22 Atlantic sharpnose sharks and one scalloped hammerhead (Sphyrna lewini) from 35 fm on March 28 and yielded 88.0 kg per 100 hook-h.

A list of the species caught with the bottom longline is presented in Table 21. Atlantic sharpnose shark was the most abundant species making up 67.1% of the total fish. Sea catfish (Arius felis) (5.9%) and red drum (Sciaenops ocellata) (3.8%) were the next most abundant species by number.

Atlantic sharpnose shark appeared in 58.8% of the samples (Table 21). Other species taken in more than 10% of the samples included red drum, sea catfish, scalloped hammerhead, banded shrimp eel (Ophichthus sp.) and spinner shark (Carcharhinus maculipinnis).

The ranges and mean sizes of the species caught are given in Table 21. Some of the more important sport and commercial fishes were red drum, 950-1030 mm TL; black drum (Pogonias cromis), 750-910 mm; red snapper, 708-815 mm; and Warsaw grouper, 660-1150 mm. The size range for the Atlantic sharpnose sharks was 750-1157 mm TL with a mean size of 939 mm.

On the bottom longline 200 lb monofilament gangions were used so that large sharks could break off without destroying the rest of the gear. The groundline was never cut in half by sharks and was only partially chewed once. The largest sharks measured in the study were a 1990-mm TL great hammerhead (29.5 kg), a 1905-mm scalloped hammerhead (7.3 kg) and a 1675-mm spinner shark (45.4 kg).

Figures 7 and 8 show the catch rates of the bottom longline for the depth zones that were sampled each season. The general patterns in each figure are similar except for the depth zone greater than 100 fm in the spring when 6.0 fish/100 hook-h equaled a total weight of only 2.01 kg/100 hook-h.

Of the depth zones sampled the 3-10 fm area had the highest average number of fish and the highest mean weight of fish in the winter, summer and fall quarters (Figures 7 and 8). In the spring when the majority of the sampling was scheduled the greatest catch rates were in the 31-40, 21-30 and 41-50 fm areas. Atlantic sharpnose sharks comprised 85% of the fish caught in these areas.

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Table 1. Brown shrimp (Penaeus aztecus) tagging operations along the Texas coast in 1978.

Dates	Area	Tag Series	No. Tagged	No. Released
May 78 16-21	Port Mansfield	118,001 - 122,000 orange	3982	3870
June 78 6-15	Rockport	122,001 - 130,000 97,201 - 118,000 orange	28,646	27,313
July 78 11-20	Rockport	94,001 - 97,200 130,001 - 136,000 orange 00201 - 03000 black	11,973	10,977
August 78 8-18	Port Aransas (offshore)	03001 - 06000 black	2986	2837
October 78 10-20	Port Aransas (offshore)	06001 - 07600 black	1586	1496
	1978 Totals		49,173	46,493

Table 2. Preliminary totals of shrimp tags returned by 30 September 1978 from 1978 brown shrimp (Penaeus aztecus) tagging studies in Texas.

Month	Area	Released	Returned	% Returned
May 78	Port Mansfield	3870	2	0.05
June 78	Rockport	27,313	1	<0.01
July 78	Rockport	10,977	3	0.03
August 78	Port Aransas (offshore)	2837	170	5.99
	TOTALS	44,997	176	0.39

Table 3. Preliminary recapture data from 1978 inshore tagging studies of brown shrimp (Penaeus aztecus) in Texas.

ID No.	Tag. No.	Sex	Direction of movement	Nautical miles traveled	Days free	Change in tail length (mm)
<u>Port Mansfield - May 78</u>						
167	118,877	M	270°	4	1	-*
168	119,323	F	05°	85	4	-
<u>Rockport - June 78</u>						
166	124,759	F	160°	32	16	4
<u>Rockport - July 78</u>						
77	131,819	F	85°	21	30	17
162	131,543	F	175°	9	26	12
165	94,225	F	270°	7	5	0

* no data

Table 4. Preliminary recapture data for brown shrimp (Penaeus aztecus) tagged with black streamer tags and released off Port Aransas, Texas (9 August - 18 August 1978).

ID No.	Tag. No.	Sex	Direction of movement	Nautical miles traveled	Days free	Change in tail length (mm)
1	04605	F	160°	4	1	-2
2	04290	F	160°	4	1	4
3	04422	M	160°	4	1	1
4	03079	F	95°	13	9	8
5	03682	M	100°	4	13	1
6	05649	F	100°	4	5	-2
7	03684	F	100°	4	13	0
8	03051	F	100°	4	13	4
9	03350	F	100°	4	13	5
10	03706	F	100°	4	13	4
11	03621	F	185°	4	2	0
12	03763	F	185°	4	2	5
13	03930	M	185°	4	2	-3
14	03055	F	185°	4	2	-1
15	03895	F	185°	4	2	2
16	03750	F	185°	4	2	2
17	03674	F	185°	4	2	-4
18	03492	F	185°	4	2	2
19	03755	F	185°	4	2	1
20	03666	M	185°	4	2	3
21	03946	F	185°	4	2	2
22	04160	F	100°	3	9	1
23	05651	F	100°	3	1	-*
24	03610	F	100°	3	13	1
25	03468	F	210°	11	14	-1
26	05062	F	180°	6	2	-3
27	03238	F	180°	6	3	-1
28	04526	F	110°	6	3	1
29	04343	M	110°	6	3	1
30	04603	F	110°	6	3	1
31	05136	F	110°	6	3	-1
32	04726	F	110°	6	3	-1
33	04548	M	110°	6	3	-8
34	04446	F	110°	6	3	0
35	04901	F	110°	6	3	-
36	05941	F	170°	16	7	2
37	03774	F	50°	56	9	4
38	04018	F	50°	56	9	3
39	03651	F	50°	56	9	25
40	03592	F	50°	56	9	7
41	03232	F	50°	56	9	1

* no data

Table 4 . (Cont'd.)

ID No.	Tag No.	Sex	Direction of movement	Nautical miles traveled	Days free	Change in tail length (mm)
42	03389	F	50°	56	9	-1
43	03471	F	50°	56	9	1
44	03926	F	50°	56	9	3
45	03239	F	50°	56	9	10
46	03640	F	50°	56	9	-1
47	04189	F	50°	56	9	5
48	03634	M	50°	56	9	5
49	04088	F	50°	56	9	0
50	05380	F	05°	5	13	3
51	04693	F	105°	3	3	2
52	04712	F	105°	3	3	-1
53	04609	F	105°	3	3	0
54	04656	F	105°	3	3	-3
55	04821	F	105°	3	3	0
56	04225	M	105°	3	3	-2
57	03855	F	160°	17	17	6
58	03560	M	120°	5	27	3
59	03770	F	110°	11	0	1
60	03015	F	55°	82	28	7
61	03944	F	60°	16	29	10
62	04718	F	315°	3	26	0
63	04486	F	135°	3	27	11
64	05536	F	45°	145	22	-1
65	05118	M	60°	11	40	-
66	04754	F	165°	6	4	4
67	03226	F	205°	5	3	-3
68	05205	F	205°	5	0	-1
69	03457	F	205°	5	3	1
70	05171	M	165°	6	4	1
71	03345	F	205°	13	9	0
72	03431	F	175°	5	4	2
73	05804	M	185°	66	32	8
74	03023	F	65°	16	40	4
75	05338	F	65°	8	-	-
76	04822	F	190°	18	36	13
78	03929	F	130°	1	0	2
79	03319	M	130°	1	0	2
80	04162	F	130°	1	0	-3
81	03948	F	130°	1	0	3
82	04569	F	95°	5	1	9
83	04577	F	130°	7	4	0
84	03344	F	130°	1	0	6
85	03861	M	140°	4	2	3
86	03529	F	140°	4	2	-1
87	04103	F	205°	5	0	0
88	03448	F	-	-	-	3

- no data

Table 4. (Cont'd.)

ID No.	Tag No.	Sex	Direction of movement	Nautical miles traveled	Days free	Change in tail length (mm)
89	04652	F	140°	10	3	0
90	04141	F	140°	4	2	4
91	04316	F	120°	9	2	-8
92	03712	F	220°	4	0	2
93	03947	F	220°	4	0	1
94	03902	F	140°	4	2	2
95	04313	F	205°	17	4	-1
96	03747	F	20°	4	-	-1
97	03105	F	220°	4	0	6
98	04773	M	250°	4	4	0
99	03919	F	220°	4	0	-9
100	04045	F	155°	6	1	-8
101	03934	F	155°	6	1	-16
102	03941	F	155°	6	1	1
103	03048	F	195°	2	6	-1
104	03053	F	195°	2	6	0
105	03585	F	195°	2	6	4
106	03664	F	195°	2	6	5
107	03758	F	195°	2	6	-8
108	04156	F	195°	2	6	0
109	03268	F	195°	2	6	2
110	05019	F	45°	23	4	1
111	05305	F	140°	10	3	10
112	03375	F	195°	40	1	-2
113	04604	F	140°	8	12	-
114	04832	M	130°	3	2	0
115	05026	F	130°	3	2	0
116	03517	F	80°	1	0	0
117	03076	M	80°	1	0	0
118	03004	F	80°	1	0	-2
119	03097	F	80°	1	0	-2
120	03022	M	80°	1	0	0
121	03283	M	80°	1	0	-3
122	03072	F	80°	1	0	0
123	03850	F	80°	1	0	-1
124	03279	F	75°	12	6	-2
125	03236	F	355°	3	2	2
126	03695	F	355°	3	2	0
127	03694	F	355°	3	2	0
128	04066	F	355°	3	2	-2
129	03537	M	355°	3	2	-3
130	03301	F	355°	3	2	-1
131	03776	F	355°	3	2	1
132	03215	F	355°	3	2	-9
133	03741	F	355°	3	2	2

- no data

Table 4. (Cont'd.)

ID No.	Tag No.	Sex	Direction of movement	Nautical miles traveled	Days free	Change in tail length (mm)
134	03235	F	355°	3	2	2
135	04067	F	355°	3	2	1
136	03288	M	355°	3	2	-1
137	03545	F	355°	3	2	-2
138	03799	F	230°	2	1	1
139	03573	M	230°	2	1	0
140	04938	M	230°	2	0	1
141	04239	F	230°	2	0	-4
142	03966	F	230°	2	1	3
143	04494	M	115°	4	9	1
144	05405	M	115°	4	8	1
145	04368	F	115°	4	9	-2
146	04888	F	115°	4	9	-
147	04032	F	80°	5	5	1
148	04472	F	100°	10	9	-
149	03282	F	100°	10	10	-
150	03083	M	190°	13	5	3
151	03361	F	190°	13	5	-
152	04062	F	190°	13	5	2
153	04724	F	190°	13	4	3
154	04851	F	190°	13	4	3
155	03221	F	185°	14	4	4
156	05201	F	05°	18	15	3
157	05399	F	55°	21	4	7
158	05442	F	55°	21	4	3
159	05529	F	55°	21	4	1
160	05874	F	335°	3	6	-8
161	05944	F	30°	13	8	7
163	04710	M	-	-	-	9
164	04753	F	-	-	19	-
169	03248	F	115°	6	41	12
170	04642	F	175°	2	27	9
171	05473	F	175°	16	35	12
172	05786	F	70°	7	20	8
173	03002	F	-	-	28	1
174	04768	F	-	-	-	6
175	05773	F	-	-	-	-
176	05122	F	145°	9	6	10

- no data

Table 5.

Texas Shrimp Tagging Operation No. 1
 Port Mansfield, Texas
 May 16-21, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>Not Released</u>	<u>% Not Released</u>	<u>No. Released</u>
5-18-78	118,001 - 119,300	1293	65	5.0	1228
5-19-78	119,301 - 120,200	899	14	1.6	885
5-21-78	120,201 - 122,000	1790	33	1.8	1757
	Final Totals	3982	112	2.8	3870

Table 6.
Texas Shrimp Tagging Operation No. 2
Rockport, Texas
June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>Not Released</u>	<u>% Not Released</u>	<u>No. Released</u>
6-6-78	122,001 - 124,200	2186	45	2.1	2141
6-7-78	124,201 - 127,000	2782	107	3.8	2675
6-8-78	127,001 - 130,000	2985	125	4.2	2860
6-9-78	112,001 - 115,000	2979	66	2.2	2913
6-10-78	115,001 - 118,000 111,401 - 112,000	3571	343	9.6	3228
6-11-78	107,401 - 111,400	3977	284	7.1	3693
6-12-78	104,001 - 107,400	3388	184	5.4	3204
6-13-78	101,201 - 104,000	2565	85	3.3	2480
6-14-78	98,401 - 101,600	3015	54	1.8	2961
6-15-78	97,201 - 98,400	1198	40	3.3	1158
Final Totals (10 days)		28,646	1333	4.7	27,313

Table 7.

Texas Shrimp Tagging Operation No. 3
 Rockport, Texas
 July 11-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>Not Released</u>	<u>% Not Released</u>	<u>No. Released</u>
7-11-78	94,001 - 95,400	1396	92	6.6	1304
7-12-78	95,401 - 96,800	1399	67	4.8	1332
7-13-78	96,801 - 97,200 130,001 - 131,000	1396	82	5.9	1314
7-14-78	131,001 - 132,200	1199	106	8.8	1093
7-15-78	132,201 - 133,200	992	62	6.2	930
7-16-78	133,201 - 134,200	997	94	9.4	903
7-17-78	134,201 - 135,200	999	83	8.3	916
7-18-78	135,201 - 136,000	1198	78	6.5	1120
	Black Tags: 000,201 - 000,600				
7-19-78	000,601 - 002,200	1598	225	14.1	1373
7-20-78	002,201 - 003,000	799	107	13.4	692
	Final Totals (10 days)	11,973	996	8.3	10,977

Table 8.
 Texas Shrimp Tagging Operation No. 4
 Port Aransas, Texas (OFFSHORE)
 August 8-18, 1978

<u>Date</u>	<u>Tag Series</u> (Black tags)	<u>No. Tagged</u>	<u>Not Released</u>	<u>% Not Released</u>	<u>No. Released</u>
8-9-78	03001-04200	1193	30	2.5	1163
8-10-78	04201-05200	998	35	3.5	963
8-11-78	05201-05389	188	0	-	188
8-16-78	05390-05600	210	39	18.6	171
8-17-78	05601-05792	189	22	11.6	167
8-18-78	05793-06000	208	23	11.1	185
Final Totals		2986	149	5.0	2837

Table 9.
 Texas Shrimp Tagging Operation No. 5
 Port Aransas, Texas (OFFSHORE)
 October 10-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>Not Released</u>	<u>% Not Released</u>	<u>No. Released</u>
	(Black tags)				
10-12-78	06001-06271	261	12	4.6	249
10-13-78	06272-06600	327	5	1.5	322
10-17-78	06601-06857	257	70	27.2	187
10-19-78	06858-07138	280	2	0.7	278
10-19-78	07139-07400	261	0	—	261
10-20-78	07401-07600	200	1	0.5	199
	Final Totals	1586	90	5.7	1496

Table 10. Mean lengths and weights of tagged brown shrimp (*Penaeus aztecus*) recaptured during successive two-week periods of the Port Aransas offshore tagging study, August 1978 (sexes combined).

Number of Days Free	Number Recaptured	Mean Tail Length (mm)	Range Tail Length (mm)	Mean Tail Weight (g)	Range Tail Weight (g)	Equivalent No./1b (Tails)
0 - 14	146	70	50 - 89	8.9	3.2 - 19.9	51
15 - 28	11	77	67 - 87	10.8	6.1 - 18.0	42
29 - 42	7	82	72 - 95	12.9	6.7 - 21.0	35

Table 11. Average bottom water temperatures ($^{\circ}$ C) at day shrimp trawl stations by depth zone and month (October 1977 - September 1978).

Depth Zone (fm)	October		November		December		January		February		March	
	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC
3-5	28.5	23.7	20.7	19.0	19.9	17.7	10.0	10.0	8.8	9.9	12.6	13.4
6-10	27.7	23.5	21.5	19.5	20.0	18.0			0.9	10.2	13.2	13.9
11-15	28.5	25.0	23.2	20.4	21.1	21.1			11.0	11.1	14.4	14.2
3-5	April		May		June		July		Aug		Sept	
	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2
3-5	No samples scheduled		28.4		28.2	27.8	28.0	28.5	30.0	31.0	29.8	26.8
6-10			26.7		27.6	26.0	25.4	26.0	28.8	28.5	29.2	27.2
11-15			22.7		22.8	25.6	23.3	27.0	28.5	28.0	29.2	27.2

PA - Port Arkansas
PC - Pass Cavallo

Table 12. Average bottom water temperatures ($^{\circ}\text{C}$) at night shrimp trawl stations by depth zone and month (October 1977-September 1978).

Depth Zone (fm)	October		November		December		January		February		March	
	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC
6-10	27.5	23.5	19.6	18.9	20.0	18.7			9.2	9.8	12.9	13.7
11-15	27.5											
16-20	27.5											
21-25	26.5											
6-10	April		May		June		July		Aug		Sept	
	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2
	No samples scheduled		26.4		24.3	27.2	27.0		29.2	28.8	27.0	
11-15			21.6		22.0	25.4	23.2	23.7	27.8	26.0	27.7	
16-20			21.2		28.6	22.8	23.0	24.2	27.0		27.8	
21-25			21.7		20.4	22.3	22.0	27.0	25.5		27.8	

PA - Port Aransas
PC - Pass Cavallo

Table 13. Average bottom water salinity (o/oo) at day shrimp trawl stations by depth zone and month (October 1977 - September 1978).

Depth Zone (fm)	October		November		December		January		February		March	
	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC
3-5	37.2	33.3	34.4	30.0	33.3	28.9	28.9	28.9	27.2	26.6	31.6	30.0
6-10	38.8	32.8	35.0	31.4	33.3	31.6	31.6	31.6	28.9	27.8	35.0	33.3
11-15	37.2	36.6	35.0	32.5	33.9	33.9	33.9	33.9	32.2	33.3	35.5	36.6
Depth Zone (fm)	April		May		June		July		Aug		Sept	
	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2
3-5	No samples scheduled		32.2	35.5	34.4	35.5	36.6	37.7	37.8	37.6	35.0	27.8
6-10			33.7	38.9	34.4	38.9	37.2	38.8	37.8	36.1	36.1	27.8
11-15			36.1	37.2	36.6	37.2	37.8	37.7	36.6	37.2	35.0	28.9

PA - Port Aransas
PC - Pass Cavallo

Table 14. Average bottom water salinity ($^{\circ}\text{C}$) at night shrimp trawl stations by depth zone and month (October 1977 - September 1978).

Depth Zone (fm)	October		November		December		January		February		March	
	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC
6-10	38.3	32.2	32.2	30.0	33.3	30.0			26.6	27.2	31.6	30.0
11-15	37.2											
16-20	38.8											
21-25	38.8											
6-10	April		May		June		July		Aug		Sept	
	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2
	No samples scheduled		32.8		34.4	34.7	36.6		37.7	36.6	27.2	
11-15			35.0		36.3	35.5	37.2	37.4	37.2	36.1	33.3	
16-20			35.5		36.6	36.6	37.7	37.7	36.6		33.3	
21-25			38.9		36.6	35.5	36.1	37.1	36.6		34.4	

PA - Port Aransas
PC - Pass Cavallo

Table 15. Brown shrimp (Penaeus aztecus) from night shrimp trawls off the central Texas coast (October 1977 - September 1978).

Depth Zone	Oct	Nov	Dec	Jan	Feb	Mar	Apr
<u>6-10 fm</u>							
Range	59-	65-					
TL (mm)	119	101					
Mean	87	81					
No/h	13	73	0		0	0	
Kg/h	0.12	0.30					
Count *	49	110					
No. samples	2	2	2	0	2	2	0
<u>11-15 fm</u>							
Range	77-						
TL (mm)	164						
Mean	113						
No/h	120						
Kg/h	1.52						
Count	36						
No. samples	1	0	0	0	0	0	0
<u>16-20 fm</u>							
Range	85-						
TL (mm)	177						
Mean	145						
No/h	126						
Kg/h	3.82						
Count	15						
No. samples	1	0	0	0	0	0	0
<u>21-25 fm</u>							
Range	100-						
TL (mm)	178						
Mean	158						
No/h	222						
Kg/h	7.70						
Count	13						
No. samples	1	0	0	0	0	0	0

* Heads-on shrimp per pound

Table 15. (Cont'd.)

Depth Zone	May	June 1	June 2	July 1	July 2	Aug 1	Aug 2	Sept
<u>6-10 fm</u>								
Range	66-	66-	71-	71-		75-	64-	86-
TL (mm)	120	132	136	160		135	141	105
Mean	92	88	89	97		103	96	97
No/h	1262	3826	2918	1112		204	224	36
Kg/h	8.48	22.32	17.4	8.96		1.92	1.82	0.36
Count *	68	78	76	56		48	56	45
No. samples	2	2	2	2	0	1	1	1
<u>11-15 fm</u>								
Range	81-	57-	71-	78-	74-	84-	96-	78-
TL (mm)	156	165	143	158	161	157	158	150
Mean	99	100	98	100	96	116	122	112
No/h	1472	2200	2590	4540	3428	408	588	224
Kg/h	12.04	20.12	22.52	42.43	28.54	6.08	9.22	3.20
Count	55	50	52	49	54	30	29	32
No. samples	2	2	2	2	2	1	1	1
<u>16-20 fm</u>								
Range	93-	82-	75-	82-	84-	88-		112-
TL (mm)	149	163	132	147	161	158		163
Mean	110	102	109	107	110	115		142
No/h	44	146	1804	1028	1224	236		24
Kg/h	0.56	1.28	20.92	11.76	13.44	3.24		0.88
Count	36	52	39	40	41	33		12
No. samples	1	1	1	1	1	1	0	1
<u>21-25 fm</u>								
Range	110-	87-	70-	98-	76-	105-		115-
TL (mm)	175	176	140	153	153	170		160
Mean	146	115	108	116	113	120		140
No/h	34	70	1672	1728	1072	636		52
Kg/h	1.02	1.06	19.08	22.80	13.52	10.01		1.40
Count	15	30	40	34	36	29		17
No. samples	1	1	1	1	1	1	0	1

* Heads-on shrimp per pound

Table 16. Mixed shrimp (Penaeus sp.) from night shrimp trawls off the central Texas coast (October 1977 - September 1978).

Depth Zone	Oct	Nov	Dec	Jan	Feb	Mar	Apr
<u>6-10 fm</u>							
Range	59-	65-	75-		73-	77-	
TL (mm)	155	181	140		113	143	
Mean	106	109	106		93	110	
No/h	113	1391	409		58	214	
Kg/h	1.06	15.38	3.90		0.41	2.18	
Count *	48	41	48		64	44	
No. samples	2	2	2	0	2	2	0
Species	B,P,W	B,P,W	P,W		W	P,W	
<u>11-15 fm</u>							
Range	77-						
TL (mm)	170						
Mean	123						
No/h	168						
Kg/h	2.84						
Count	27						
No. samples	1	0	0	0	0	0	0
Species	B,P,W						
<u>16-20 fm</u>							
Range	85-						
TL (mm)	177						
Mean	145						
No/h	128						
Kg/h	3.86						
Count	15						
No. samples	1	0	0	0	0	0	0
Species	B,W						
<u>21-25 fm</u>							
Range	90-						
TL (mm)	178						
Mean	156						
No/h	228						
Kg/h	7.76						
Count	13						
No. samples	1	0	0	0	0	0	0
Species	B,P						

* Heads-on shrimp per pound

Table 16. (Cont'd.)

Depth Zone	May	June 1	June 2	July 1	July 2	Aug 1	Aug 2	Sept
<u>6-10 fm</u>								
Range	66-	66-	71-	71-		75-	64-	50-
TL (mm)	194	192	202	197		172	141	158
Mean	95	89	92	99		106	96	87
No/h	1332	3882	3036	1152		220	224	232
Kg/h	10.98	24.32	22.64	10.77		2.46	1.82	1.80
Count *	55	72	61	49		41	56	58
No. samples	2	2	2	2	0	1	1	1
Species	B,P,W	B,P,W	B,P,W	B,P,W		B,P,W	B	B,P,W
<u>11-15 fm</u>								
Range	81-	57-	71-	78-	74-	84-	96-	78-
TL (mm)	156	165	143	158	161	157	158	150
Mean	99	100	98	100	96	116	122	112
No/h	1472	2200	2594	4540	3428	408	588	232
Kg/h	12.04	20.12	22.62	42.43	28.54	6.08	9.22	3.32
Count	55	50	52	49	54	30	29	32
No. samples	2	2	2	2	2	1	1	1
Species	B	B	B,P	B	B	B	B	B,P
<u>16-20 fm</u>								
Range	93-	82-	75-	82-	84-	88-		112-
TL (mm)	149	163	132	147	161	158		163
Mean	110	102	109	107	110	115		142
No/h	44	146	1804	1028	1224	236		24
Kg/h	0.56	1.28	20.92	11.76	13.44	3.24		0.88
Count	36	52	39	40	41	33		12
No. samples	1	1	1	1	1	1	0	1
Species	B	B	B	B	B	B		B
<u>21-25 fm</u>								
Range	110-	87-	70-	98-	76-	105-		115-
TL (mm)	175	176	140	153	153	170		160
Mean	146	115	108	116	113	120		140
No/h	34	70	1672	1728	1072	636		52
Kg/h	1.02	1.06	19.08	22.80	13.52	10.01		1.40
Count	15	30	40	34	36	29		17
No. samples	1	1	1	1	1	1	0	1
Species	B	B	B	B	B	B		B

* Heads-on shrimp per pound

Table 17. Average brown shrimp (*Penaeus aztecus*) catches in different combinations of depth zones off the central Texas coast during May-August period in 1975-1978. (Each five fathom depth zone was given equal weight in computations.)

Depth Zone	May		June		July		August		
	76	77	76	77	76	77	76	77	
<u>6-25 fm</u>									
No/h	798	496	1368	1249	1903	2214	2167	1906	861
Kg/h	5.14	3.84	11.12	12.20	15.59	23.55	25.74	18.80	10.42
Count	70	59	56	46	55	43	38	46	37
No. samples	14	14	17	15	12	15	16	10	8
<u>6-20 fm</u>									
No/h	1050	615	1756	1603	2247	2543	2036	2074	1080
Kg/h	6.38	4.21	13.89	14.96	17.43	26.01	23.06	19.01	12.11
Count	75	66	57	49	58	44	40	49	40
No. samples	11	11	14	12	10	12	13	8	6
<u>11-25 fm</u>									
No/h	249	346	1689	1280	1414	2228	2074	2170	674
Kg/h	2.76	3.57	13.81	13.23	14.16	24.76	25.05	22.08	10.94
Count	41	44	55	44	45	41	38	45	28
No. samples	9	10	10	10	8	11	11	8	6
<u>11-20 fm</u>									
No/h	352	450	2432	1828	1685	2730	1830	2555	910
Kg/h	3.42	3.98	19.29	17.90	16.21	29.04	20.68	24.04	13.75
Count	47	51	57	46	47	43	40	48	30
No. samples	6	7	7	7	6	8	8	6	4

* No 6-10 fm samples included

Table 18. White shrimp (*Penaeus setiferus*) from day shrimp trawls off the central Texas coast (October 1977 - September 1978).

	October		November		December		January		February		March	
	PA	PC	PA	PC	PA	PC	PA	PC	PS	PC	PA	PC
<u>3-5 fm</u>												
Range	107-		99-	94-	93-	86-	68-		79-	67-	78-	115-
TL (mm)	161		159	150	148	127	106		102	113	113	147
Mean	139		126	123	118	106	85		94	90	95	127
No/h	10	0	374	584	728	336	26		20	136	774	64
Kg/h	0.14		5.90	9.24	8.74	2.48	0.15		0.13	0.72	4.80	1.08
Count *	32		29	29	38	61	79		70	86	73	27
No. samples	1	1	1	1	1	1	1	0	1	1	1	1
<u>6-10 fm</u>												
Range	112-	90-	72-	95-	100-	89			82-	88-	97-	98-
TL (mm)	170	211	163	180	170	136			124	128	149	146
Mean	137	146	131	125	132	116			100	109	119	127
No/h	64	64	506	281	111	1170			308	338	109	30
Kg/h	1.66	1.78	8.92	4.57	2.16	14.06			2.28	3.92	1.37	0.40
Count	17	16	26	28	23	38			61	39	36	34
No. samples	1	1	2	2	2	1	0	0	1	1	2	1
<u>11-15 fm</u>												
Range	135-		120-	120-	114-	113-			98-	97-	119	121-
TL (mm)	178		179	188	175	178			135	140	146	162
Mean	147		149	152	142	143			118	122	132	142
No/h	60	0	66	100	186	88			276	318	28	4
Kg/h	1.86		1.76	2.93	4.00	1.92			3.55	4.64	0.50	0.08
Count	15		17	15	21	21			35	31	25	23
No. samples	1	1	2	2	1	1	0	0	1	1	1	1

* Heads-on shrimp per pound PA - Port Aransas PC - Pass Cavallo

Table 18. (Cont'd.)

	April		May		June		July		August		September	
	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2
<u>3-5 fm</u>												
Range	No samples scheduled											
TL (mm)					179-				80-	127-	153-	82-
Mean					189				196	196	158	184
No/h					184				139	161	156	151
Kg/h			0		0	16	0	0	16	20	4	138
Count *					0.60				0.59	0.78	0.12	4.04
No. samples	1		1		12	1	1	1	12	12	15	15
<u>6-10 fm</u>												
Range												
TL (mm)	146-				152-							123-
Mean	180				172				181			195
No/h	166				166				181			155
Kg/h	7		0		44	0	0	0	4	0	0	208
Count	0.24				1.88				0.16			6.40
No. samples	13		1		11	11	1	1	1	1	1	15
<u>11-15 fm</u>												
Range												
TL (mm)					173-							
Mean					173							
No/h			0		4	0	0	0	0	0	0	0
Kg/h					0.28							
Count					6							
No. samples	1		1		1	1	1	1	1	1	1	1

* Heads-on shrimp per pound PA - Port Aransas

Table 19. Mixed shrimp (*Penaeus* sp.) from day shrimp trawls off the central Texas coast (October 1977 - September 1978).

	October		November		December		January		February		March	
	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC	PA	PC
<u>3-5 fm</u>												
Range	88-		73-	84-	73-	80-	68-	79-	67-	70-	115-	
TL (mm)	161		159	150	148	127	106	102	113	113	147	
Mean	130		117	121	116	106	85	94	90	94	127	
No/h	12	0	486	626	814	348	28	20	136	780	64	
Kg/h	0.16		6.50	9.62	9.56	2.60	0.17	0.13	0.72	4.84	1.08	
Count *	34		34	30	39	61	72	70	86	73	27	
No. samples	1	1	1	1	1	1	1	1	1	1	1	1
Species	W,B		W,B,P	W,P	W,P	W,P	W,P	W	W	W,P	W	
<u>6-10 fm</u>												
Range	73-		66-	89-	73-	89-	82-	88-	88-	91-	98-	
TL (mm)	170		163	180	170	136	124	128	128	149	146	
Mean	128		120	123	127	116	100	109	109	119	127	
No/h	82	94	705	297	142	1174	312	342	342	113	30	
Kg/h	1.80	2.12	10.14	4.70	2.60	14.10	2.31	3.96	3.96	1.42	0.40	
Count	21	20	32	29	25	38	61	39	39	36	34	
No. samples	1	1	2	2	2	1	1	1	1	2	1	
Species	W,B	W,B	W,B,P	W,B,P	W,B,P	W,P	W,P	W,P	W,P	W,P	W	
<u>11-15 fm</u>												
Range	72-		78-	90-	89-	85-	98-	97-	97-	119-	121-	
TL (mm)	178	169	179	188	175	178	164	140	140	146	162	
Mean	120	124	142	138	141	139	119	122	122	132	142	
No/h	296	118	77	218	198	138	288	318	318	28	4	
Kg/h	4.50	1.86	1.86	4.88	4.14	2.78	3.82	4.64	4.64	0.50	0.08	
Count	30	29	19	20	22	23	34	31	31	25	23	
No. samples	1	1	2	2	1	1	1	1	1	1	1	
Species	W,B	B	W,B	W,B,P	W,B,P	W,B,P	W,P	W,P	W	W	W	

* Heads-on shrimp per pound PA - Port Aransas PC - Pass Cavallo

Table 19. (Cont'd.)

	April		May		June		July		August		September	
	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2	PA-1	PA-2
<u>3-5 fm</u>												
Range	No samples		89-	65-					80-	78-	153-	82-
TL (mm)	scheduled		125	189					196	196	158	184
Mean			109	93					126	118	156	145
No/h			16	156	0	0	0	0	62	72	4	154
Kg/h			0.16	1.28					1.51	1.34	0.12	4.16
Count *			45	55					19	24	15	17
No. samples	1		1	1	1	1	1	1	1	1	1	1
Species			B	W,B					W,B,P	W,B	W	W,B,P
<u>6-10 fm</u>												
Range			74-	73-	78-	98-			80-	80-	65-	
TL (mm)			141	172	181	170			192	145	195	
Mean			97	95	106	120			109	107	134	
No/h			384	2036	152	48			136	84	322	0
Kg/h			284	16.80	1.56	0.53			1.58	0.96	7.48	
Count			61	55	44	41			39	40	20	
No. samples	3		1	1	1	1			1	1	1	1
Species	W,B		B	W,B,P	W,B	B			B,P	B	W,B,P	
<u>11-15 fm</u>												
Range			78-	76-	82-	87-			120-	116-	72-	99-
TL (mm)			101	173	137	114			120	116	158	120
Mean			89	93	101	100			120	116	113	110
No/h			788	224	4840	48			4	4	86	20
Kg/h			4.26	1.76	41.08	0.48			0.04	0.04	1.10	0.30
Count			84	58	53	45			45	45	35	30
No. samples	1		1	1	1	1			1	1	1	1
Species	B		B	W,B	B	B			B	B	B	B

* Heads-on shrimp per pound PA - Port Aransas

Table 20. Bottom longline samples off the central Texas coast December 1977 - September 1978.

Date	Area	Depth (fm)	Bait	Bottom water °C	Bottom water o/oo	Species (*)	Range TL (mm)	Mean	No/100 hook-h	Kg/100 hook-h
<u>Dec 77</u> 14	PC	10	Mixed fish	18.9	31.6	Red drum (1) Atl sharpnose shark (3)	-	-	6.7	-
<u>Jan 78</u> 22	PA	10	Squid, fish	12.0	32.2	Red drum (1)	-	1020	3.7	36.96
<u>Feb 78</u> 14	PA	12	Squid, fish & mantis shrimp	11.0	32.2	Black drum (1)	-	910	0.5	6.77
27	PA	10	Squid, fish	13.5	32.2	No catch	-	-	-	-
<u>Mar 78</u> 9	PA	26	Squid, fish & mantis shrimp	16.5	35.5	Red snapper (2) Warsaw grouper (1) Atl sharpnose (36) Fla smoothhound (2) Great hammerhead (1)	795-815 - 870-1010 1190-1310 -	805 660 939 1245 1990	0.8 0.4 14.4 0.8 0.4	5.99 2.13 54.09 8.03 11.79
9	PA	38	Squid, fish & mantis shrimp	16.1	36.1	Bonnethead (1) Atl sharpnose (22) Fla smoothhound (1) Smooth dogfish (1) Scalloped hammerhead (3) Blacknose shark (1) Rock sea bass (1)	- 750-980 - - 810-1090 - -	650 846 865 860 915 1200 280	0.5 11.0 0.5 0.5 1.5 0.5 0.5	0.48 34.67 1.25 1.19 5.13 4.99 0.11

() = No. of fish caught

PA - Port Aransas

PC - Pass Cavallo

Table 20. (Cont'd.)

Date	Area	Depth (fm)	Bait	Bottom water OC	o/oo	Species (*)	Range TL (mm)	Mean	No/100 hook-h	Kg/100 hook-h
Mar 78 9	PA	42	Squid, fish & mantis shrimp	16.1	35.5	Scalloped hammer-head (1) Atl sharpnose (11) Banded shrimp eel (2) Rock sea bass (1)	- 750-950 1150-1260 -	1030 860 1205 345	0.7 7.3 1.3 0.7	3.36 20.00 3.36 0.23
10	PA	75	Squid, fish	16.4	36.1	Fla smoothhound (6) Wenchman (1) Cuban dogfish (1)	905-1320 - -	1088 245 450	3.0 0.5 0.5	16.90 0.11 0.21
10	PA	107	Squid, fish	16.4	36.1	Wenchman (1) Yellowedge grouper (1) Gulf hake (1) Spotted hake (1) Cuban dogfish (2)	- - - - 448-477	245 354 208 289 462	1.0 1.0 1.0 1.0 2.0	0.19 0.59 0.08 0.19 0.96
15	PA	7	Squid, fish	14.2	34.4	No catch	-			
15	PA	28	Squid, fish	16.8	37.8	Red snapper (2) Warsaw grouper (1) Atl sharpnose (6)	786-810 - 890-1020	798 1150 968	2.0 1.0 6.0	16.67 39.39 27.44
15	PA	30	Squid, fish	16.5	36.6	Red snapper (1) Shrimp eel (1) Atl sharpnose (6) Banded shrimp eel (1)	- - 872-980- -	708 510 941 1053	1.0 1.0 6.0 1.0	7.03 0.09 23.02 1.58
28	PA	12	Squid, fish	16.3	36.6	Atl sharpnose (1) Banded shrimp eel (1)	- -	1000 1120	1.0 1.0	5.13 2.03

() = No. of fish caught PA - Port Aransas

Table 20. (Cont'd.)

Date	Area	Depth (fm)	Bait	Bottom water °C	Bottom water o/oo	Species (*)	Range TL (mm)	Mean	No/100 hook-h	Kg/100 hook-h
Mar 78 28	PA	19	Squid, fish	16.8	38.3	Atl sharpnose (7) Spinner shark (1) Banded shrimp eel (1)	958-1156 - -	1010 786 1365	4.7 0.7 0.7	22.00 1.89 2.19
28	PA	28	Squid, fish	16.9	36.6	Atl sharpnose (20)	891-1010	958	20.0	81.99
28	PA	35	Squid, fish	17.6	37.8	Atl sharpnose (22) Scalloped hammer- head (1)	820-995 -	911 1160	22.0 1.0	80.74 7.26
29	PA	26	Squid, fish	16.9	37.2	Atl sharpnose (6)	899-1075	1004	6.0	31.52
29	PA	26	Squid, fish	16.9	37.2	Atl sharpnose (16) Spinner shark (1)	895-1065 -	971 1675	8.0 0.5	36.63 22.68
29	PA	22	Squid, fish	17.4	37.8	Atl sharpnose (7)	945-1065	990	7.0	35.38
29	PA	15	Squid, fish	16.5	36.6	Snapper eel (1)	-	558	1.0	0.11
29	PA	4	Squid, fish	18.3	32.8	Finetooth shark (1) Atl sharpnose (1) Sea catfish (1)	- - -	1445 990 360	1.0 1.0 1.0	17.01 4.76 0.45
30	PA	10	Squid, fish	17.3	33.9	Red drum (2) Atl sharpnose (3)	990-1030 970-1020	1010 995	0.8 1.2	9.25 5.22
Apr 78 13	PA	10	Squid	19.0	31.6	Red drum ^a (3) Black drum (2) Atl sharpnose (7) Gafftopsail catfish (4)	890-1030 750-750 905-990 510-590	997 750 954 551	1.0 0.7 2.4 1.4	11.57 4.77 10.28 2.74

() = No. of fish caught PA - Port Aransas a - Transported alive for spawning studies

Table 20. (Cont'd.)

Date	Area	Depth (fm)	Bait	Bottom water OC	o/oo	Species (*)	Range TL (mm)	Mean	No/100 hook-h	Kg/100 hook-h
<u>Apr 78</u> 14	PA	10	Squid	19.2	31.6	Red drum ^a (2) Crevalle jack (1) Atl sharpnose (9) Gafftopsail catfish (1) Sea catfish (4)	950-970 - 885-1010 - 317-420	960 914 970 539 352	0.7 0.3 3.1 0.3 1.4	6.57 2.97 12.79 0.63 0.59
14	PA	10	Squid	19.2	31.6	Red drum ^a (2) Black drum (1) Atl sharpnose (5) Scalloped hammerhead (1) Sea catfish (2)	950-1010 - 900-995 - 335-380	980 770 951 1905 358	0.7 0.3 1.7 0.3 0.7	7.04 2.50 6.96 2.50 0.55
<u>June 78</u> 28	PA	11	Blue crabs, mullet	26.8	36.6	No catch				
28	PA	10	Blue crabs, mullet	25.6	35.5	Atl sharpnose (5)	923-1135	1008	6.2	28.78
29	PA	21	Mullet	21.1	38.3	Atl sharpnose (1)	-	1000	0.8	3.02
29	PA	28	Squid, mantis shrimp	20.3	36.6	Silky shark (2)	1040-1090	1065	2.6	16.43
29	PA	31	Squid, mantis shrimp	19.8	37.6	No catch				
<u>Sep 78</u> 16	PA	6	Squid, mullet	29.0	36.6	Spinner shark (1) Finetooth shark (1) Sea catfish (4)	- - 284-345	1185 1460 302	0.5 0.5 2.0	5.39 8.45 0.59

() = No. of fish caught

PA = Port Aransas

a = Transported alive for spawning studies

Table 20. (Cont'd.)

Date	Area	Depth (fm)	Bait	Bottom water OC o/oo	Species (*)	Range TL(mm)	Mean	No/100 hook-h	Kg/100 hook-h
Sep 78 16	PA	10	Squid, mullet	28.9	36.6	-	1320	0.6	7.26
					Finetooth shark (1)				
					Sea catfish (5)	340-361	355	2.9	1.22 ^b
					Spinner shark (1)	-	-	0.6	12.96 ^b
					Unidentified sharks (2)	-	-	1.1	0.91 ^b
16	PA	3	Mullet, mantis shrimp, crabs	29.2	34.4	499-563	531	2.0	2.71
					Gafftopsail catfish (2)				
21	PA	16	Croaker, squid, Atl threadfin	28.8	36.6	-	1255	1.1	11.61
					Scalloped hammer- head (1)				

^aTransported alive for spawning studies -
estimated length and weight

^bEstimated weight

() = No. of fish caught PA - Port Aransas

Table 21. List of species taken on the bottom longline in order of their abundance by number from October 1977 through September 1978.

Rank by number	Scientific name	Common name	Total number	Frequency (N=34)	Range TL (mm)	Mean TL (mm)
1	<u>Rhizoprionodon terraenovae</u>	Atlantic sharpnose shark	194	20	750-1156	939
2	<u>Arius felis</u>	Sea catfish	17	6	284-420	341
3	<u>Sciaenops ocellata</u>	Red drum	11	6	150-1030	991
4	<u>Mustelus norrisi</u>	Florida smoothhound	9	3	865-1320	1099
5	<u>Sphyrna lewini</u>	Scalloped hammerhead	7	5	810-1905	1156
6	<u>Bagre marinus</u>	Gafftopsail catfish	7	3	499-590	544
7	<u>Lutjanus campechanus</u>	Red snapper	5	3	708-815	783
8	<u>Ophichthus sp.</u>	Banded shrimp eel	5	4	1053-1365	1190
9	<u>Carcharhinus maculipinnis</u>	Spinner shark	4	4	786-1675	1215
10	<u>Pogonias cromis</u>	Black drum	4	3	750-910	795
11	<u>Aprionodon isodon</u>	Finetooth shark	3	3	1320-1460	1408
12	<u>Squalus cubensis</u>	Cuban dogfish	3	2	448-477	458
13	<u>Epinephelus nigritus</u>	Warsaw grouper	2	2	660-1150	905
14	<u>Centropristis philadelphica</u>	Rock sea bass	2	2	280-345	312
15	<u>Pristipomoides aquilonaris</u>	Wenchmen	2	2	245-245	245
16	<u>Carcharhinus falciformis</u>	Silky shark	2	1	1040-1090	1065
17	<u>Sphyrna mokarran</u>	Great hammerhead	1	1	-	1990
18	<u>Carcharhinus acronotus</u>	Blacknose shark	1	1	-	1200
19	<u>Caranx hippos</u>	Crevalle jack	1	1	-	914
20	<u>Mustelus canis</u>	Smooth dogfish	1	1	-	860
21	<u>Sphyrna tiburo</u>	Bonnethead	1	1	-	650
22	<u>Mystriophis mordax</u>	Snapper eel	1	1	-	558
23	<u>Ophichthus gomesi</u>	Shrimp eel	1	1	-	510
24	<u>Epinephelus flavolimbatus</u>	Yellowedge grouper	1	1	-	354
25	<u>Urophycis regius</u>	Spotted hake	1	1	-	289
26	<u>Urophycis cirratus</u>	Gulf hake	1	1	-	208
27	Unidentified sharks		2	1	-	-
		Total	289			

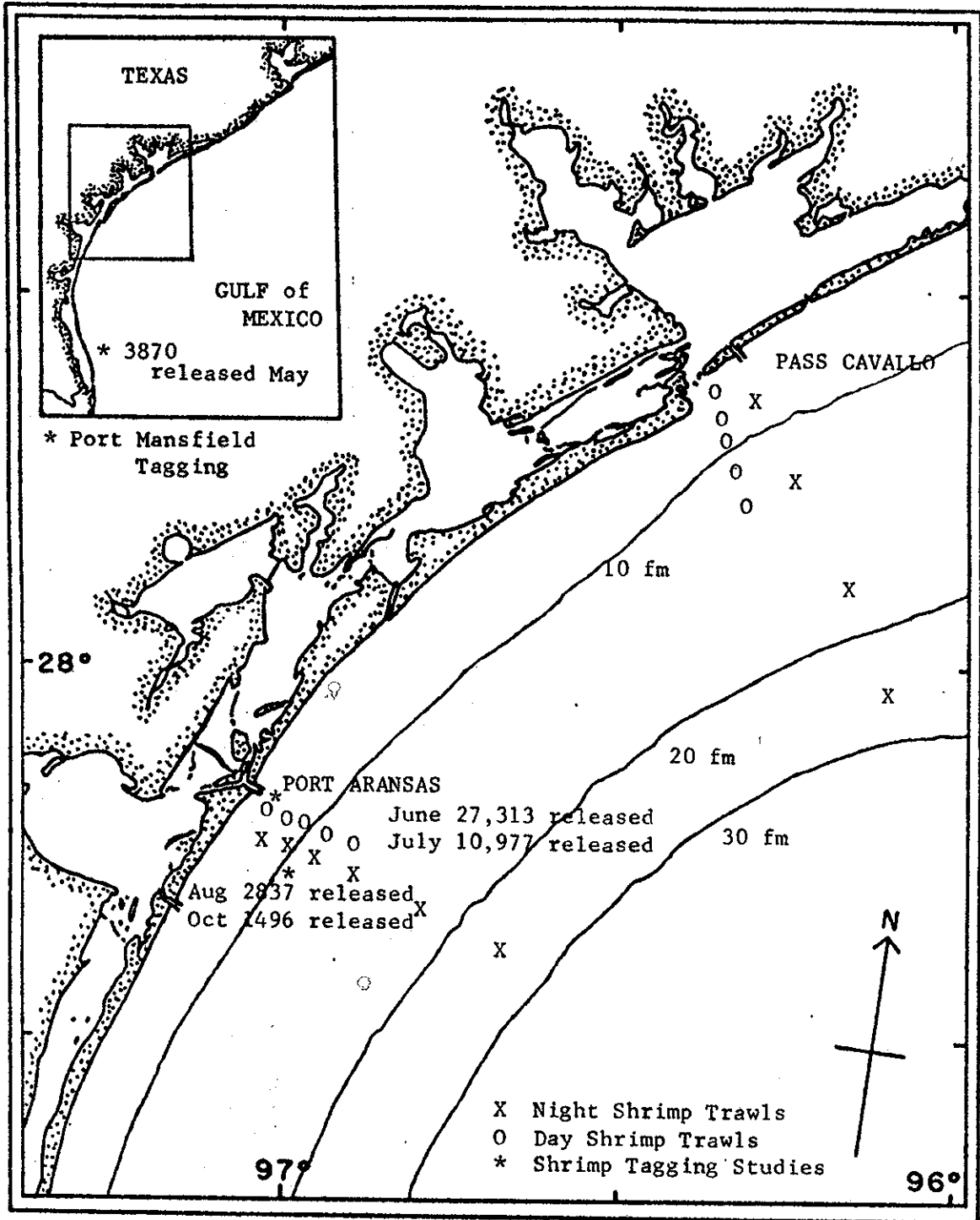


Figure 1. General sampling areas and release sites for shrimp tagging studies during the first project year.

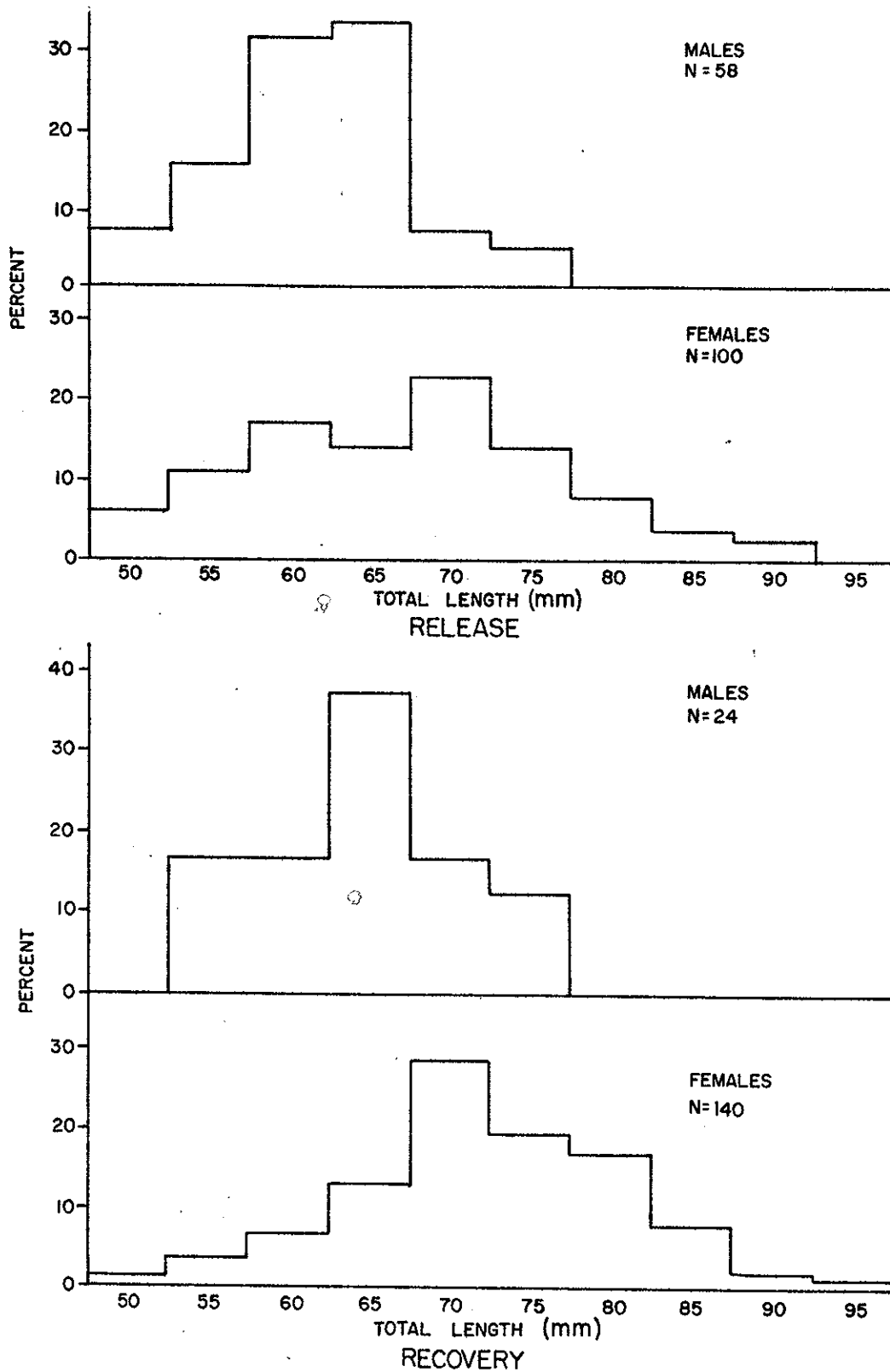


Figure 2. Length-frequency distributions of tagged brown shrimp (*Penaeus aztecus*) at release and recovery (August 1978 offshore study).

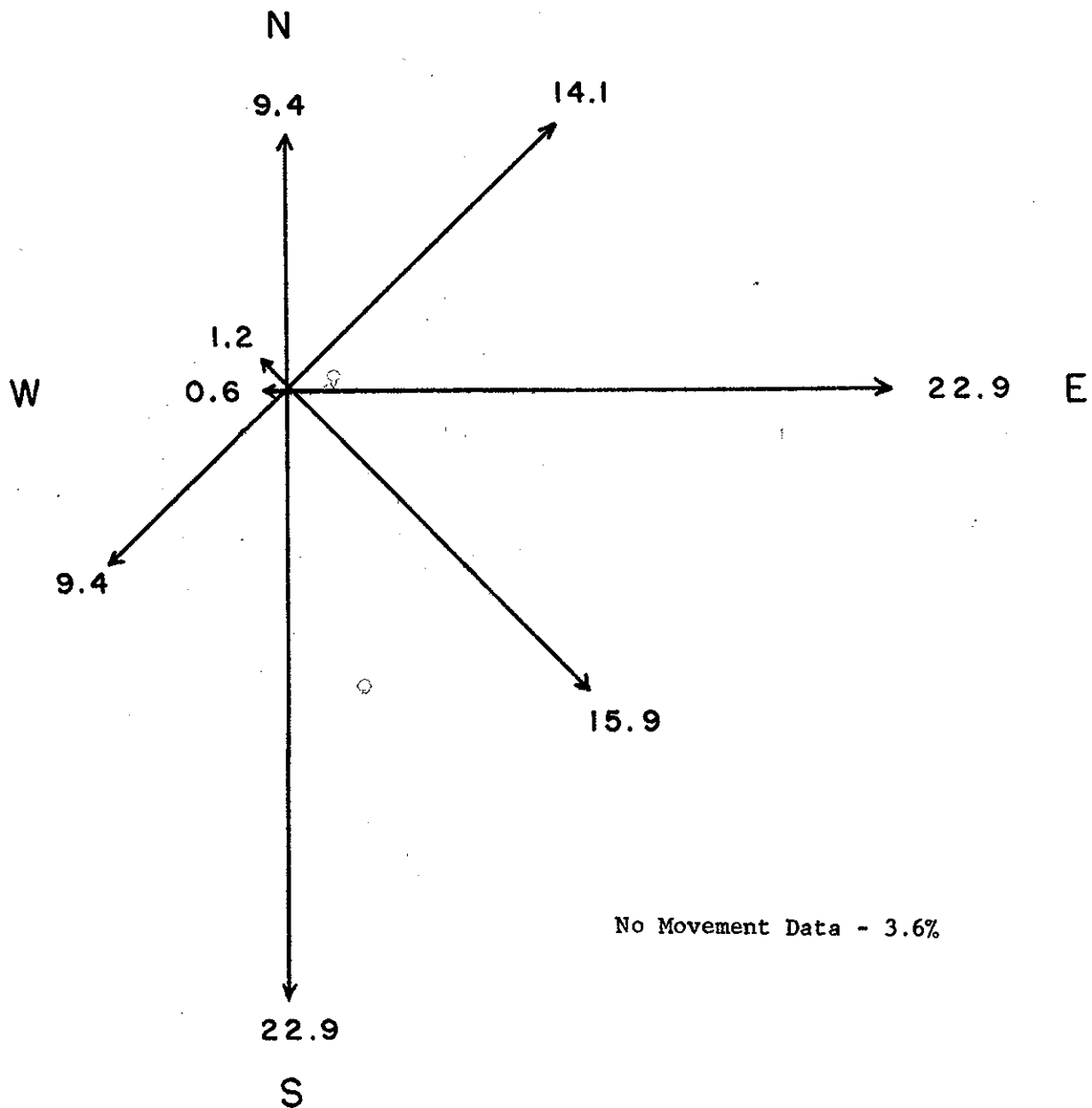


Figure 3. Percentage of recaptured brown shrimp (*Penaeus aztecus*) moving in 8 compass directions (August 1978 offshore study).

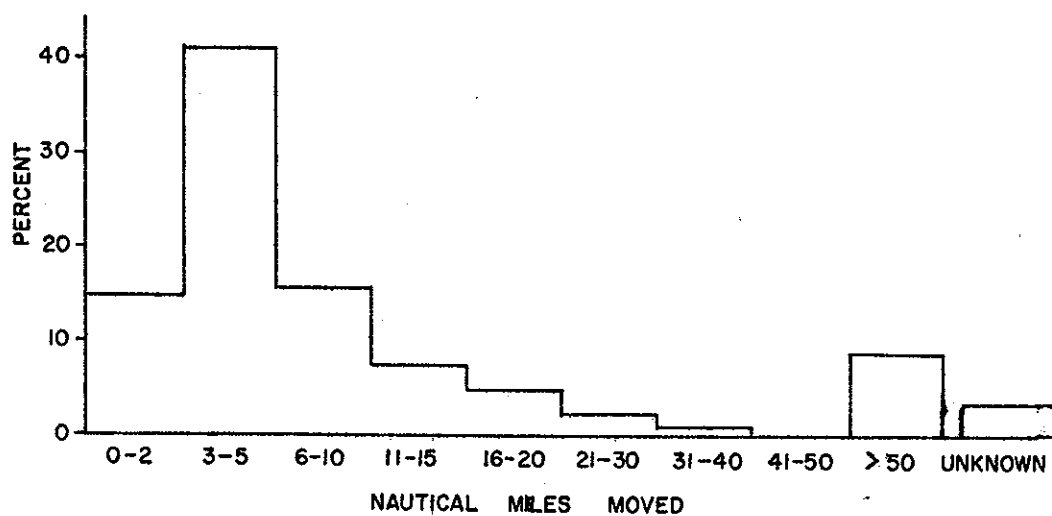


Figure 4. Distance moved by recaptured brown shrimp (Penaeus aztecus) (August 1978 offshore study).

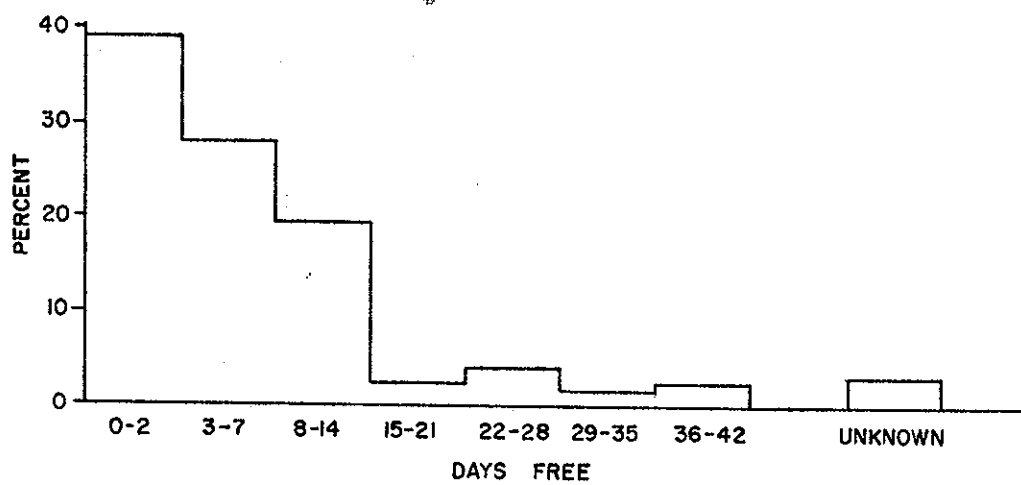
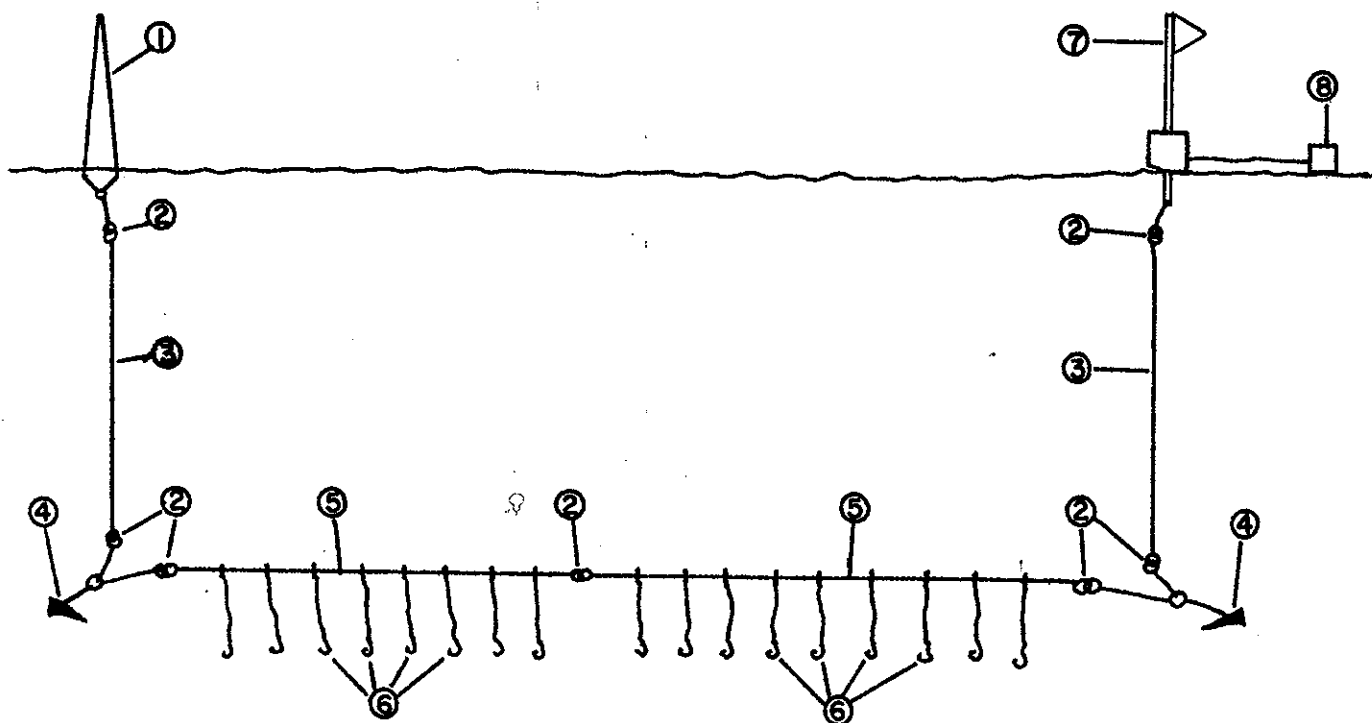


Figure 5. Time free by recaptured brown shrimp (Penaeus aztecus) (August 1978 offshore study).



1. Marker buoy
2. Brummel hooks
3. Buoy lines
4. Anchors - Navy type 20 or 30 lb
5. Groundline - Mittet #32 ($\frac{1}{2}$ inch nylon)
6. Gangions - 200# test monofilament line;
#9 Halibut snap with 6/0 swivel;
Circle tuna hooks #'s 4,5,6,7,8
7. Flag buoy
8. Catch buoy

Figure 6. Diagram of a bottom longline.

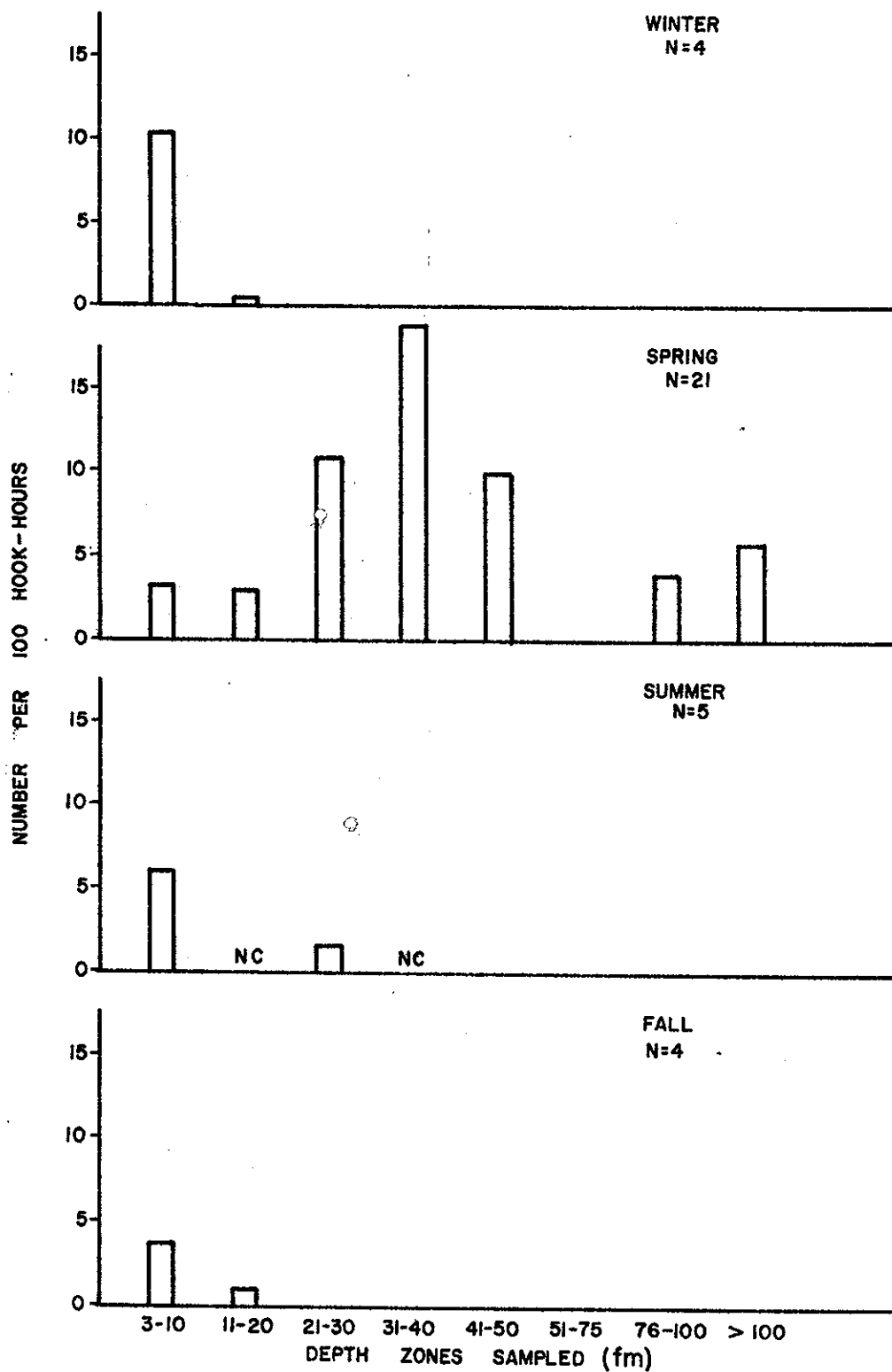


Figure 7. Seasonal catch rates by number for bottom longline samples off the central Texas coast (December 1977-September 1978).

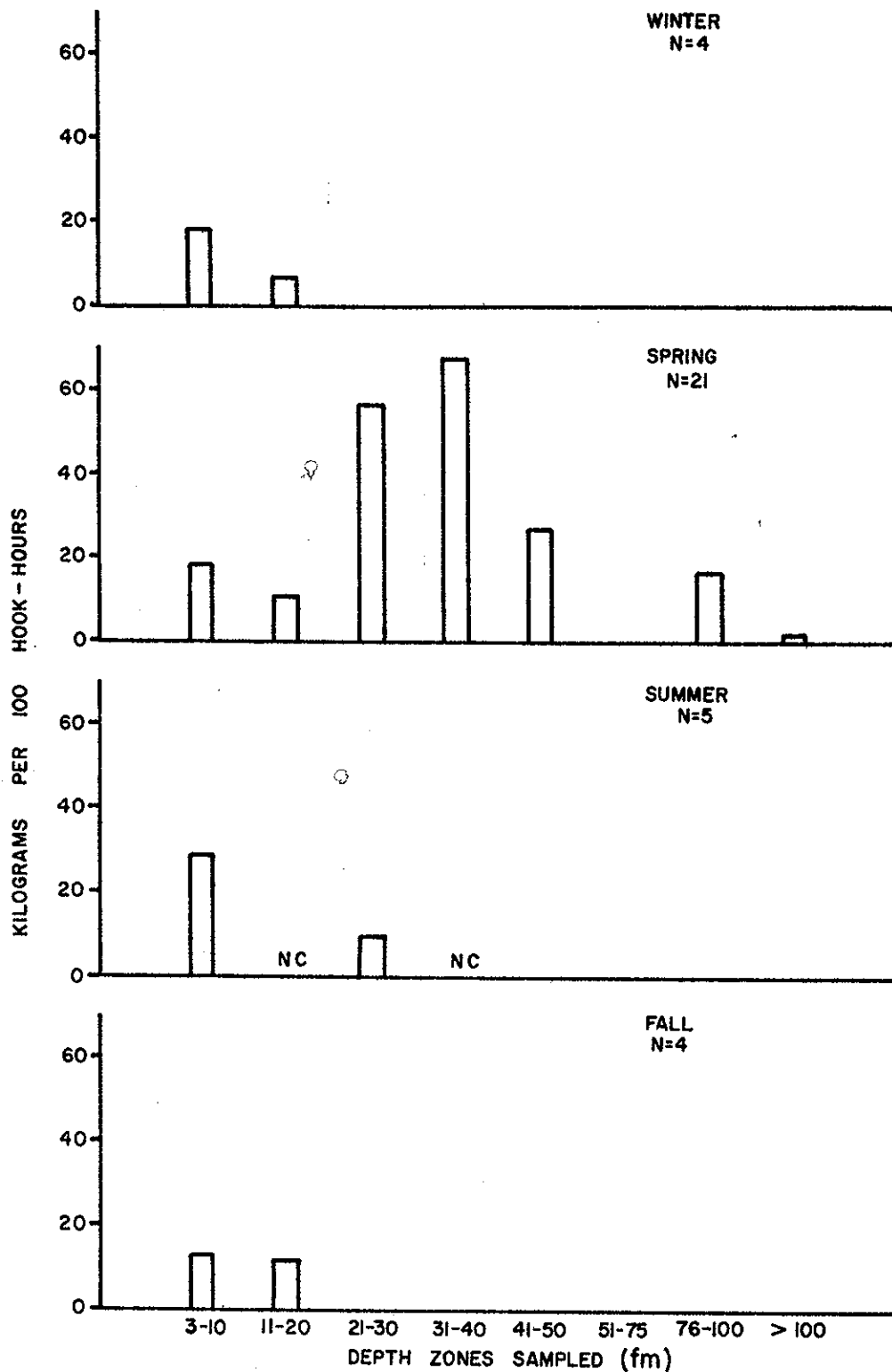


Figure 8. Seasonal catch rates by weight for bottom longline samples off the central Texas coast (December 1977-September 1978).

Texas Shrimp Tagging 1978

- Who? A cooperative study by Texas Parks and Wildlife Department, Texas A&M University, National Marine Fisheries Service and Instituto Nacional De Pesca of Mexico.
- What? Tagging of individual shrimp with orange, blue or black plastic streamers with words "NMFS 00623" etc.
- Why? To determine growth, movement and mortality, if possible, of brown shrimp stocks along the Texas coast.
- Where? & When?

		(Dates)	
May	—————>	Port Mansfield (16-21)	5 days
June	—————>	Port Aransas (6-16)	10 days
July	—————>	Port Aransas (11-21)	10 days
August	—————>	Offshore from Port Aransas South (7-17)	10 days
September	—————>	NMFS (Oregon II)	22 days off Mexico
October	—————>	Offshore from Port Aransas South (11-20)	10 days
- How? Shrimp will be caught in bays or Gulf and transported to a work area where they will be individually sexed, measured and weighed (when possible).

Shrimp will then be tagged with streamer tags - held for a period of time to assure their live release and released in areas that will offer best chance for survival.

Returns

Can be made to any state or federal biologist, statistician for NMFS, marine agent, etc. Commercial shrimp houses in the area will also have packets for tagged shrimp and return slips.

Information Needed

Date of Capture
 Location of Capture (including depth caught)
 Preserved shrimp so that accurate measurements can be taken
 Tag number and color
 Address, phone and name

Awards

Each tag that is returned with the needed information will be included into a computerized drawing, "a fishing contest", which periodically throughout the year will select four (4) winners.

First Prize	\$500.00
Second Prize	\$200.00
Third Prize	\$100.00
Fourth Prize	\$50.00

Several contests will be held during the year with all four (4) prizes awarded each time so it is advantageous to return tags early so that your name will be in more contests (names remain in the

contest pool for following contests).

Additional information and tag data sheets soon available (if not already) at all commercial shrimp dealers and hopefully bait dealers, etc.

Note: This program is being conducted in Louisiana, Texas and Mexico simultaneously to give biologists as good a picture as possible of shrimp stocks in the western Gulf of Mexico.

Appendix 1. (cont'd)

Agencies and Personnel cooperating in the return of tagged
shrimp in the Corpus Christi, Aransas Pass, and Rockport areas

National Marine Fisheries Service
Conn Brown Harbor
Aransas Pass, Tx. 78336 Phone: 758-3787

Statistical agents : Elise Dorman
Madeline Bailey Osburn
Mary McGee

TAMU Agricultural Research & Extension Center
P. O. Box FFF
Corpus Christi, Tx. 78406 Phone: 265-9201

Area Marine Fisheries Specialist : Russel J. Miget

Texas Agricultural Extension Service
Aransas County Courthouse
Rockport, Tx. 78382 Phone: 729-1211

County Extension Marine Agent: Jeff Messinger

Texas Parks & Wildlife Department
715 S. Bronte
Rockport, Tx. 78382 Phone: 729-2328

Terry J. Cody or any biologist for TPWD

Appendix 2. Daily summary of brown shrimp tagging data (May 1978).
 Texas Shrimp Tagging Operation No. 1
 Port Mansfield, Texas
 May 16-21, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
5-18-78	118,001 - 118,200	199		Total Tagged - 1293
	118,201 - 118,400	198		Total Dead at Release - 65
	118,401 - 118,600	198		Total Released - 1228
	118,601 - 118,800	200		Release Site: Marker #7
	118,801 - 119,000	200		Port Mansfield Channel (1.25 miles from end of jetties)
	119,001 - 119,200	198		Time: 1900
	119,201 - 119,300	100		Observations: Strong outgoing tide
	119,301 - 119,400	100		Total Tagged - 899
	119,401 - 119,600	200		Total Dead at Release - 14
	119,601 - 119,800	200		Total Released - 885
5-19-78	119,801 - 120,000	199		Release Site: Marker #7
	120,001 - 120,200	200		Port Mansfield Channel (1.25 miles from end of jetties)
				Time: 2015
				Observations: Strong outgoing tide
	120,201 - 120,400	199		Total Tagged - 1790
	120,401 - 120,600	199		Total Dead at Release - 33
	120,601 - 120,800	198		Total Released - 1757
	120,801 - 121,000	199		Release Site: Marker #7
	121,001 - 121,200	200		Port Mansfield Channel (1.25 miles from end of jetties)
	121,201 - 121,400	200		Time: 2000
5-21-78	121,401 - 121,600	198		Observations: Strong outgoing tide;
	121,601 - 121,800	198		day before full moon
	121,801 - 122,000	199		

Personnel :
 TPWD -

Terry J. Cody
 Ken W. Rice
 David McKee
 Domingo Perez, Jr.
 David Mejorado

 Dennis Emiliani
 Carl Jones

GRAND TOTALS - PORT MANSFIELD

Total Tagged - 3982
 Total Dead at Release - 112

Total Released - 3870

NMFS -

Appendix 3. Daily summary of brown shrimp tagging data (June 1978).

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-6-78	122,001 - 122,200	200		Total Tagged: 2186
	122,201 - 122,400	197		Total Dead at Release: 45
	122,401 - 122,600	200		Total Released: 2141
	122,601 - 122,800	200		Release Site: North side of Arkansas Pass
	122,801 - 123,000	198		(1.25 miles from end of jetties; 30-35
	123,001 - 123,200	195		ft. deep)
	123,201 - 123,400	200		Time: 2230
	123,401 - 123,600	196		Observations: Strong outgoing tide; day
	123,601 - 123,800	200		after new moon
	123,801 - 124,000	200		
	124,001 - 124,200	200		

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-7-78	124,201 - 124,400	199		Total Tagged: 2782 Total Dead at Release: 107 Total Released: 2675 Release Site: Gulf of Mexico - 0.5 miles SW of Marker #5 Aransas Pass; 1.1 miles off Port Aransas beach; 30 ft. deep Loran: 3H2-3987 3H3-2160 Time: 1930 Observations: Strong outgoing tide; 2 days past new moon Water Temperature: Surface 28.1 Bottom 27.9 Water Salinity: Surface 28.9 Bottom 28.9 Totals for Operation: Tagging Days: 2 Total Tagged: 4968 Total Released: 4816
	124,401 - 124,600	197		
	124,601 - 124,800	200		
	124,801 - 125,000	198		
	125,001 - 125,200	200		
	125,201 - 125,400	199		
	125,401 - 125,600	199		
	125,601 - 125,800	199		
	125,801 - 126,000	199		
	126,001 - 126,200	200		
	126,201 - 126,400	200		
	126,401 - 126,600	200		
	126,601 - 126,800	194		
	126,801 - 127,000	198		

Appendix 3 . (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-8-78	127,001 - 127,200	198		Total Tagged; 2985
	127,201 - 127,400	198		Total Not Released: 125
	127,401 - 127,600	197		Total Released: 2860
	127,601 - 127,800	199		Release Site: Gulf of Mexico - 0.4 miles
	127,801 - 128,000	200		SW of Marker #5 Aransas Pass; 0.9
	128,001 - 128,200	200		miles off Port Aransas Beach; 30 ft
	128,201 - 128,400	198		deep
	128,401 - 128,600	199		
	128,601 - 128,800	200		Loran: 3H2 - 3984
	128,801 - 129,000	200		3H3 - 2158
	129,001 - 129,200	200		
	129,201 - 129,400	196		Time: 1930
	129,401 - 129,600	200		Observations: Outgoing tide; 3 days past
	129,601 - 129,800	200		new moon
	129,801 - 130,000	200		
				Water temperature: Surface 29.7
				Bottom 26.4
				Water salinity: Surface 31.1
				Bottom 31.1
				Totals for Operation No. 2:
				Tagging Days: 3
				Total Tagged: 7953
				Total Released: 7676

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date:</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-9-78	112,001 - 112,200	199		Total Tagged: 2979
	112,201 - 112,400	198		Total Not Released: 66
	112,401 - 112,600	198		Total Released: 2913
	112,601 - 112,800	199		Release Site: Gulf of Mexico - 0.5 miles
	112,801 - 113,000	200		SW of Marker #5 Aransas Pass, 1.0 miles
	113,001 - 113,200	200		off Port Aransas Beach; 30 ft deep
	113,201 - 113,400	199		
	113,401 - 113,600	198		LORAN: 3H2 - 3987
	113,601 - 113,800	197		3H3 - 2156
	113,801 - 114,000	200		Time: 1930
	114,001 - 114,200	193		Observations: Outgoing tide; 4 days past
	114,201 - 114,400	200		new moon
	114,401 - 114,600	198		Water Temperature: Surface 29.0
	114,601 - 114,800	200		Bottom 28.5
	114,801 - 115,000	200		Water Salinity: Surface 33.3
				Bottom 33.3
Totals for Operation No. 2:				
				Tagging Days: 4
				Total Tagged: 10,932
				Total Released: 10,589

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

Date Tag Series No. Tagged No. Returns

6-10-78	115,001 - 115,200	196	
	115,201 - 115,400	200	
	115,401 - 115,600	195	
	115,601 - 115,800	200	
	115,801 - 116,000	197	
	116,001 - 116,200	200	
	116,201 - 116,400	198	
	116,401 - 116,600	200	
	116,601 - 116,800	198	
	116,801 - 117,000	200	
	117,001 - 117,200	198	
	117,201 - 117,400	200	
	117,401 - 117,600	200	
	117,601 - 117,800	200	
	117,801 - 118,000	195	

New series - descending order

111,801 - 112,000	200
111,601 - 111,800	196
111,401 - 111,600	198

Release Information

Total Tagged: 3571
 Total Not Released: 343
 Total Released: 3228
 Release site: Gulf of Mexico - 0.75 miles
 SW of Marker #5; 0.75 miles off
 Port Aransas Beach; 30 ft deep

○ LORAN: 3H2 - 3987
 3H3 - 2160

Time: 1945

Observations: Outgoing tide; water at
 release site clear; 3 days before
 First Quarter Moon; seagulls appeared
 in area after release, some shrimp
 evidently went to surface after
 release

Water Temperature: Surface 29.0
 Bottom 29.0

Water Salinity: Surface 30.5
 Bottom 30.5

Totals for Operation No. 2:

Tagging Days:	5
Total Tagged:	14,503
Total Released:	13,817

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
Rockport, Texas
June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-11-78	111,201 - 111,400	200		Total Tagged; 3977
	111,001 - 111,200	199		Total Not Released; 284
	110,801 - 111,000	200		Total Released; 3693
	110,601 - 110,800	198		Release Site: North side of Aransas Pass
	110,401 - 110,600	199		(1.25 miles from end of jetties;
	110,201 - 110,400	200		30-35 ft. deep; opposite UT-MSI)
	110,001 - 110,200	199		Time: 2100
	109,801 - 110,000	198		Observations; Very strong outgoing tide;
	109,601 - 109,800	198		2 days before 1st Quarter Moon
	109,401 - 109,600	199		
	109,201 - 109,400	200		
	109,001 - 109,200	194		
	108,801 - 109,000	200		
	108,601 - 108,800	197		Totals for Operation No. 2:
	108,401 - 108,600	200		Tagging Days: 6
	108,201 - 108,400	200		Total Tagged: 18,480
	108,001 - 108,200	200		Total Released: 17,510
	107,801 - 108,000	200		
	107,601 - 107,800	200		
	107,401 - 107,600	196		

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-12-78	107,201 - 107,400	200		Total Tagged: 3388
	107,001 - 107,200	200		Total Not Released: 184
	106,801 - 107,000	200		Total Released: 3204
	106,601 - 106,800	200		
	106,401 - 106,600	198		Release Site: Gulf of Mexico - 0.5 miles
	106,201 - 106,400	198		SW of Marker #5 Aransas Pass; 1.0
	106,001 - 106,200	200		miles off Port Aransas Beach; 30 ft.
	105,801 - 106,000	200		deep
	105,601 - 105,800	199		
	105,401 - 105,600	198		LORAN: 3H2 - 3987
105,201 - 105,400	200		3H3 - 2156	
105,001 - 105,200	200			
104,801 - 105,000	199		Time: 2215	
104,601 - 104,800	200		Observations: Outgoing tide; 1 day before	
104,401 - 104,600	199		1st Quarter Moon; seas moderately	
104,201 - 104,400	200		rough and release took longer than	
104,001 - 104,200	197		usual (1.5 hrs); seagulls in area	
			when we turned on lights- a few	
			shrimp noticed at surface among	
			baitfish that gulls were feeding on	
			Water Temperature: Surface 29.0	
			Bottom 29.0	
			Water Salinity: Surface 31.1	
			Bottom 31.1	

Totals for Operation No. 2:

Tagging Days: 7
 Total Tagged: 21,868
 Total Released: 20,714

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-13-78	103,801 - 104,000	199		Total Tagged: 2565
	103,601 - 103,800	200		Total Not Released: 85
	103,401 - 103,600	200		Total Released: 2480
	103,201 - 103,400	199		
	103,001 - 103,200	200		Release Site: Aransas Pass - 1/8 mile
	102,801 - 103,000	200		west of end of jetties; 30 ft deep
	102,601 - 102,800	198		
	102,401 - 102,600	200		Time: 2015
	102,201 - 102,400	199		Observations: - Outgoing tide; First
	102,001 - 102,200	200		Quarter Moon; No seagulls
	101,801 - 102,000	199		
	101,601 - 101,800	200		Water Temperature: Surface 30.1
	101,401 - 101,471	71		Bottom 28.0
	101,201 - 101,300	100		Water Salinity: Surface 30.5
				Bottom 32.8
				<u>Totals for Operation No. 2</u>
				Tagging Days: 8
				Total Tagged: 24,433
				Total Released: 23,194

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-14-78	101,472 - 101,600	129		Total Tagged: 3015
	101,301 - 101,400	100		Total Not Released: 54
	101,001 - 101,200	198		Total Released: 2961
	100,801 - 101,000	200		
	100,601 - 100,800	193		Release Site: Aransas Pass - 1/4 mile
	100,401 - 100,600	200		west of end of jetties: 30-32 ft deep
	100,201 - 100,400	199		
	100,001 - 100,200	200		Time: 2030
	99,801 - 100,000	199		
	99,601 - 99,800	199		Observations: Outgoing tide; 1 day after
	99,401 - 99,600	200		First Quarter Moon; no seagulls.
	99,201 - 99,400	200		
	99,001 - 99,200	199		Totals for Operation No. 2:
	98,801 - 99,000	200		Tagging Days: 9
	98,601 - 98,800	200		Total Tagged: 27,448
	98,401 - 98,600	199		Total Released: 26,155

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
 Rockport, Texas
 June 6-15, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
6-15-78	98,201 - 98,400	199		Total Tagged: 1198
	98,001 - 98,200	200		Total Not Released: 40
	97,801 - 98,000	200		Total Released: 1158
	97,601 - 97,800	199		
	97,401 - 97,600	200		Release Site: Aransas Pass - 1/4 mile west
	97,201 - 97,400	200		of end of jetties; 30 ft deep
				Time: 1730
				Observations: Outgoing tide; 2 days after
				First Quarter Moon; no birds
				Water Temperature: Surface 30.5
				Bottom 30.5
				Water Salinity: Surface 29.4
				Bottom 30.0

Final Totals for Operation No. 2

Tagging Days: 10
 Total Tagged: 28,646
 Total Released: 27,313

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
Rockport, Texas
June 6-15, 1978

Thanks to participating personnel:

Texas Parks & Wildlife Department - Rockport:

Terry J. Cody
Ken W. Rice
David McKee
Domingo C. Perez, Jr.
David Mejorado
Bill Mercer
Manuel Flores

National Marine Fisheries Service - Galveston:

Neal Baxter
Steve Hollaway
Jim Smickley
David Hopkins
Robert Granjean
Daniel Patlan

Instituto Nacional de Pesca de Mexico - Tampico, Mexico:

R. Guillermo Castro Melendel
Eduardo Arzate Aguilar

Texas Parks & Wildlife Department - Seadrift:

W. F. Neill
Mario Garcia
Gil Gilmore
B. J. Lee

Texas Parks & Wildlife Department - Seabrook:

Leslie Gale
Bill Baker
Lynn Benefield
Charles Wilkes

National Marine Fisheries Service - Aransas Pass:

Elise Dorman

Appendix 3. (cont'd)

Texas Shrimp Tagging Operation No. 2
Rockport, Texas
June 6-15, 1974
Page 2

With assistance from:

Roy Johnson - Texas Parks & Wildlife Department, La Porte
Meg McNutt - Texas Parks & Wildlife Department, Rockport
Steve Marwitz - Texas Parks & Wildlife Department, Rockport
Bill Harshaney - Texas Parks & Wildlife Department, Seabrook
Mark Kiefling - Texas Parks & Wildlife Department, Rockport
Maintenance Shop - Texas Parks & Wildlife Department, Rockport

Appendix 4. Daily summary of brown shrimp tagging data (July 1978).
 Texas Shrimp Tagging Operation No. 3
 Rockport, Texas
 July 11-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
7-11-78	94,001 - 94,200	198		Total Tagged: 1396
	94,201 - 94,400	200		Total Not Released: 92 (6.6%)
	94,401 - 94,600	198		Total Released: 1304
	94,601 - 94,800	200		
	94,801 - 95,000	200		Release Site: Aransas Pass - north
	95,001 - 95,200	200		side opposite UT-MSI; 1.5 miles from
95,201 - 95,400	200		Gulf end of jetties; 30 ft deep	

Time: 2110

Observations: Outgoing tide; 2 days
 before First Quarter Moon

Water:	Temp.	Sal.
S	28.0	37.8
B	27.8	38.3

7-12-78	95,401 - 95,600	200		Total Tagged: 1399
	95,601 - 95,800	200		Total Not Released: 67 (4.8%)
	95,801 - 96,000	200		Total Released: 1332
	96,001 - 96,200	200		
	96,201 - 96,400	200		Release Site: Gulf of Mexico - 0.5 miles
	96,401 - 96,600	200		south of Marker #5 (Aransas Pass);
96,601 - 96,800	199		30 ft deep	

Time: 2115

Observations: Outgoing tide; 1 day before
 First Quarter Moon; no birds

Water:	Temp.	Sal.
S	29.3	37.2
B	29.3	37.2

Appendix 4. (cont'd)

Texas Shrimp Tagging Operation No. 3
 Rockport, Texas
 July 11-20, .978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
7-13-78	96-801 - 97,000	200		Total Tagged - 1396
	97,001 - 97,200	198		Total Not Released - 82 (5.9%) Total Released - 1314
	130,001 - 130,200	199		Release Site: Gulf of Mexico - 0.5 miles south of Marker #5 (Aransas Pass); 30 ft deep
	130,201 - 130,400	199		
	130,401 - 130,600	200		
	130,601 - 130,800	200		
	130,801 - 131,000	200		

Time - 1930

Observations - Outgoing tide; no birds;
 First Quarter Moon

Water: Temp. Sal.

S 29.0 37.7
 B 29.0 37.7

7-14-78	131-001 - 131,200	200		Release Site: Gulf of Mexico - 0.5 miles south of Marker #5 (Aransas Pass); 30 ft deep
	131,201 - 131,400	200		
	131,401 - 131,600	200		
	131,601 - 131,800	200		
	131,801 - 132,000	200		
	132,001 - 132,200	199		

Total Tagged - 1199
 Total Not Released - 106 (8.8%)
 Total Released - 1093

Time - 1700

Observations: Outgoing tide; 1 day after
 First Quarter Moon; no birds

Water: Temp. Sal.

S 29.0 37.2
 B 27.7 37.2

Appendix 4. (cont'd)

Texas Shrimp Operation No. 3
 Rockport, Texas
 July 11-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>
7-15-78	132,201 - 132,400	200	
	132,401 - 132,600	200	
	132,601 - 132,800	200	
	Gulf Shrimp:		
	132,801 - 133,000	196	
	133,001 - 133,200	196	

Release Information

Total Tagged; 992
 Total Not Released: 62 (6.2%)
 Bay - 36/600 (6.0%)
 Gulf - 26/392 (6.6%)
 Total Released: 930
 Release Site: Gulf of Mexico - 0.5 miles
 south of Marker #5 (Aransas Pass;
 30 ft deep
 Time: 1700
 Observations: Outgoing tide; no birds;
 2 days after First Quarter Moon

Water: Temp. Sal.
 S 30.0 37.7
 B 29.8 37.7

7-16-78	133,201 - 133,400	200	
	133,401 - 133,600	199	
	133,601 - 133,800	199	
	133,801 - 134,000	200	
	134,001 - 134,200	199	

Total Tagged: 997
 Total Not Released: 94 (9.4%)
 Total Released: 903
 Release Site: Gulf of Mexico - 0.15 miles
 south of Marker #5 (Aransas Pass);
 30 ft deep
 Time: 1600
 Observations: Outgoing tide; no birds;
 3 days before Full Moon

Water: Temp. Sal.
 S 28.5 37.7
 B - -

Appendix 4. (cont'd)
 Texas Shrimp Operation No. 3
 Rockport, Texas
 July 11-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
7-17-78	134,201 - 134,400	200		Total Tagged: 999
	134,401 - 134,600	200		Total Not Released: 83 (8.3%)
	134,601 - 134,800	199		Total Released: 916
	134,801 - 135,000	200		Release Site: Gulf of Mexico - 0.25 miles south of Marker #5 (Aransas Pass); 30 ft deep
	135,001 - 135,200	200		Time: 1730 Observations: Outgoing tide; no birds; \approx 2 days before Full Moon
7-18-78	135,201 - 135,400	200		Water: Temp. Sal. S 29.0 36.6 B 28.0 37.7
	135,401 - 135,600	200		
	135,601 - 135,800	199		Total Tagged: 1198
	135,801 - 136,000	200		Total Not Released: 78 (6.5%) Orange - 68 (8.5%) Black - 10 (2.5%)
	Black Tags:			Total Released: 1120
	000,201 - 000,400	199		Release Site: Gulf of Mexico - 0.25 miles south of Marker #5 (Aransas Pass); 30 ft deep
	000,401 - 000,600	200		Time: 1630 Observations: Outgoing tide; no birds; 1 day before Full Moon

Appendix 4. (cont'd)
 Texas Shrimp Tagging Operation No. 3
 Rockport, Texas
 July 11-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
7-19-78	000,601 - 000,800	200		Total Tagged - 1598
	000,801 - 001,000	200		Total Not Released - 225 (14.1%)
	001,001 - 001,200	200		Total Released - 1373
	001,201 - 001,400	200		Release Site - Gulf of Mexico - 0.5 miles
	001,401 - 001,600	199		south of Marker #5 (Aransas Pass) -
	001,601 - 001,800	200		30 ft. deep
	001,801 - 002,000	199		Time - 1730
	002,001 - 002,200	200		Observations - Outgoing tide; full moon;
				no birds
				Water - <u>Temp.</u> <u>Sal.</u>
			S 30.0 38.8	
			B 28.6 37.1	
7-20-78	002,201 - 002,400	199		Total Tagged - 799
	002,401 - 002,600	200		Total Not Released - 107 (13.4%)
	002,601 - 002,800	200		Total Released - 692
	002,801 - 003,000	200		Release Site - Gulf of Mexico - 0.25 miles
				south of Marker #5 (Aransas Pass);
				30 ft. deep
				Time - 1700
				Observations - Outgoing tide; 1 day after
				full moon; no birds
				Water - <u>Temp.</u> <u>Sal.</u>
			S 30.0 37.7	
			B 29.0 37.7	

Appendix 5. Daily summary of brown shrimp tagging data (August 1978).
 Texas Shrimp Tagging Operation No. 4.
 Port Aransas, Texas (OFFSHORE)
 August 8-18, 1978

<u>Date</u>	<u>Tag Series</u> (Black tags)	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>	
8-9-78	03001-03200	199		Total Tagged - 1193 Total Not Released - 30 (2.5%) Total Released - 1163 Release Site - Gulf of Mexico off Port Aransas; depth-12 fm; 12 canisters released on a heading of 215° @ 900 RPM starting at 3H2-3969, 3H3-2150 and ending at 3H2-3963, 3H3-2088 Time - 1805-1906 Observations - 2 days before First Quarter moon; Tank: temp - 29.5 Bottom water: temp - 28.5 sal - 37.8 sal - 36.6	
	03201-03400	200			
	03401-03600	199			
	03601-03800	198			
	03801-04000	197			
	04001-04200	200			
	(Black tags)				
	8-10-78	04201-04400	200		
		04401-04600	199		
		04601-04800	200		
04801-05000		198			
05001-05200		201			
Total Tagged - 998 Total Not Released - 35 (3.5%) Total Released - 963 Release Site - Gulf of Mexico off Port Aransas; depth-14 fm; 10 canisters released on a heading of 215° @ 900 RPM starting at 3H2-3963, 3H3-2155 and ending at 3H2-3958, 3H3-2111 Time - 1732-1817 Observations - 1 day before First Quarter moon; Tank: temp - 31.5 Bottom water: temp - 28.5 sal - 36.6 sal - 36.0					

Appendix 5. (cont'd)

Texas Shrimp Tagging Operation No. 4
 Port Aransas, Texas (OFFSHORE)
 August 8-18, 1978

<u>Date</u>	<u>Tag Series</u> (Black tags)	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release information</u>
8-11-78	05201-05389	188		Total Tagged - 188 Total Not Released - 0 Total Released - 188 Release Site - Gulf of Mexico off Port Aransas; depth 10 fm; 2 canisters @ 3H2-3976, 3H3-2150 and 3H2-3976, 3H3-2151 Time - 0307-0312 Observations - First Quarter moon; Tank: temp - 31.5 Bottom water: temp - 28.5 sal - 36.0 sal - 36.1
8-16-78	(Black tags) 05390-05400 05401-05600	11 199		Total Tagged - 210 Total Not Released - 39 (18.6%) Total Released - 171 Release Site - Gulf of Mexico off Port Aransas; depth - 13.5 fm; 2 canisters @ 3H2-3965, 3H3-2161 and 3H2-3965, 3H3-2158 Time - 1940-1950 Observations - 2 days before Full Moon; Tank: temp - 29.0 Bottom water: temp - 26.0 sal - 37.0 sal - 36.1

Appendix 5. (cont'd)
 Texas Shrimp Tagging Operation No. 4
 Port Aransas, Texas (OFFSHORE)
 August 8-18, 1978

<u>Date</u>	<u>Tag Series</u> (Black tags)	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
8-17-78	05601-05792	189		Total Tagged - 189 Total Not Released - 22 (11.6%) Total Released - 167 Release Site - Gulf of Mexico off Port Aransas; depth-12 fm; 2 canisters @ 3H2-3972, 3H3-2191 and 3H2-3971, 3H3-2186 Time - 1945-1955 Observations - 1 day before Full Moon; Tank: temp - 29.0 Bottom water: temp - 26.5 sal - 38.5
8-18-78	(Black tags) 05793-05800 05801-06000	8 200		Total Tagged - 208 Total Not Released - 23 (11.1%) Total Released - 185 Release Site - Gulf of Mexico off Port Aransas; depth - 10 fm; 2 canisters @ 3H2-3977, 3H3-2158 and 3H2-3976, 3H3-2149 Time - 2300 - 2335 Observations - Full Moon Tank: temp - 29.0 Bottom water: temp - 28.8 sal - 38.5

Appendix 6. Daily summary of brown shrimp tagging data (October 1978).
 Texas Shrimp Tagging Operation No. 5
 Port Aransas, Texas (OFFSHORE)
 October 10-20, 1978

<u>Date</u>	<u>Tag Series</u> (Black tags)	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
10-12-78	06001-06200 06201-06271	194 67		Total Tagged - 261 Total Not Released - 12 (4.6%) Total Released - 249 Release Site - Gulf of Mexico off Port Aransas; depth - 11 fm; 5 canisters released on a heading of 210° @ 900 RPM starting at 3H2-3990, 3H3 - 2375 and ending at 3H2 - 3986, 3H3 - 2340 Time - 2000 Observations - 3 days after First Quarter Moon Tank: temp - 27.0 Bottom water: temp - 27.4 sal - 28.9
10-13-78	(Black tags) 06272-06400 06401-06600	128 199		Total Tagged - 327 Total Not Released - 5 (1.5%) Total Released - 322 Release Site - Gulf of Mexico off Port Aransas; depth - 11 fm; 5 canisters released on a heading of 205° @ 900 RPM starting at 3H2-3980, 3H3-2227 and ending at 3H2-3976, 3H3-2208 Time - 0300 Observations - 3 days before Full Moon Tank: temp - 26.0 Bottom water: temp - 26.2 sal - 28.9

Appendix 6. (cont'd)
 Texas Shrimp Tagging Operation No. 5
 Port Aransas, Texas (OFFSHORE)
 October 10-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returns</u>	<u>Release Information</u>
10-17-78	(Black tags) 06601-06800 06801-06857	200 57		Total Tagged - 257 Total Not Released - 70 (27.2%) Total Released - 187 Release Site - Gulf of Mexico off Port Aransas; depth - 10 fm; 3 canisters released on a heading of 210° @ 900 RPM starting at 3H2-3976, 3H3-2152 Time - 1815 Observations - 1 day after Full Moon; seas very rough Tank: temp - 24.5 Bottom water: temp - 24.8 sal - 29.4 sal - 30.5
10-18-78	(Black tags) 06858-07000 07001-07138	142 138		Total Tagged - 290 Total Not Released - 2 (0.7%) Total Released - 278 Release Site - Gulf of Mexico off Port Aransas; depth 10 fm; 5 canisters released on a heading of 210° @ 900 RPM starting at 3H2-3977, 3H3-2153 and ending at 3H2-3975, 3H3-2136 Time - 2010 Observations - 2 days after Full Moon Tank: temp - 24.2 Bottom water: temp - 24.5 sal - 32.2 sal - 32.2

Appendix 6. (cont'd)
 Texas Shrimp Tagging Operation No. 5
 Port Aransas, Texas (OFFSHORE)
 October 10-20, 1978

<u>Date</u>	<u>Tag Series</u>	<u>No. Tagged</u>	<u>No. Returned</u>	<u>Release Information</u>
10-19-78	(Black tags) 07139-07200 07201-07400	62 199		Total Tagged - 261 Total Not Released - 0 Total Released - 261 Release Site - Gulf of Mexico off Port Aransas; depth - 10 fm; 4 canisters on a heading of 210° @ 900 RPM starting at 3H2-3975, 3H3-2129 and ending at 3H2-3972, 3H3-2112 Time - 1930 Observations - 3 days after Full Moon Tank: temp - 24.0 Bottom water: temp - 24.2 sal - 32.8
10-20-78	(Black tags) 07401-07600	200		Total Tagged - 200 Total Not Released - 1 (0.5%) Total Released - 199 Release Site - Gulf of Mexico off Port Aransas; depth - 10 fm; 4 canisters released on a heading of 20° @ 900 RPM starting at 3H2-3975, 3H3-2113 and ending at 3H2-3975, 3H3-2119 Time - 0235 Observations - 3 days before Last Quarter Tank: temp - 24.2 Bottom water: temp - 24.8 sal - 32.8

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