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Estimated Average Daily Instantaneous Numbers of Recreational and Commercial Fishermen and Boaters in the St. Andrew Bay System, Florida, and Adjacent Coastal Waters, 1973

Doyle F. Sutherland

May 1978

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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Juanita M. Kreps, Secretary

National Oceanic and Atmospheric Administration

Richard A. Frank, Administrator

National Marine Fisheries Service

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Estimated Average Daily Instantaneous Numbers of Recreational and Commercial Fishermen and Boaters in the St. Andrew Bay System, Florida, and Adjacent Coastal Waters, 1973

DOYLE F. SUTHERLAND¹

ABSTRACT

In the St. Andrew Bay system and adjacent coastal waters, 92.0% of the estimated recreational fishing effort was for finfish, 3.7% for crabs, 2.7% for scallops, 1.4% for oysters, and 0.2% for shrimp. Coastal waters were the most used area for finfish fishing (36.2%), followed by St. Andrew Bay (31.8%), North and West Bays (21.6%), and East Bay (10.4%). Of the estimated effort, 43.5% was from fixed platforms extending over water, 30.8% from private boats, and the remaining 25.7% from shoreline platforms, charter boats, and water. The most popular method of finfish fishing was with a rod and reel (93.9%).

The annual number of daytime anglers was estimated to range from 208,400 to 303,200 with associated expenditures ranging from \$4.2 to \$6.1 million. The estimates are based on the number of anglers actually seen fishing. The number of transit anglers and other recreational fishermen probably equal or exceed the basic estimates. The average daily instantaneous number of occupants of transit motorboats alone was estimated to reach 52 in North and West Bays, 32 in East Bay, 392 in St. Andrew Bay, and 207 in coastal waters.

The distribution of commercial fishing effort among fisheries was estimated to be 34.7% for shrimp, 33.3% for oysters, 22.0% for finfish, 8.9% for scallops, and 1.1% for crabs. The principal area for each fishery was: East Bay for shrimp (36.5%), oysters (85.7%), and crabs (85.2%); coastal waters for finfish (44.1%); and St. Andrew Bay for scallops (84.4%). The highest estimated average daily instantaneous number of active and transit commercial fishermen in each fishery was 66 for shrimp, 37 for oysters, 91 for finfish, 19 for scallops, and 7 for crabs.

INTRODUCTION

Recreational fishing, boating, water skiing, snorkeling, scuba diving, and similar activities attract millions of persons to marine and estuarine waters each year. The demand for recreational space increases as the population grows and leisure time lengthens. Maintenance of the aesthetic values and biological productivity of the coastal zone, consequently, becomes more difficult.

Vast quantities of living resources are harvested annually by fishermen. Many are occasional fishermen; others are incessant; some fish for sport, others for food, and still others for combinations of sport, food, and economic gains. Few game and food fishes escape their attention. Many edible invertebrates also are harvested.

Data on recreational fishing in marine waters are generally unavailable or inadequate for management considerations. Commercial fisheries, however, are well documented annually, nationwide. Estimates of salt-water angling effort and catch are sparse, although such data were obtained in 1960, 1965, and 1970 by the Bureau of Census for the Bureau of Sport Fisheries and Wildlife

and the National Marine Fisheries Service (Clark 1962; Deuel and Clark 1968; Deuel 1973). Estimates of salt-water angling effort for specific areas have been made by Richards (1962), Moe (1963), Miller and Gotshall (1965), and Pinkas et al. (1967). Attempts to assess the value of recreational angling for State and local areas have been made by Ellis et al. (1958), Brown et al. (1964), Gilbert and Nobe (1969, cited by Gordon et al. 1973), and Gordon et al. (1973).

This report presents the results of a 1-yr study undertaken to: 1) provide resource managers with comparative statistics on recreational and commercial fishing effort in the St. Andrew Bay system and adjacent coastal waters; 2) determine the socioeconomic value of this area to recreational and commercial fishermen; and 3) contribute to the development of methods for obtaining useful statistics on recreational fishing in the coastal zone. The term effort as used in this paper is defined as the number of fishermen and persons that were counted or estimated.

STUDY AREA

The study area was limited to the St. Andrew Bay system and adjacent coastal waters (Fig. 1) located in Bay

¹Panama City Laboratory, Southeast Fisheries Center, National Marine Fisheries Service, NOAA, Panama City, FL 32401.

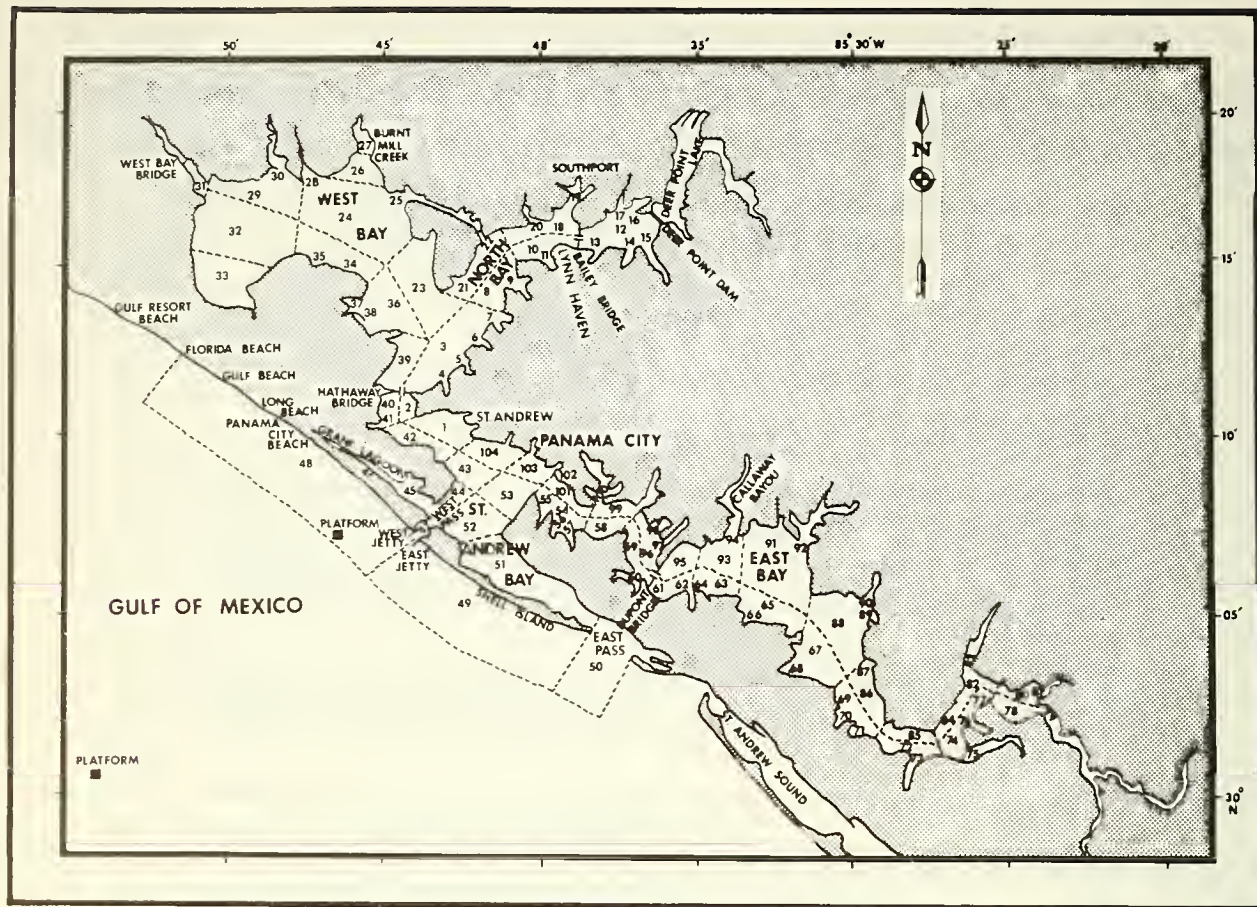


Figure 1.—Survey area and numbered subareas of the St. Andrew Bay system, Fla., and adjacent coastal waters.

County, Fla., along the northeastern Gulf of Mexico (long. 85°23' to 85°53'W, lat. 30°00' to 30°20'N). The system is a shallow plain estuary of about 90 square miles (233 km²). It consists of North Bay, West Bay, East Bay, and St. Andrew Bay. Two passes (East Pass, a natural channel, and West Pass, an excavated channel) connect St. Andrew Bay to the Gulf of Mexico.

For statistical and logistical reasons the study area was divided into four major areas and each major area into several subareas. The major areas were: 1) North and West Bays, 2) East Bay, 3) St. Andrew Bay, and 4) coastal waters. All bayous and brackish water creeks were included in the areas that could be navigated by outboard motorboat or surveyed from an outboard motorboat with the aid of binoculars.

MARINE ESTUARINE FEATURES

The St. Andrew Bay system was described by Waller (1961) as a positive estuary, in that freshwater inflow exceeds evaporation. Econfina Creek, which is dammed at Deer Point in West Bay, is the principal source of freshwater in the system. Several small creeks contribute to the total inflow. The inland bays are generally less saline

than the coastal bay. St. Andrew Bay salinity approaches that of the Gulf of Mexico waters (hereafter referred as gulf waters) (Hopkins 1964). That salinity and turbidity are related was also revealed by Hopkins (1964); the lower saline waters of the inland bays have the highest turbidity. Waller (1961) found lower salinities and transparencies on the westward side of the bay system. Ichiye (in Waller 1961) suggested the condition may result from the Coriolis effect. Repeated observations have shown that gulf waters are usually less transparent west of West Pass than to the east. Floating vegetation of estuarine and freshwater origin is frequently seen off West Pass and seldom off East Pass, suggesting that most of the freshwater flows out of the system through West Pass.

The bay system has mean depths of 1.8 m in North Bay, 2.1 m in West Bay, 2.1 m in East Bay, and 5.2 m in St. Andrew Bay (Waller 1961). Maximan depths to about 15 m are found in ship channels in West Pass and St. Andrew Bay and in the intracoastal waterway through East, St. Andrew, and West Bays (National Ocean Survey, Nautical Chart 868-5C).

East Pass is not maintained, hence it is comparatively shallow and has a constantly shifting entrance channel.

Ichiye and Jones (1961) estimated 65-75% of the tidal volume flows through this pass.

Except for the maintained ship channel in West Pass and seaward approach, the gulf shelf off St. Andrew Bay slopes gradually and smoothly from the shore seaward. At the outer limit of the survey area, the water depth averages 18-20 m.

Extensive beds of submerged vegetation, primarily *Thalassia* and *Diplanthera*, are found in shallow waters of the bay system and in East Pass. Only small scattered beds are evident in West Pass and in coastal waters.

Monthly average water temperatures of the bay range from 11.5°C in January to 28.8°C in July-August (Hopkins 1964). Mean annual rainfall near Panama City was 110 cm and the mean air temperature was 20.6°C for years 1924-46 (Tyndall Air Force Base, unpubl. manusc.)

PLANS AND PROCEDURES

This study possibly represents the first attempt to derive estimates of all daytime recreational and commercial fishermen and boaters in an estuarine system and adjoining marine waters. Schemes of stratified random sampling and measures of average fishing time have been used successfully to estimate total effort in other studies (Ellis et al. 1958; Pinkas et al. 1967; Deuel 1973). Such schemes could not be used in this study for the following reasons: 1) reliable estimates of total effort require an intensive survey; 2) all types of fisheries, platforms, and methods of fishing were not known at the beginning of the survey; and 3) the peculiarities of each known fishery precluded randomization of the survey effort within areas by fishery or other strata.

To accomplish the stated objectives of this study, the survey was designed to obtain reliable estimates of the average daily instantaneous fishing effort and boating activity in the four major areas. To facilitate comparison of that effort and activity, the four major areas were surveyed systematically on the same days within a fixed period. For logistic reasons, each major area was subdivided into several subareas (Fig. 1).

The plan was to survey the study area on a weekday and weekend-day each week of 1973. Since the surveys were done in small boats, fair weather days were usually selected; most were done in midweekdays and on Saturdays. Time of day, day of the week, starting point, and direction of travel were recognized as unmeasured sources of variation affecting the effort estimates. Of the 104 scheduled surveys, 93 were completed and 11 were abandoned owing to adverse weather or motor failure. The effect was to reduce the number of surveys for computing daily average numbers.

The estimated daily averages were computed from actual counts of the observed effort and activity. Counted were: 1) fishermen and persons participating in each fishery by platform and method of fishing; 2) fishing boats that were used in each fishery; 3) occupants of transit boats; and 4) type of transit boat. The term fishermen refers to those individuals actively fishing or

have fishing equipment in possession; persons refers to all individuals on a fishing platform including fishermen; occupants refers only to individuals on transit boats that may or may not include fishermen; and transit boats refers to those being launched, hauled, underway, anchored, beached, or moored away from their home docks but not being used as a fishing platform when observed.

Counts were made by the surveyors in single traverses of each subarea. In most subareas, the task was completed in a few minutes; the coastal subareas and other heavily used subareas regularly required from 10 to 60 min to complete. All counts regardless of the time of day or duration were assumed to be estimates of the "instantaneous" numbers of persons in all subareas during the survey day—0800-1630 h.

The four major areas were surveyed by three persons—one assigned to North and West Bays, one to East Bay, and one to St. Andrew Bay and adjacent coastal waters. Each surveyor was equipped with an outboard motorboat, a navigation chart of the area and subareas, 7 × 50 binoculars, fishing effort survey logs, and a fishing effort survey guide. The guide contained a numerically coded list of fisheries, platforms, and methods of fishing that were known or suspected to exist in the study area. Corrections and additions to the list were made when revealed by the survey. This list is shown below as it existed at the end of the survey.

| <i>Fishery</i> | <i>Platform</i> | <i>Method</i> |
|------------------------------|-----------------|-----------------------|
| Fishfish—food, sport or bait | Private boat | Rod and reel—still |
| | Commercial boat | Rob and reel—cast |
| Shrimp—food or bait | Party boat | Rob and reel—troll |
| | Charter boat | Canepole or hand-line |
| Crab—food or bait | Bridge | Cast net |
| | Pier | Hands |
| Oyster—food | Dock | Tongs or rakes |
| Scallop—food | Jetty | Spear |
| | Shore | Seine |
| | Seawall | Trotline |
| | Abutment | Trap |
| | Water—wade | Trawl |
| | Water—swim | Gill net |
| | | Dip net |
| | | Dredge |
| | | Scuba |
| | | Snorkel |

On entering each assigned subarea, the surveyor logged the subarea number, time and code numbers of the fisheries, appropriate platforms, and methods of fishing. All fishermen and persons on stationary platforms were counted. In some subareas within major areas, boats were occasionally too numerous or widely dispersed to classify and to count all individuals on-board. Instead, a count of fishermen, persons, or occupants was made for a sample of boats in each fishery or activity and the average per boat expanded by the total number of boats in each classification.

Fishermen and total number of persons on fishing

boats or transit boats were particularly difficult to assess owing to concealment by the cabin structure. Number, mobility, and distribution of the boats added to the difficulty. The effort could usually be classified rapidly and accurately by observing the fishing gear, activity of individuals on the boats, movement of the boat, and awareness of the fisheries in the subareas. Close approach and prolonged observation was necessary in cases where an unusual activity was observed or when a single boat was used for more than one fishery.

The effort on fixed platforms also presented problems of classification and assessment. Activity on those platforms was rarely static. Fishermen often changed locations and methods of fishing, left their gear unattended, fished only when fish were sighted, and engaged in two or more fisheries simultaneously. Presence of a large number of persons not fishing further complicated the problem. To minimize the error of assessment, the survey was done in the shortest possible time consistent with good judgment. When the effort was highly concentrated, a total count of all persons on the platform was obtained, followed by a count of the fishermen by fishery and method. Persons moving about, entering or leaving with fishing gear in possession, were classified as fishermen. Some error in classification undoubtedly resulted. For example, handlines used by anglers may have appeared identical to the lines used by crabbers; a fish stringer may have appeared as either; a crab trap may have been set and retrieved by rod and reel; and several persons may have shared fishing equipment.

Snorkel and scuba divers engage in diverse recreational activity. In the coastal area it is a popular method of fishing for finfish. Because time or circumstance did not permit personal interviews, they were arbitrarily included in the count of persons using water as the platform in the finfish fishery. In St. Andrew Bay, snorkel and scuba gear are frequently used by recreational and commercial fishermen in their search for scallops. The fishery, however, was easily identified, and the method of gathering scallops was the same as used by others, i.e., hand or dip net.

METHODS OF ESTIMATING EFFORT

Average Daily Instantaneous Effort

Estimates of the average daily instantaneous fishing effort and boating activity were derived by dividing the number of monthly surveys into the sum of the instantaneous counts or estimates in all subareas each month. Estimated averages were calculated for weekdays and weekend-days each month by fishery, platform, method of fishing, and type of boat within each major area.

In those instances when it was necessary to estimate the number of fishermen, persons, or occupants on boats in a subarea the following formula was used:

$$\bar{x} = \left(\frac{A}{B} \right) C$$

where \bar{x} = estimated number

A = number of fishermen, persons, or occupants in sample

B = number of boats in sample

C = total number of boats.

No attempt was made to count or estimate the number of fishermen on party boats (also called head boats) as those boats did not fish in the study area. Fishermen on private boats when still or cast fishing were identified and counted separately from the total number of persons on board. All persons on trolling boats were counted as fishermen. The distinction between methods of fishing is that still and cast fishing is usually an individual effort, and trolling is often a collective effort. All persons on commercial boats, excluding party boats, also were counted as fishermen. Boats were considered the principal platform when used to reach a secondary platform such as a bridge or shore. When used for snorkeling or scuba diving for finfish, water was considered the principal platform. Persons snorkeling or scuba diving from boats often could not be distinguished from those entering the water from shore.

The estimates of effort were summarized for all stationary platforms, and grouped into three categories as follows: 1) extension (bridge, pier, dock, jetty); 2) shoreline (shore, abutment, seawall); and 3) water (wade, swim).

Total Daytime Angling Effort

Estimates of the maximum, minimum, and average number of anglers for the 0800-1630 period were derived from expanded average daily instantaneous numbers. The expansion factors used for anglers and persons on private and charter boats were taken from the results of a survey of sport fishing in Virginia by Richard (1962). In that survey, instantaneous counts were made at 2-h intervals from a single observation point and the corrected totals from dockside interviews. Maximum and minimum variations in the instantaneous counts of private boats yielded corrected total counts when expanded by factors of 2.79 and 1.83, respectively. The average expansion factor was 2.31. For charter boats the expansion factors were 2.18 for maximum estimation, 1.52 for minimum estimation, and 1.80 for average estimation.

Estimates of daytime angling effort on fixed platforms were computed by methods analogous to private and charter boats. Interval counts and interviews were made at three locations in the St. Andrew Bay system and coastal waters at 2-h intervals twice monthly. Variations in angler effort are shown in Table 1. Since the average fishing time on those platforms was less than 2 h, those anglers who arrived after a surveyor's visit and left before the surveyor's next visit were not counted. Thus, the estimated total number of anglers exceeded the sum of interval counts. The estimated total was computed by the method of Moyle and Franklin (1957). The expansion factors derived from the instantaneous counts and

Table 1.--Number of anglers counted bihourly, number of anglers interviewed, and total hours fished at three locations in St. Andrew Bay system, Florida, and adjacent coastal waters, 1973.

| Location | Time of counts | | | | Anglers interviewed | |
|-----------------|----------------|------|------|------|---------------------|--------------|
| | 0900 | 1100 | 1300 | 1500 | Number | Hours fished |
| West Jetty | 196 | 409 | 331 | 294 | 298 | 594.25 |
| Hathaway Bridge | 252 | 323 | 249 | 273 | 234 | 508.50 |
| Deer Point Dam | 158 | 144 | 156 | 189 | 180 | 305.00 |
| Total | 606 | 876 | 736 | 756 | 712 | 1,407.75 |

the corrected totals were 4.96 for maximum variation, 3.43 for minimum variation, and 4.4 for average variation.

RECREATIONAL FISHING EFFORT

Distribution of Effort

Finfish fishing was by far the most important of the five recreational fisheries that were disclosed by the effort survey (Table 2). Of the sum of the estimated average daily instantaneous number of recreational fishermen, 92.0% fished for finfish, 3.7% for crabs, 2.7% for scallops, 1.4% for oysters, and 0.2% for shrimp.

Finfish fishing dominated the recreational fishing effort in all areas. Coastal water was the most important single area for finfish fishing (36.2%), closely followed by St. Andrew Bay (31.8%). St. Andrew Bay was the most important for crabbing (64.8%) and scalloping (93.8%), East Bay for oystering (71.8%), and North and West Bays for shrimping (56.3%). While finfish fishing and crabbing were important activities in all areas, oystering and shrimping were limited to the bay system and scalloping to St. Andrew Bay and adjacent coastal waters (Table 3).

Finfish Fishing Effort

The estimated recreational finfish fishing effort on weekdays, weekend-days each month in the four major areas is shown in Figure 2. The effort on weekend-days exceeded the weekday effort each month in all areas. The seasonal effort pattern differed by area, however. In North and West Bays and in East Bay, the greatest effort occurred during late fall and winter months, while in St. Andrew Bay and coastal waters it occurred during spring through fall months.

Factors contributing to the differences in seasonal fishing pattern in the four major areas were chiefly environmental conditions, availability of finfish, and vacation schedules. Adverse weather and sea conditions limit boat operations in open bay and coastal waters in late fall through early spring. Pelagic fishes decline in avail-

Table 2.--Percentage distribution of recreational fishing effort among fisheries and areas, 1973.

| Fishery | North and West Bays | East Bay | St. Andrew Bay | Coastal waters | Sum |
|----------|---------------------|----------|----------------|----------------|------|
| Finfish | 19.8 | 9.6 | 29.3 | 35.3 | 92.0 |
| Crabs | 0.8 | 0.4 | 2.4 | 0.1 | 3.7 |
| Scallops | 0.0 | 0.0 | 2.6 | 0.2 | 2.7 |
| Oysters | 0.3 | 1.0 | 0.1 | 0.0 | 1.4 |
| Shrimp | <0.1 | <0.1 | <0.1 | 0.0 | 0.2 |

Table 3.--Percentage distribution of recreational fishing effort within fisheries by areas, 1973.

| Fishery | North and West Bays | East Bay | St. Andrew Bay | Coastal waters | Sum |
|----------|---------------------|----------|----------------|----------------|-----|
| Finfish | 21.6 | 10.4 | 31.8 | 36.2 | 100 |
| Crabs | 21.9 | 9.5 | 64.8 | 3.8 | 100 |
| Scallops | 0.0 | 0.0 | 93.8 | 6.2 | 100 |
| Oysters | 18.7 | 71.8 | 9.5 | 0.0 | 100 |
| Shrimp | 56.3 | 19.9 | 23.8 | 0.0 | 100 |

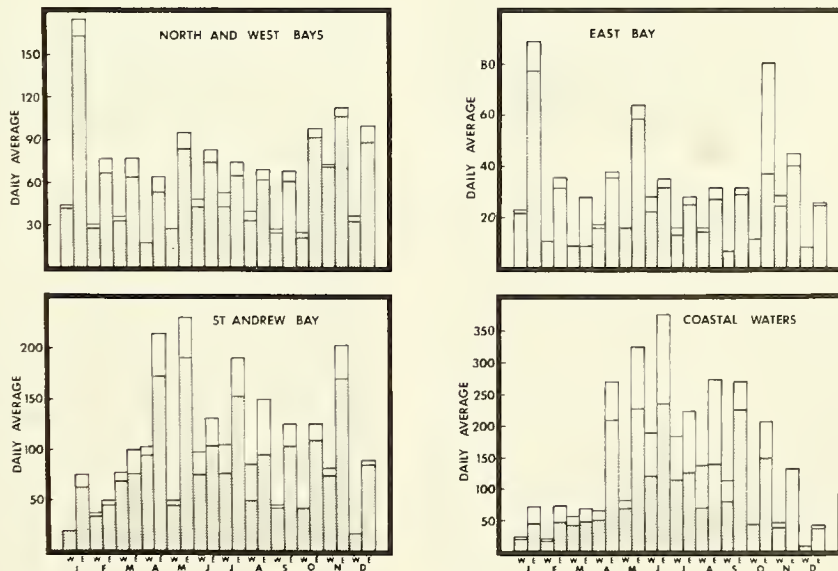


Figure 2.—Estimated average daily instantaneous numbers of recreational finfish fishermen (dark) and persons (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

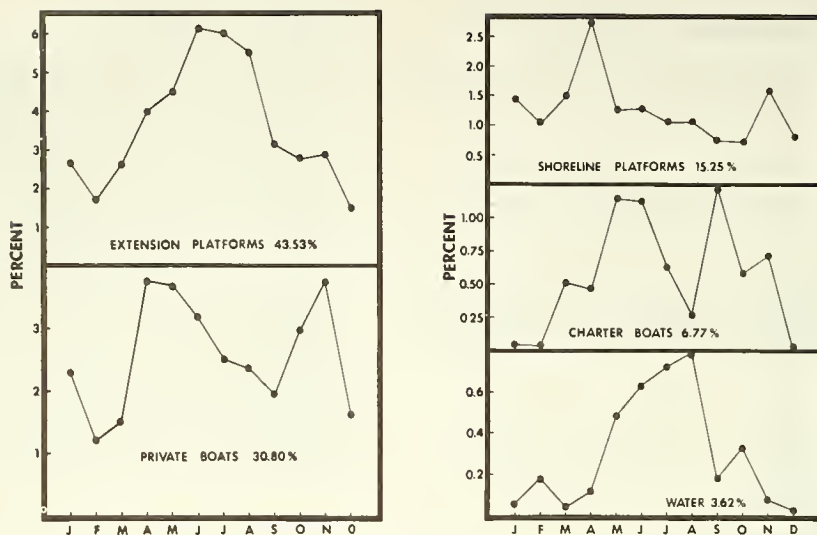


Figure 3.—Percentage distribution of the estimated average daily instantaneous numbers of recreational finfish fishermen in all areas by type of platform used each month in 1973.

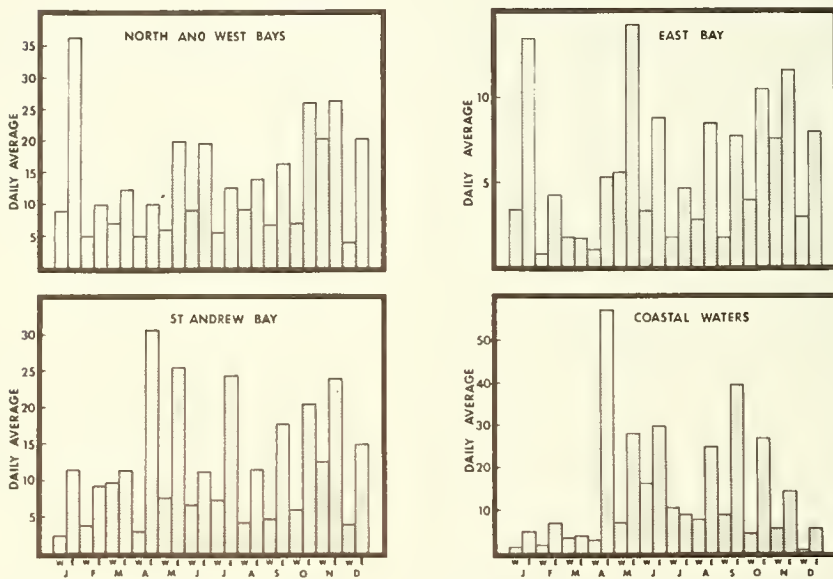


Figure 4.—Estimated average daily instantaneous numbers of private boats used in recreational finfish fishing by areas, weekdays (W), and weekend-days (E) each month in 1973.

ability during these months and certain bay fishes, particularly spotted seatrout, *Cynoscion nebulosus*; red drum, *Sciaenops ocellata*; and mullet, *Mugil* sp., become increasingly available in protected waters. The latter are pursued vigorously by fishermen in small boats and from fixed platforms in lagoons and bayous of the bay areas. Fishing effort in St. Andrews Bay increases in March with the arrival of Spanish mackerel, *Scomberomorus maculatus*, and in coastal waters with the arrival of king mackerel, *Scomberomorus cavalla*, from mid-May to early June. Summer visitors to the area contribute heavily to recreational fishing in St. Andrew Bay and coastal waters.

The percentage distribution of recreational finfish fishing effort by type of platform and by month is shown in Figure 3. The sum of all daily estimates of persons finfish fishing was included in the percentage calculations. The relative importance of fixed platforms that extend out from the shorelines to other types is clearly indicated. Limitations of the coastal water survey to 2 miles offshore minimizes the relative importance of charter boats as a fishing platform. Frequently, charter boats were seen fishing just beyond the 2-mile boundary during the survey period; many others were observed in transit within the survey area. The limitation also applied to private boats, but to a lesser extent.

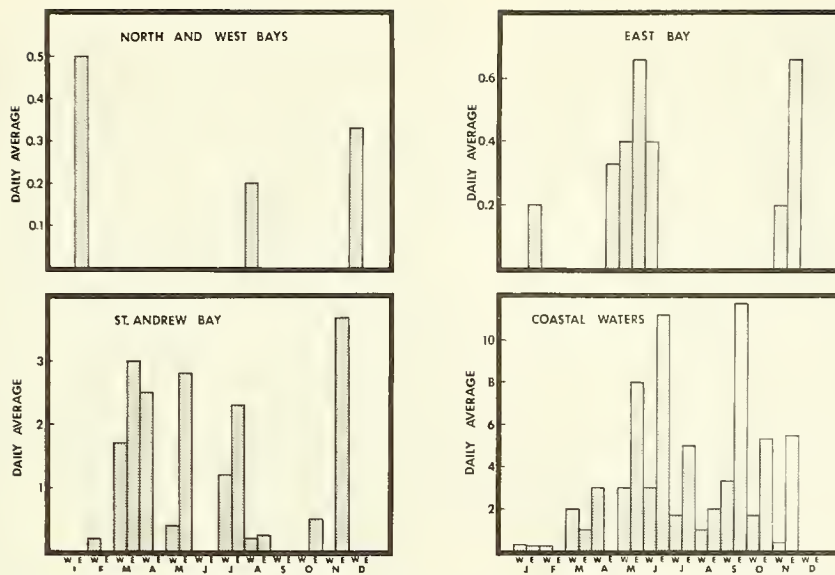


Figure 5.—Estimated average daily instantaneous numbers of charter boats used in recreational finfish fishing by areas, weekdays (W), and weekend-days (E) each month in 1973.

The areal distribution of, and estimated recreational finfish fishing effort on, private and charter boats by months, weekdays, and weekend-days are shown in Figures 4 and 5. All methods of fishing for food, sport, and bait finfish are included in the estimates. The daily and monthly variations in distribution and numbers of private boats were similar to those of finfish fishermen (Fig. 2) for the reasons previously described. In contrast to private boats, charter boats were infrequently seen in North, West, or East Bays. While fishermen occasionally charter a boat to fish in those areas, the relatively small number of fishermen and persons counted on those boats suggested that most were used privately by the owner for recreational fishing. Seasonal irregularities in the estimated numbers of charter boats in St. Andrew Bay and adjacent coastal waters were largely due to changes in availability and movement of game fishes and to sea conditions.

The percentage distribution of recreational finfish fishing effort by method of fishing, area, and platform is shown in Table 4. The percentages were computed from the sum of all daily estimates of recreational finfish fishermen and persons snorkeling and scuba diving. Of the various methods of finfish fishing, still, cast, and troll fishing with a rod and reel was by far the most popular, composing 93.9% of the effort in all areas from all platforms. Still fishing with a rod and reel, canepole, and handline composed 61.2% of the effort followed by trolling (22.4%) and casting (12.2%). A substantial number of persons used snorkel and scuba gear in pursuit of finfish (3.2%). Spear (gig) and net fishing composed only 1.0% of the estimated daily effort.

Recreational Anglers and Expenditures

Estimates of the number of recreational anglers in the St. Andrew Bay system and adjacent coastal waters in

Table 4.—Percentage of distribution of recreational finfish fishing effort by methods of fishing, areas, and platforms in 1973.

| Methods | North and West Bays % | East Bay % | St. Andrew Bay % | Coastal waters % | All areas % |
|------------------------------------|-----------------------|------------|------------------|------------------|-------------|
| -----from private boats----- | | | | | |
| RR*-still | 65.97 | 53.97 | 43.53 | 25.15 | 44.99 |
| RR-cast | 28.22 | 35.15 | 18.05 | 1.69 | 17.43 |
| RR-troll | 4.60 | 7.13 | 37.52 | 73.08 | 36.55 |
| Canepole** | 0.80 | 2.30 | 0.04 | 0.08 | 0.52 |
| Spear | 0.11 | 0.12 | 0 | 0 | 0.04 |
| Gillnet | 0.11 | 0.53 | 0.31 | 0 | 0.17 |
| Cast net | 0.15 | 0 | 0.25 | 0 | 0.11 |
| Dip net | 0 | 0.12 | 0 | 0 | 0.01 |
| Seine | 0 | 0.69 | 0.27 | 0 | 0.15 |
| Trotline | 0 | 0 | 0.04 | 0 | 0.01 |
| Trawl | 0.04 | 0 | 0 | 0 | 0.01 |
| -----from charter boats----- | | | | | |
| RR-still | 34.64 | 22.07 | 1.46 | 0.48 | 1.08 |
| RR-cast | 16.34 | 65.95 | 1.12 | 0 | 1.25 |
| RR-troll | 49.02 | 7.98 | 97.42 | 99.52 | 97.66 |
| -----from extension platforms----- | | | | | |
| RR-still | 88.06 | 90.35 | 91.41 | 84.30 | 87.65 |
| RR-cast | 6.32 | 7.01 | 3.43 | 14.44 | 9.02 |
| Canepole** | 4.54 | 2.01 | 4.21 | 1.21 | 2.77 |
| Cast net | 0.95 | 0.62 | 0.92 | 0.05 | 0.52 |
| Spear | 0.13 | 0 | 0.04 | 0 | 0.04 |
| -----from shoreline platforms----- | | | | | |
| RR-still | 81.36 | 72.48 | 79.77 | 80.04 | 79.46 |
| RR-cast | 9.28 | 23.77 | 12.09 | 19.96 | 12.71 |
| Canepole** | 5.49 | 2.60 | 6.97 | 0 | 5.87 |
| Cast net | 3.86 | 1.15 | 1.17 | 0 | 1.97 |
| -----from water----- | | | | | |
| RR-still | 17.96 | 20.47 | 17.54 | 3.35 | 8.66 |
| RR-cast | 27.89 | 57.69 | 26.39 | 0.65 | 11.32 |
| Canepole* | 0 | 0 | 0.25 | 0 | 0.07 |
| Spear | 4.78 | 4.60 | 0 | 0 | 0.36 |
| Cast net | 27.22 | 13.65 | 4.1B | 1.30 | 3.58 |
| Gill net | 8.79 | 0 | 0 | 0 | 0.33 |
| Seine | 13.37 | 3.64 | 7.74 | 0 | 2.87 |
| Snorkel | 0 | 0 | 11.63 | 64.65 | 44.42 |
| SCUBA | 0 | 0 | 32.28 | 30.04 | 28.40 |

*Rod and reel

**Includes handlines

1973 and their expenditures were derived from two sources: first, from an estimate of the total number of daytime anglers in each area by months, weekdays, and weekend-days; second, from an estimate of the monies spent per angler per day.

Results of the 1970 national survey of fishing and hunting (U.S. Fish and Wildlife Service, Bureau of Sport

Fisheries and Wildlife 1972) showed that 9,460,000 saltwater fishermen on all coasts spent \$1,224,705,000 for 113,694,000 recreational days. From those data, an average of \$129 during the entire year or \$10.77 each recreational day was calculated to have been spent by each saltwater fisherman. On the gulf coast each of 2,272,000 fishermen spent an average of \$178 during the entire year, or \$11.36 per recreational day.

In a 1974 survey of Florida's coastal counties, Fred W. Bell (pers. commun.) found that the expenditures relating to a recreational angling day averaged \$21.32. An expenditure of \$18.97 per angling day was used in this study to estimate the expenditures of recreational anglers in St. Andrew Bay system and adjacent waters. That figure was derived by reducing \$21.32 by 11% to account for the inflationary rate during the period 1973-74.

The term "recreational fishermen" as used by the reference sources above applied to recreational anglers only. The term "angler" as currently used refers only to fishermen who use a hook-and-line to take finfish. Therefore, the average expenditure of \$18.97 for an angling day applies only to recreational angling for finfish and not to other methods of finfish fishing or to other fisheries. The estimates of anglers and expenditures presented in this section, then, are based on numbers of finfish fishermen identified as fishing with hook-and-line only.

The estimated annual number of daytime anglers in St. Andrew Bay and adjacent coastal waters in 1973 and their expenditures are summarized in Table 5 by area and angling platform.

The number of daytime anglers in all areas and on all platforms was estimated to range from a minimum of 208,400 to a maximum of 303,200 and the expenditures from a minimum of \$4.2 million to a maximum of \$6.1 million. The estimates include only those anglers that fished from 0800 to 1630 h. Excluded were an approximately equal number of individuals that were classified as occupants of transit boats, the majority of whom were enroute to or returning to finfish fishing grounds.

Crab Fishing Effort

Recreational crab fishing was second in importance to finfish fishing in the St. Andrew Bay system and adjacent coastal waters, composing 3.7% of the recreational fishing effort. Most crab fishing effort was limited to summer months when the blue crab, *Callinectes sapidus*, was available in shallow water. A small winter fishery for the blue crab was observed in West Bay, subarea 25. The water in that subarea, warmed by the effluent from an electric generating plant, provided a suitable shallow-water habitat for the crabs in the winter months. The crab was sought primarily for its food value.

The fiddler crab, *Uca* sp., was observed to be harvested by an occasional recreational angler. The crabs are used locally as bait for catching sheepshead, *Archosargus probatocephalus*, and black drum, *Pogonias cromis*.

The estimated recreational crab fishing effort is shown in Figure 6 for major areas, weekdays, and weekend-days each month in 1973. The estimates include both food and bait crab fishing from all platforms by all methods.

Classification and assessment of fishermen and persons participating in the recreational crab fishery were particularly difficult for the surveyor, for it was not essential that all participants have fishing equipment in possession. That is, fishermen may actively search for crabs by wading or boating in shallow water but do not participate in their capture. Frequently, several crab fishermen share a single dip net or crab trap. In areas where both crabs and scallops were found, the fishermen often engage in the two fisheries simultaneously. Baited traps and handlines usually require less than full attention of fishermen. During periods of inactivity, the fishermen may appear to the surveyor as observers. As a result, the number of fishermen may be underestimated or in some cases the effort incorrectly classified.

Comparison of platforms and the estimated average daily instantaneous number of private boats used in the recreational crab fishery are shown in Figures 7 and 8.

Table 5.--Estimates of the annual number of daytime recreational anglers and expenditures (in hundreds) in St. Andrew Bay system and adjacent coastal waters in 1973 by areas and fishing platforms.

| Range | Areas | | | | | | | | Total | |
|-------------------------------|---------------------|---------|----------|---------|----------------|---------|----------------|----------|---------|----------|
| | North and West Bays | | East Bay | | St. Andrew Bay | | Coastal Waters | | Anglers | Dollars |
| -----Private Boats----- | | | | | | | | | | |
| Maximum | 250.3 | 4,997.7 | 95.6 | 1,908.9 | 216.0 | 4,313.7 | 275.4 | 5,499.6 | 837.3 | 16,719.9 |
| Minimum | 166.4 | 3,323.4 | 62.7 | 1,251.3 | 148.2 | 2,959.0 | 183.8 | 3,671.5 | 561.1 | 11,205.2 |
| Average | 207.5 | 4,144.2 | 79.2 | 1,580.8 | 187.2 | 3,737.8 | 230.0 | 4,593.9 | 703.9 | 14,056.7 |
| -----Charter Boats----- | | | | | | | | | | |
| Maximum | 0.4 | 8.8 | 2.2 | 43.3 | 31.4 | 627.5 | 116.6 | 2,328.5 | 150.6 | 3,008.1 |
| Minimum | 0.3 | 6.2 | 1.5 | 30.2 | 21.9 | 437.7 | 81.7 | 1,631.6 | 105.4 | 2,105.7 |
| Average | 0.4 | 7.2 | 1.8 | 36.2 | 25.9 | 518.0 | 96.8 | 1,952.3 | 124.9 | 2,493.7 |
| -----Extension Platforms----- | | | | | | | | | | |
| Maximum | 258.3 | 5,158.2 | 129.8 | 2,592.9 | 454.8 | 9,083.2 | 636.0 | 12,741.7 | 1,480.9 | 29,576.0 |
| Minimum | 178.6 | 3,567.6 | 89.8 | 1,792.3 | 314.5 | 6,281.4 | 441.2 | 8,810.4 | 1,024.1 | 20,451.7 |
| Average | 210.4 | 4,201.1 | 106.0 | 2,116.4 | 370.5 | 7,398.3 | 520.6 | 10,396.6 | 1,207.5 | 24,112.4 |
| -----Shoreline Platforms----- | | | | | | | | | | |
| Maximum | 150.8 | 3,011.7 | 57.2 | 1,142.5 | 303.5 | 6,060.5 | 9.2 | 183.5 | 520.7 | 10,398.2 |
| Minimum | 104.4 | 2,085.1 | 39.6 | 790.0 | 213.3 | 4,259.4 | 6.4 | 126.8 | 363.7 | 7,261.3 |
| Average | 123.0 | 2,456.1 | 46.6 | 931.0 | 251.2 | 5,016.9 | 7.5 | 149.6 | 428.3 | 8,553.6 |
| -----Water Platforms----- | | | | | | | | | | |
| Maximum | 2.9 | 58.7 | 4.4 | 88.7 | 23.5 | 469.3 | 11.7 | 234.0 | 42.5 | 850.7 |
| Minimum | 2.0 | 40.5 | 3.1 | 61.5 | 16.2 | 324.3 | 8.1 | 161.8 | 29.4 | 588.1 |
| Average | 2.4 | 47.5 | 3.6 | 72.3 | 19.1 | 350.4 | 9.5 | 190.5 | 34.6 | 691.1 |

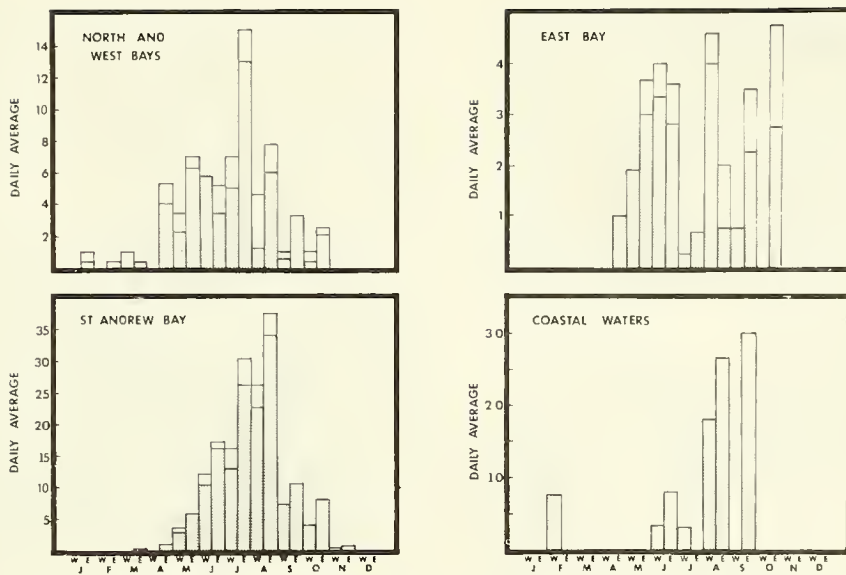


Figure 6.—Estimated average daily instantaneous numbers of recreational crab fishermen (dark) and persons (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

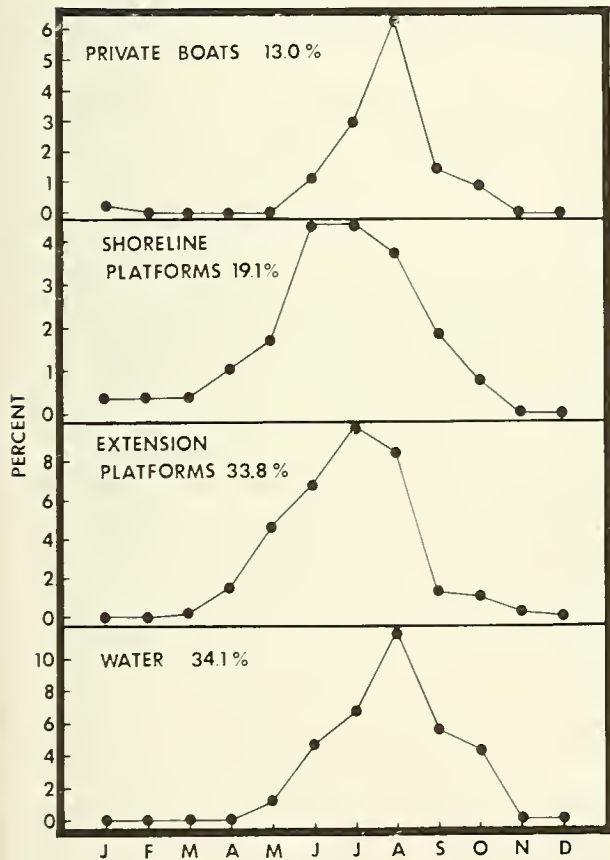


Figure 7.—Percentage distribution of the estimated average daily instantaneous numbers of recreational crab fishermen in all areas by type of platform used each month in 1973.

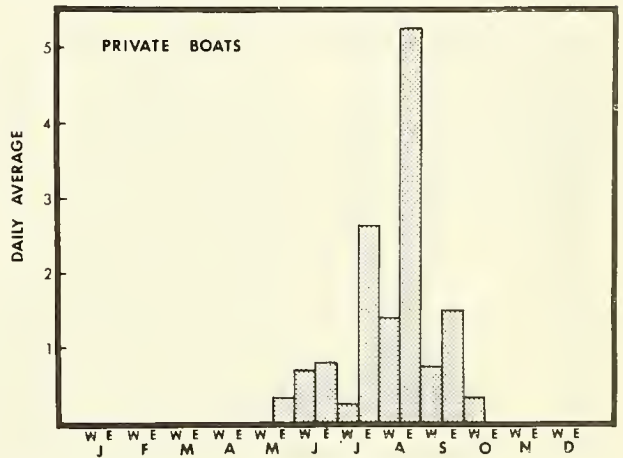


Figure 8.—Estimated average daily instantaneous numbers of private boats used for recreational crab fishing in all areas on weekdays (W) and weekend-days (E) each month in 1973.

Table 6.—Percentage distribution of recreational crab fishing effort by methods of fishing, areas, and platforms in 1973.

| Methods | North and West Bays % | East Bay % | St. Andrew Bay % | Coastal waters % | All areas % |
|-------------------------------|-----------------------|------------|------------------|------------------|-------------|
| -----private boats----- | | | | | |
| Dip net | 66.3 | 100.0 | 95.2 | 0 | 87.9 |
| Trap | 27.4 | 0 | 4.8 | 0 | 10.4 |
| Trotline | 6.3 | 0 | 0 | 0 | 1.7 |
| -----extension platforms----- | | | | | |
| Dip nets | 10.9 | 35.6 | 1.2 | 0 | 4.9 |
| Trap | 82.1 | 12.2 | 83.4 | 3.73 | 79.7 |
| Handline | 7.0 | 52.2 | 15.4 | 0 | 15.4 |
| -----shoreline platforms----- | | | | | |
| Dip net | 31.8 | 60.5 | 16.1 | 0 | 28.1 |
| Trap | 38.0 | 33.4 | 70.1 | 0 | 50.5 |
| Handline | 30.2 | 6.2 | 13.8 | 0 | 21.4 |
| -----water----- | | | | | |
| Dip net | 100.0 | 93.7 | 99.7 | 5.16 | 99.2 |
| Handline | 0 | 6.3 | 0.3 | 0 | 0.8 |

The order of preference for crab fishing platforms as indicated by the estimated number of fishermen was water

(36.1%), extension platforms (34.1%), shoreline platforms (17.7%), and private boats (12.1%).

Assessment of the methods of recreational crab fishing by type of platform and month is shown in Table 6.

Crabbers fishing in shallow water by wading or boating preferred to visually search and capture crabs with a dip net (93.6%). Since the crabs frequent shallow water and were widely distributed, availability was virtually assured at all access sites. A trap was preferred by those fishermen on extension and shoreline platforms (65.1%). The crab fishing effort by trapping may be underestimated, however, for many traps are fished almost continuously from private docks.

Scallop Fishing Effort

The bay scallop, *Pecten irradians*, supported a substantial recreational fishery in 1973. That fishery attracted 2.8% of the estimated effort for all fisheries and was third in importance to recreational fishermen after finfish and crabs.

Unlike finfish and crabs, scallops were limited in distribution to lower St. Andrew Bay and East Pass. According to the distribution of fishing effort they were found in abundance only in subareas 44, 45, and 50-53.

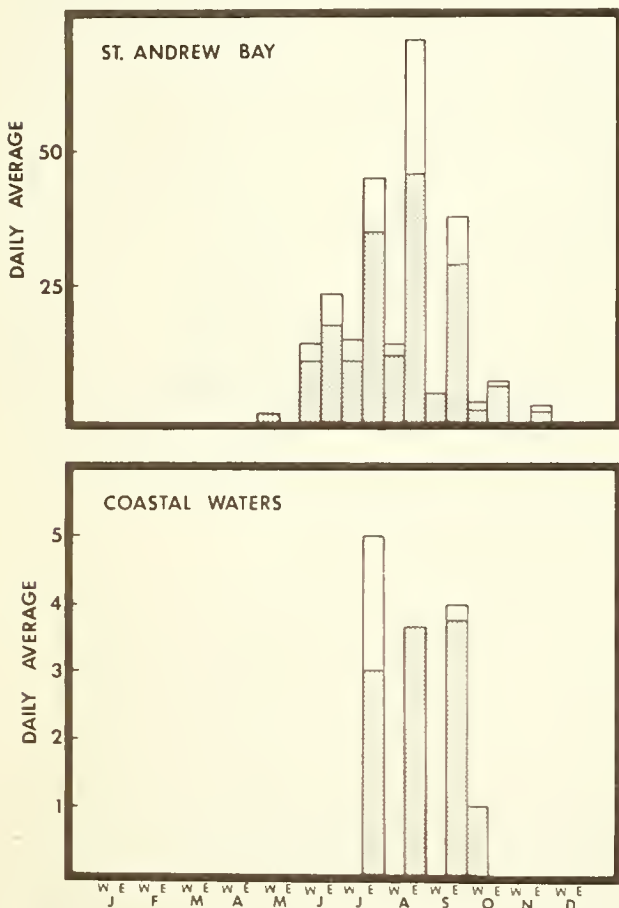


Figure 9.—Estimated average daily instantaneous numbers of recreational scallop fishermen (dark) and persons (light) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in North, West, and East Bays.

An occasional scallop fisherman was seen in other sub-areas of St. Andrew Bay; none were seen in North, West, or East Bay. While scallops apparently reside in grass beds all year (Gutsell 1931), the annual harvest began in early May and extended through September. Florida State law permits taking of scallops by hand or dredge from 1 June through 15 October and only by hand on other days.

The estimated recreational scallop fishing effort is shown in Figure 9 by areas on weekdays and weekend-days each month in 1973. The estimated effort includes all methods of fishing from all platforms.

Only two platforms were used in this fishery, private boats and water (Figs. 10, 11). Private boats served primarily as a means of transport to scallop grounds. Most fishermen entered the water and fished by wading, snorkeling, and scuba diving. Those that used water as the primary platform entered from shore.

Most fishermen preferred to search for scallops and catch them by hand (Table 7). Snorkel and scuba equipment extended the effort to considerable depth. Comparatively few fishermen searched for scallops while standing in a boat or by wading and dip netting them in a manner similar to crab fishing. A dredge was fished occasionally from private motorboats.

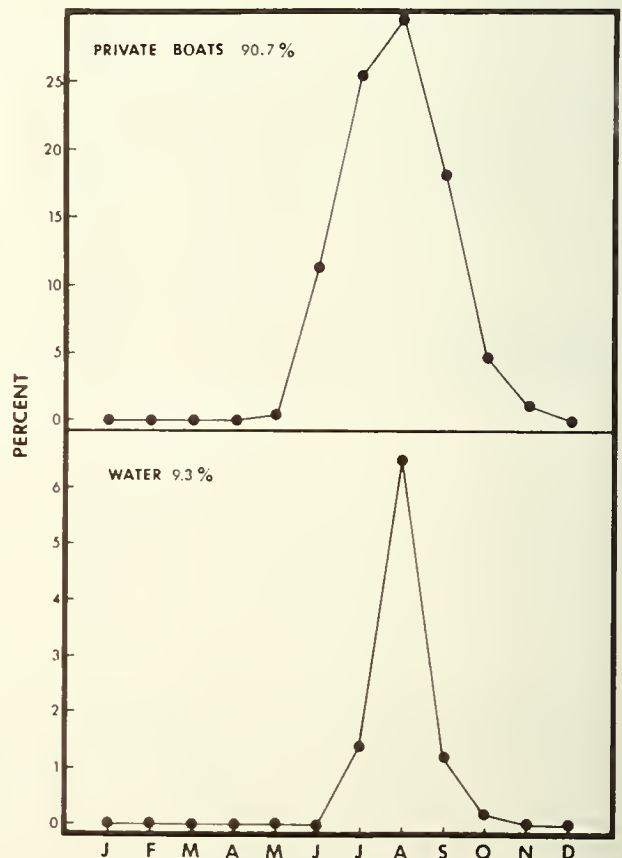


Figure 10.—Percentage distribution of the estimated average daily instantaneous numbers of recreational scallop fishermen in all areas by type of platform used each month in 1973.

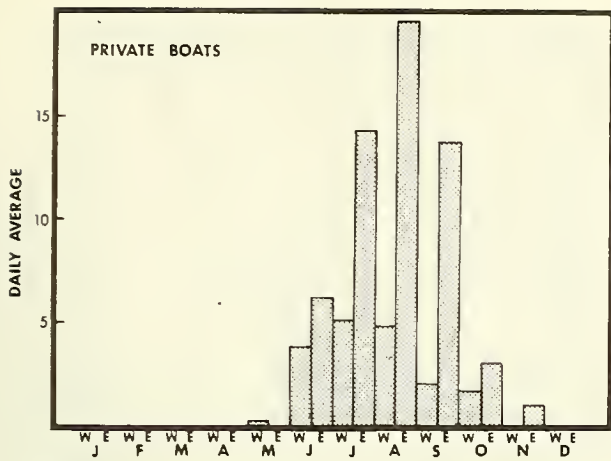


Figure 11.—Estimated average daily instantaneous numbers of private boats used for recreational scallop fishing in all areas on weekdays (W) and weekend-days (E) each month in 1973.

Table 7.—Percentage distribution of recreational scallop fishing effort by methods of fishing, areas, and platforms in 1973.

| Method | Private boats | | | Water | | |
|---------|------------------|------------------|-------------|------------------|------------------|-------------|
| | St. Andrew Bay % | Coastal waters % | All areas % | St. Andrew Bay % | Coastal waters % | All areas % |
| Hands | 89.2 | 26.7 | 86.0 | 84.1 | 100.0 | 89.1 |
| Dredge | 9.70 | 73.3 | 13.0 | 0 | 0 | 0 |
| Dip net | 1.1 | 0 | 1.0 | 15.9 | 0 | 10.9 |

Oyster Fishing Effort

The oyster fishery attracted 1.4% of the estimated recreational fishing effort and was fourth in importance to recreational fishermen after finfish, crabs, and scallops. Of that effort, 71.8% occurred in East Bay, 18.7% in North and West Bays, and 9.5% in St. Andrew Bay. None occurred in coastal waters.

In East Bay, subareas 92 and 94 supported most of the oystering effort, although numerous oyster beds are located in the bay and in most bayous. Subarea 12 and adjoining bayous, subarea 19 and adjoining bay area, and subarea 30 and adjoining bay area were popular oyster grounds in North and West Bays. Virtually all recreational oystering in St. Andrew Bay was observed in subareas 59 and 60.

The estimated recreational oyster fishing effort is shown in Figure 12 by areas, weekdays, and weekend-days each month in 1973. The taking of oysters is prohibited by law in June, July, and August.

Oyster fishing was done primarily from private boats as the more productive beds were inaccessible from fixed platforms. During periods of very low tide, exposed oysters were harvested in limited numbers from shore or by wading. Assessment of the recreational oystering effort by type of platform is shown in Figure 13 and the number of private boats in Figure 14.

Most of the oysters were harvested with tongs or rakes from boats anchored over oyster beds (Table 8). In shall-

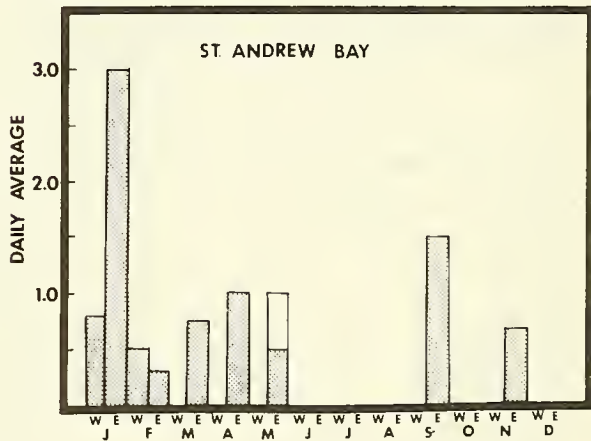
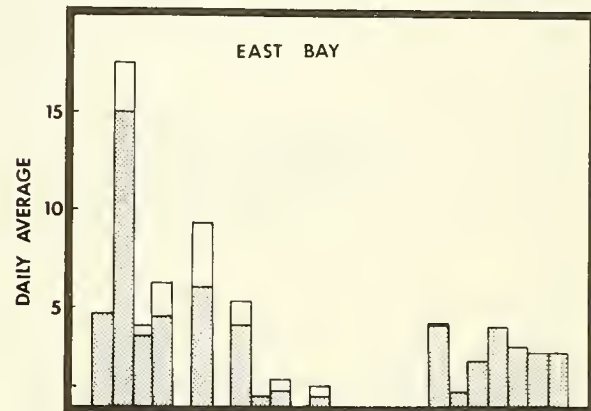
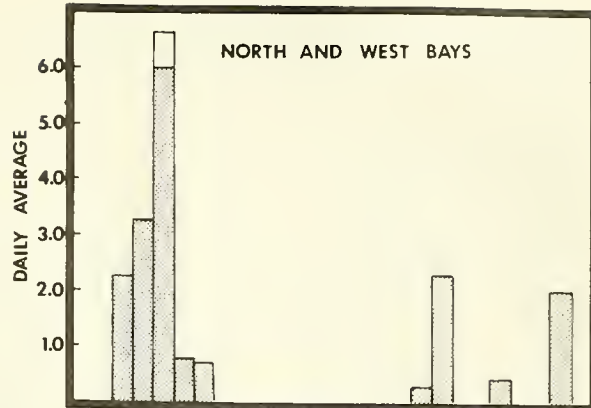


Figure 12.—Estimated average daily instantaneous numbers of recreational oyster fishermen (dark) and persons (light) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in coastal waters.

low water and intertidal zone the oysters were simply gathered by hand or dip net.

Shrimp Fishing Effort

From the results of this survey, shrimp was ranked fifth and least important of the daytime recreational fisheries in the St. Andrew Bay system and adjacent coastal waters in 1973. That effort, composed 0.2% of the

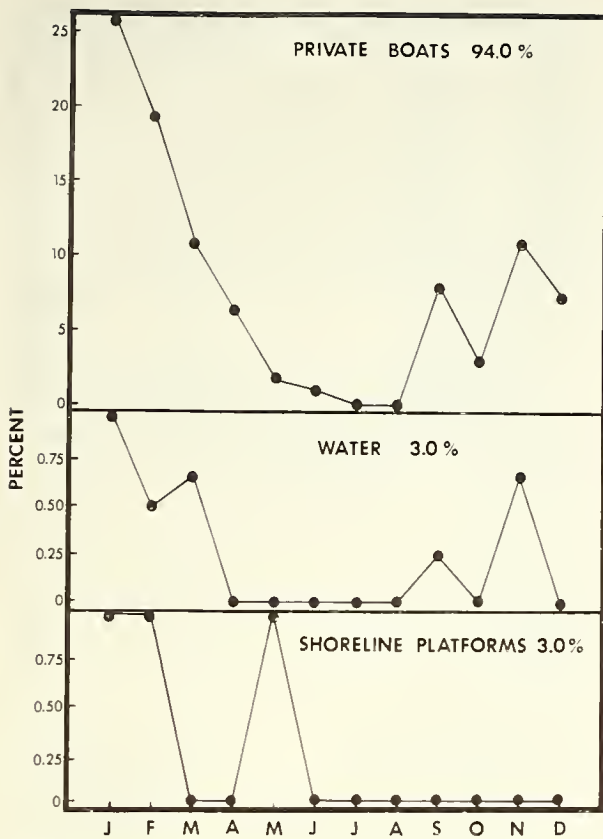


Figure 13.—Percentage distribution of the estimated daily instantaneous numbers of private boats used for recreational scallop fishing in all areas on weekdays (W) and weekend-days (E) each month in 1973.

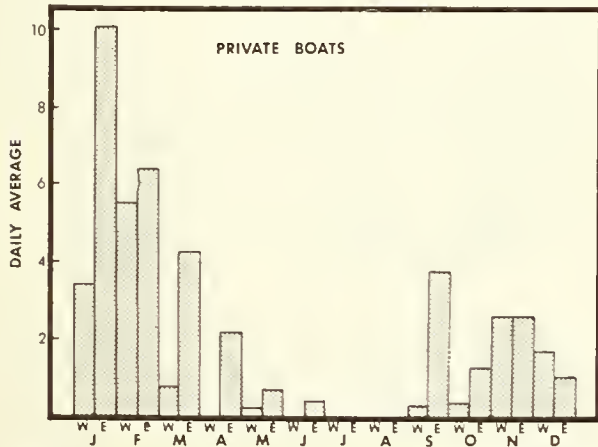


Figure 14.—Estimated average daily instantaneous numbers of private boats used for recreational scallop fishing in all areas on weekdays (W) and weekend-days (E) each month in 1973.

estimated effort for all fisheries, was irregularly distributed through the year and was essentially limited to weekend-days in North and West Bays (Fig. 15).

Table 8.—Percentage distribution of recreational oyster fishing effort by methods of fishing, areas, and platforms in 1973.

| Methods | North and West Bays % | East Bay % | St. Andrew Bay % | All areas % |
|---------------------|-----------------------|------------|------------------|-------------|
| Private boats | | | | |
| Tongs | 82.68 | 95.11 | 95.63 | 90.89 |
| Hands | 3.87 | 5.82 | 6.37 | 5.45 |
| Dredge | 11.55 | 0 | 0 | 2.51 |
| Dip net | 1.90 | 1.07 | 0 | 1.14 |
| Shoreline platforms | | | | |
| Tongs | 0 | 30.00 | 0 | 10.00 |
| Hands | 0 | 70.00 | 100.00 | 90.00 |
| Water | | | | |
| Tongs | 0 | 47.92 | 0 | 29.77 |
| Hands | 100.00 | 52.08 | 0.67 | 70.23 |

The observed recreational shrimping was limited to trawling with private boats and trapping from shoreline platforms. The trawling effort could easily be identified by the boat rigging and trawl warp. Shrimp trapping, however, was a problem as the method differs little from that used by crabbers. By close observation, the surveyor could usually detect differences in the trap and accessories used in the two fisheries. On occasion, the fishery could only be determined from personal interviews.

Assessment of the platforms and methods that were used in the recreational shrimp fishery is shown in Figures 16 and 17 and Table 9.

TRANSIT RECREATIONAL BOATS AND OCCUPANTS

This survey included an assessment of transit recreational boats and occupants. Since circumstances did not permit personal interview of the occupants, their activities were simply classed according to boat type. From repeated observations, the function of most boats could be determined from the boat structure, gear, appearance of the occupants, location, and direction of travel. On weekdays and in inclement weather, an estimated 90-100% of the observed private motorboats were enroute to or returning from fishing. On weekend-days during fair weather the proportion of nonfishing motorboats increased but probably did not exceed 20%.

Included in the category of private motorboats were licensed and unlicensed boats of all sizes or classes used for recreational purposes, rentals with or without guides, canoes with or without a motor, and motorized inflatable craft. Nonmotorized rafts, such as inner tubes and similar floatation devices, were excluded since they relate more to swimming than fishing. The estimated average daily instantaneous number of private motorboats is shown in Figure 18 by areas, weekdays, and weekend-days for each month in 1973.

Sailing was an important recreational pursuit in local waters. However, an occasional sailboat was seen trolling while under full sail. They also served as an anchored platform for finfish fishing, crabbing, and scalloping. Classification and assessment in such cases was the same as other private boats. Of the observed sailboats, probably less than 5% were used as fishing platforms. An area comparison of the estimated average daily number of transit sailboats is shown in Figure 19.

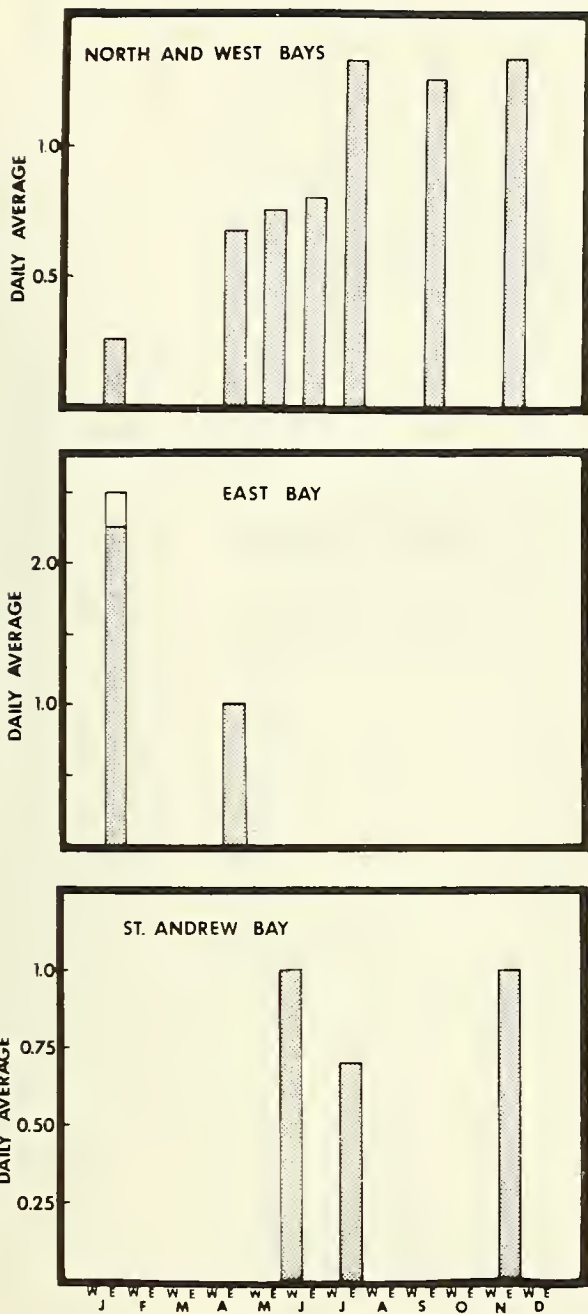


Figure 15.—Estimated average daily instantaneous numbers of recreational shrimp fishermen (dark) and persons (light) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in coastal waters.

Skiing, like sailing, was an important recreational water sport in local waters. Ski boats are commonly used alternately for skiing and fishing. Their proportionate use as a fishing platform was not determined by this survey. An area comparison of the estimated average daily number of transit ski boats is shown in Figure 20.

From 125 to 130 charter boats and about 15 party boats operated intermittently or on a daily schedule out of local marinas in 1973. They are included in this section

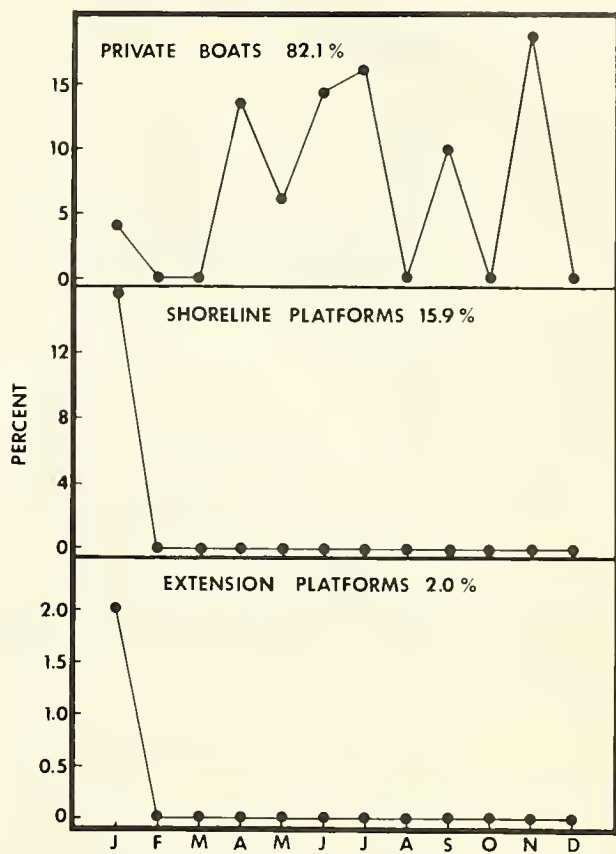


Figure 16.—Percentage distribution of the estimated average daily instantaneous numbers of recreational shrimp fishermen in all areas by type of platform used each month in 1973.

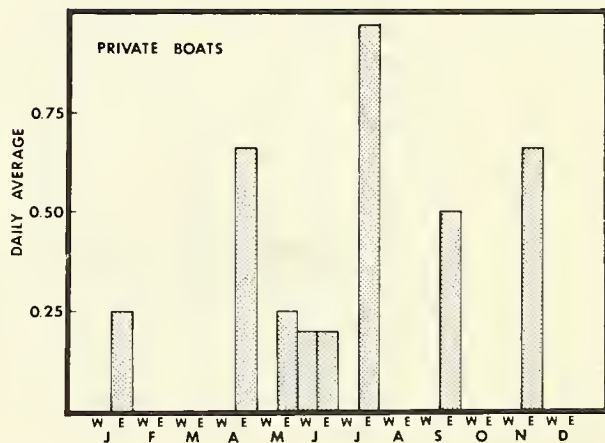


Figure 17.—Estimated average daily instantaneous numbers of private boats used for recreational shrimp fishing in all areas on weekdays (W) and weekend-days (E) each month in 1973.

Table 9.—Percentage distribution of recreational shrimp fishing effort by methods of fishing areas and platforms in 1973.

| Method | North and West Bays % | East Bay % | St. Andrew Bay % | Coastal waters % | All areas % |
|-------------------------------|-----------------------|------------|------------------|------------------|-------------|
| -----private boats----- | | | | | |
| Trawl | 96.08 | 22.22 | 2.67 | 0 | 82.50 |
| -----shoreline platforms----- | | | | | |
| Trap | 3.92 | 77.78 | 0 | 0 | 17.70 |

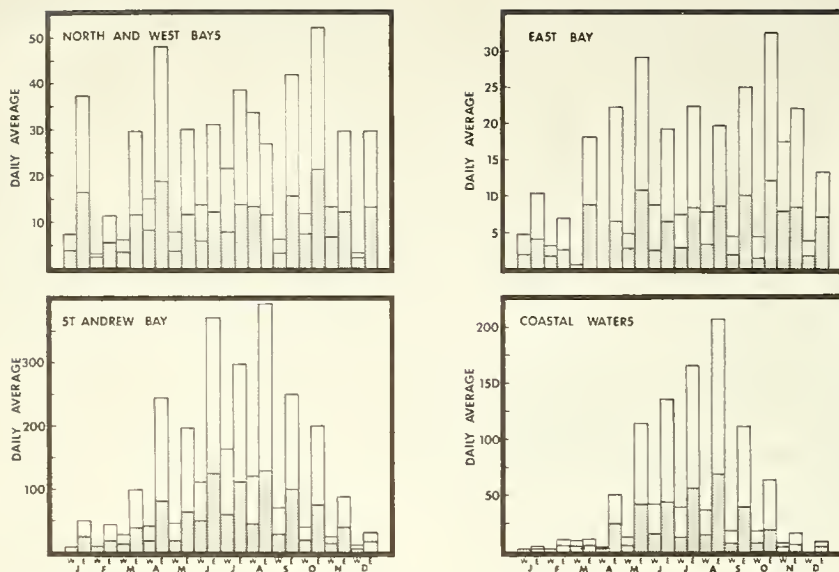


Figure 18.—Estimated average daily instantaneous numbers of transit private motorboats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

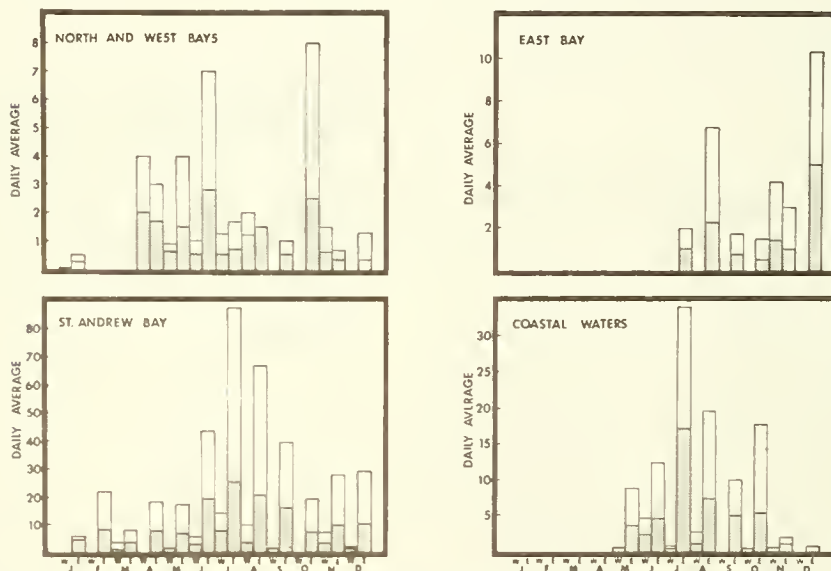


Figure 19.—Estimated average daily instantaneous numbers of transit private sailboats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

because of their direct participation in recreational fin-fish fishing, recognizing such boats do, in fact, commercialize recreational fishing. Charter boats are those boats licensed for hire by the U.S. Coast Guard and the captain is licensed to carry passengers for a fee. Generally, fishermen verbally contract the services of the boat and captain. Party boats and captains, also licensed by the U.S. Coast Guard, normally do not operate on a contractual basis. Instead, they charge a fixed fee for passage and services.

Charter boats can usually be identified from a distance by their hull design, rigging, and arrangement of fishing accommodations in the cockpit. Most of the fin-

fish fishing effort by chartered boats was in coastal and offshore waters. As a result, a substantial part of the fishing effort was outside the survey area. The estimated number of transit boats and fishermen in St. Andrew Bay and coastal waters (Fig. 21) largely reflects the intensity of recreational fishing effort in offshore waters.

According to the effort survey, party boats were not used as a fishing platform in St. Andrew Bay or adjacent coastal waters in 1973. Apparently the number and species of bottom fishes usually sought by the party boat fleet was insufficient to supply the demand. Most of the boats that regularly made daily trips traveled 10-20 miles offshore to find fish; a few traveled 40-50 miles offshore

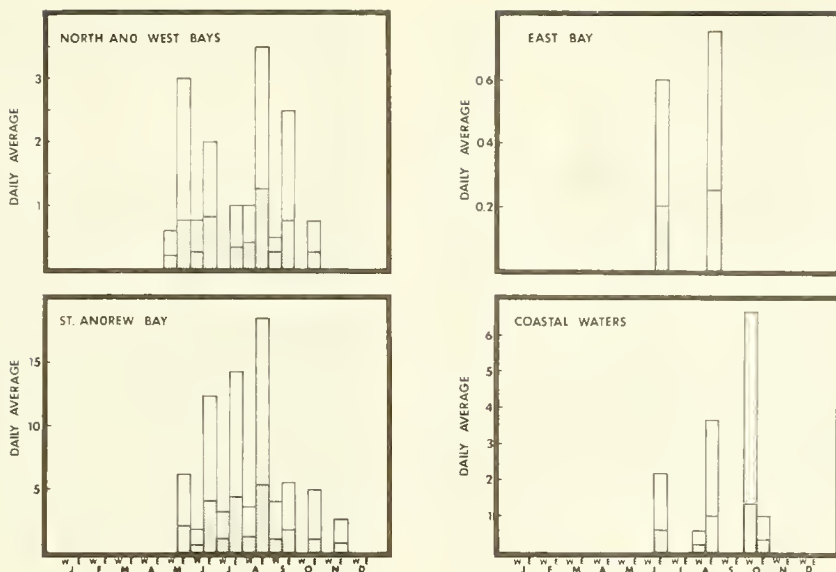


Figure 20.—Estimated average daily instantaneous numbers of transit private ski boats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

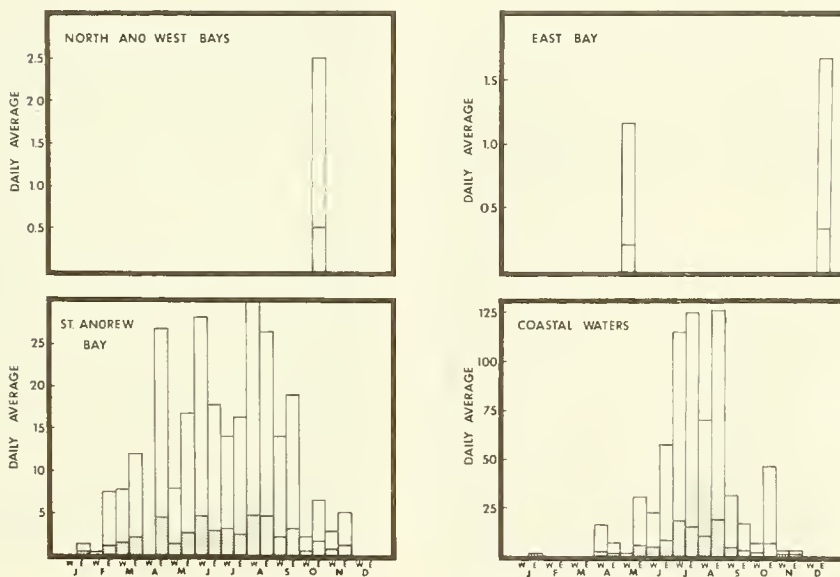


Figure 21.—Estimated daily instantaneous numbers of transit charter boats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

each day. The larger party boats are licensed to carry a maximum of 90 persons, but usually limit the number of fishermen to about 70; a minimum of 15 fishermen is generally required by the boat operators. The average number of fishermen on party boats probably averages 30-40 over the entire season. At a distance, party boats may be confused with commercial snapper boats, for the hull design is similar, otherwise there was little difficulty assessing transit party boats. The estimated number of transit party boats is shown in Figure 22.

COMMERCIAL FISHING

Distribution of Effort

From the results of the survey for commercial fishing effort, five commercial fisheries existed in the St. Andrew Bay system and adjacent coastal waters in 1973. Those fisheries, identical to the ones described under recreational fishing, were: shrimping for food or bait, oystering for food, finfish fishing for food or bait, scalloping

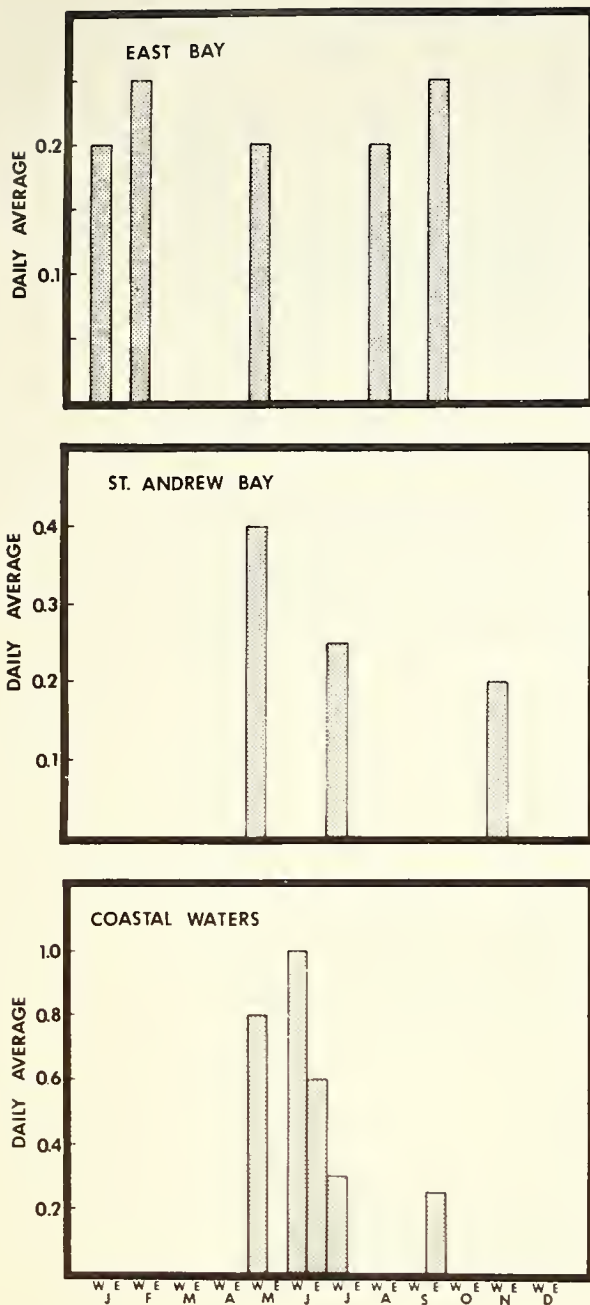


Figure 22.—Estimated average daily instantaneous numbers of transit party boats by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in North and West Bays.

Table 10.—Percentage distribution of all commercial fishing effort among fisheries and areas, 1973.

| Fishery | North and West Bays | East Bay | St. Andrew Bay | Coastal waters | Total |
|----------|---------------------|----------|----------------|----------------|-------|
| Shrimp | 12.0 | 12.7 | 10.0 | 0.0 | 34.7 |
| Oysters | 4.6 | 28.5 | 0.2 | 0.0 | 33.3 |
| Finfish | 5.6 | 2.2 | 4.5 | 9.7 | 22.0 |
| Scallops | 0.0 | 0.1 | 7.5 | 1.3 | 8.9 |
| Crabs | <0.1 | 1.0 | <0.1 | 0.0 | 1.1 |

for food, and crabbing for food. The percentage distribution of effort among the fisheries, based on the sum of all effort estimates was (Table 10): shrimp, 34.7%; oysters, 33.3%; finfish, 22.0%; scallops, 8.9%; and crabs, 1.1%.

The area preference for each fishery as indicated by the effort estimates was (Table 11): East Bay for shrimp (36.5%), oysters (85.7%), and crabs (85.2%); coastal waters for finfish (44.1%); and St. Andrew Bay for scallops (84.4%).

Shrimp Fishing Effort

Of the five fisheries in the St. Andrew Bay system and adjacent coastal waters revealed by this survey, shrimp was first in importance to commercial fishermen. The effort was well distributed throughout the bay system (Table 11). While no shrimping effort was observed within the coastal waters, a viable fishery existed just offshore of the survey boundary.

Trawlers rigged with either a single or double trawl fished for shrimp in the bay system. The single rigged trawler, generally smaller and more maneuverable of the two, fished from maximum depth to the edge of shallow water grass beds, whereas the double rigged trawlers were generally limited to fishing deep water in and along the intracoastal waterway and other navigation channels.

The estimated daytime commercial shrimping effort, shown in Figure 23, is thought to be a relatively small part of the total shrimping effort in St. Andrew Bay. Since shrimp are more vulnerable to trawls fished at night, the major effort undoubtedly occurred at that time. The estimated numbers of transit shrimp boats (Fig. 24) partially reflect the intensity of the night fishery. Most of those boats were observed by the surveyors during the early morning and late afternoon hours enroute to the docks or returning to the shrimp fishing grounds. The estimates of transit shrimp boats in adjacent coastal waters are indicative of the night shrimping effort in offshore waters.

The commercial shrimp fishing effort observed in St. Andrew Bay system was entirely by trawling.

Oyster Fishing Effort

The oyster fishery was second in importance to commercial fishermen in the study area accounting for 33.3% of the total estimated daily effort expended among all

Table 11.—Percentage distribution of commercial fishing effort within fisheries by area, 1973.

| Fishery | North and West Bays | East Bay | St. Andrew Bay | Coastal waters | Total |
|---------|---------------------|----------|----------------|----------------|-------|
| Shrimp | 34.6 | 36.5 | 28.9 | 0.0 | 100 |
| Oyster | 13.9 | 85.7 | 0.4 | 0.0 | 100 |
| Finfish | 25.5 | 9.9 | 20.5 | 44.1 | 100 |
| Scallop | 0.0 | 1.1 | 84.4 | 14.5 | 100 |
| Crab | 9.1 | 85.2 | 5.7 | 0.0 | 100 |

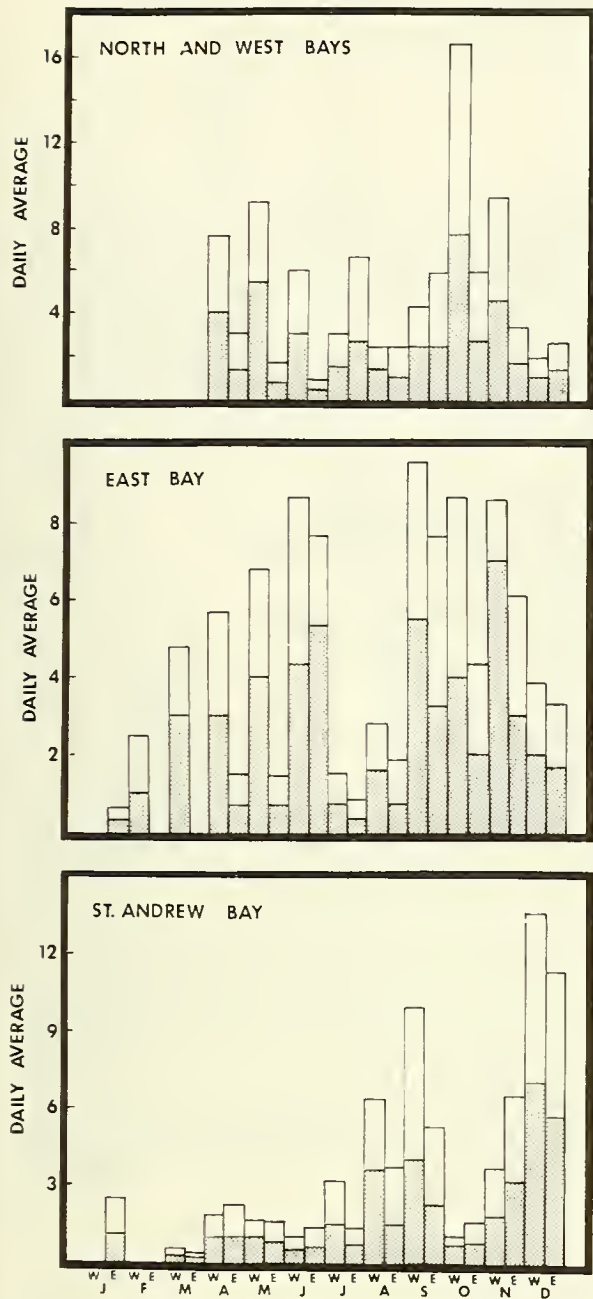


Figure 23.—Estimated average daily instantaneous numbers of commercial shrimp fishermen (light) and boats (dark) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in coastal waters.

fisheries. Of the oyster fishing effort 85.7% was in East Bay, 13.9% in North and West Bays, 0.4% in St. Andrew Bay, and 0% in coastal waters (Table 11).

The observed oyster fishing effort was essentially limited to subareas 88, 90, 91, and 92 in East Bay, subarea 12 in North Bay, subarea 29 and 30 in West Bay, and subarea 59 in St. Andrew Bay. Both public and private beds were harvested by the commercial fishermen.

The seasonal pattern and level of oyster fishing effort are shown in Figure 25 and transit boats in Figure 26. In Florida the taking of oysters is prohibited by law during June, July, and August. A small effort during the closed season was revealed in North and West Bays by the survey, however. The level of effort in season probably resulted from several factors including, but not limited to, the price of oysters, their condition (size, quality), and competing opportunities for the fishermen. The availability of scallops in September and October provides the fishermen with an optional fishery. The specially built flat-bottom, wooden boats used in the oyster fishery are also adaptable to the scallop fishery.

The fishermen in the St. Andrew Bay system relied on individually operated oyster tongs as the method of harvesting oysters commercially. The only observed exception was a single commercial fisherman using a dip net to reach oysters in shallow water.

Finfish Fishing Effort

The finfish fishery of the St. Andrew Bay system and adjacent coastal waters was third in importance to commercial fishermen as measured by the estimated fishing effort. That effort amounted to 22.0% of the sum of the estimated effort for all fisheries. By area 44.1% of the effort was in coastal waters, 25.5% in North and West Bays, 20.5% in St. Andrew Bay, and 9.9% in East Bay (Table 11). The daily and monthly estimated number of fishermen and boats engaged in commercial finfish fishing is shown in Figure 27; transit finfish fishermen and boats are shown in Figure 28.

Of the finfish fishing effort, 68.9% was classified as seine fishing for bait and 31.1% as gill net fishing for food fish. Since circumstances did not permit personal interviews or inspection of the catch, the percentage figures may be in error. Most seine boats that operated along the coastal beaches and in the passes carried nets of various mesh sizes for fishing for both bait and food fishes. The target species of that fishery generally were the round scad, *Decapterus punctatus*; scaled sardine, *Harengula pensacolatae*; and ladyfish, *Elops saurus*. These species are used extensively as bait by recreational and commercial fishermen. Food fishes, however, were sought when seasonally available; mixed catches of bait and food fishes were common to that fishery.

In the bay system, beach seines were used primarily to catch food fish and secondarily to capture bait fishes. The shallow draft boats especially built to operate along the ocean beaches serve equally well in shallow bay, bayou, and lagoon waters.

All observed gill net fishing was judged to be for food fish, although low-quality food fishes that were caught by gill netters undoubtedly entered the bait fish market. The preferred fishes were chiefly mullet, *Mugil* sp.; spotted seatrout, *Cynoscion nebulosus*; and pompano, *Trachinotus carolinus*. The mullet and seatrout fisheries were essentially limited to late fall and winter, when they become relatively abundant in marketable size. The pompano is generally available from spring to late fall.

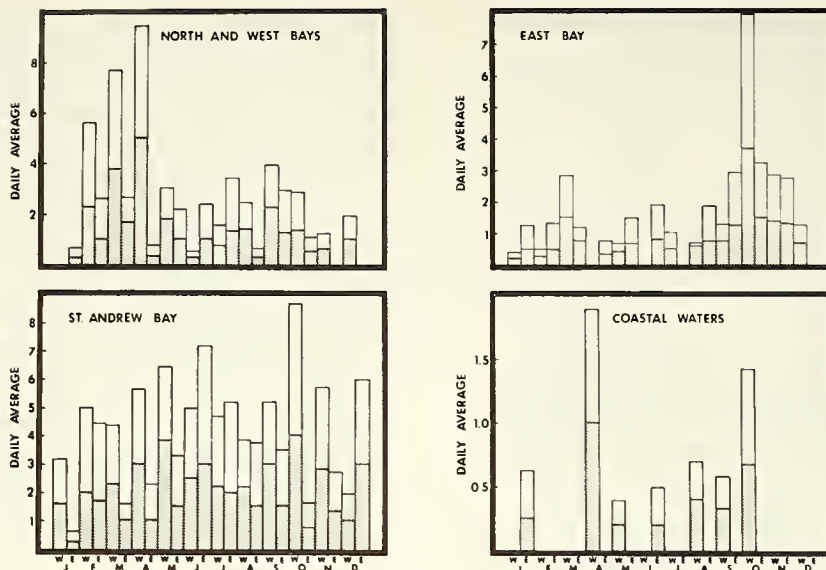


Figure 24.—Estimated average daily instantaneous numbers of transit commercial shrimp fishing boats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

Since these fishes occur in protected waters of the bay system, they attract the attention of many full- and part-time commercial fishermen, as a comparatively small expenditure for gear or labor is required to participate in the fishery. One- and two-man operations were commonly observed. A similar fishery was described in detail by Irby (1974) for Okaloosa and Walton Counties in northwest Florida.

Commercial Scallop Fishery

The scallop fishery was fourth in importance to commercial fishermen in the area; it accounted for 22.0% of the estimated effort for all fisheries. According to the distribution of effort, scallops occurred in commercial quantity only in lower St. Andrew Bay (subareas 44, 51, 52) and in East Pass (subarea 50). A minor fishing effort with a dredge was observed in East Bay. Since scallops are not known to occur in the East Bay area, the effort possibly was exploratory in nature or misclassified. The latter seems more likely for a limited amount of dredging of leased oyster beds is permitted by the State of Florida.

The estimated numbers of scallop fishermen and boats are shown in Figure 29 for weekdays and weekend-days each month in 1973. The numbers of transit scallop boats and occupants are shown in Figure 30.

The flat-bottom, wooden boat mentioned in the section on commercial oyster fishing also served as the primary platform for scallop fishing. The method most employed to harvest the scallops was to tow a sled-type dredge through the grass beds inhabited by scallops. State laws limit the mechanical harvest of scallop to the period from 15 October to June 1. An occasional commercial fisherman was seen gathering scallops by hand with the aid of scuba gear.

Commercial Crab Fishing

Commercial crabbing was ranked fifth and least important among the commercial fisheries in the areas as measured by fishing effort. That effort involved only 1.2% of the sum of the estimated effort for the five fisheries. By area 85.2% of the crabbing effort was in East Bay, 9.1% in North and West Bays, 5.7% in St. Andrew Bay, and 0.0% in coastal waters (Table 11).

The estimated numbers of commercial crabbers and crab boats are shown in Figure 31 for areas, weekdays, and weekend-days each month in 1973. No transit crab boats were observed.

All observed crab fishing was by baited lift traps that were set and hauled from small boats. Large quantities of crabs are harvested by shrimpers, however, incidental to their shrimp catches.

DISCUSSION

The need for reasonably accurate statistics on social and economic value of recreational fishing and related activities in marine-estuarine waters is well recognized by resource managers, environmentalists, scientists, and others. While commercial, industrial, municipal, and residential uses of these waters and resources are generally accepted by the public as being in the public interest, to optimize their social, economic, and biological benefits the recreational user necessarily has to be considered.

The waters of the coastal zone offer a great variety of recreational opportunities. Fishing, boating, and swimming are examples. A complete and reliable survey of all recreational activities in St. Andrew Bay and adjacent coastal waters would involve such enormous effort and

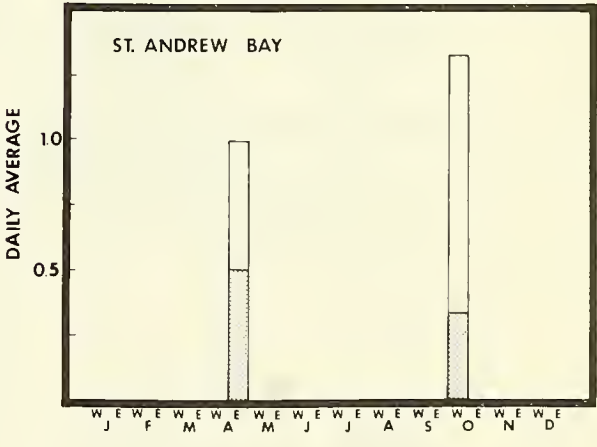
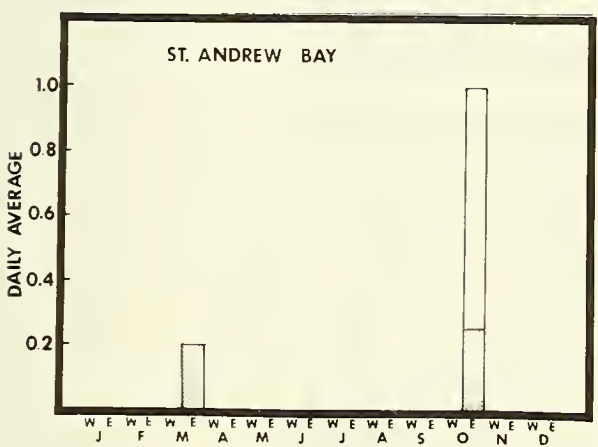
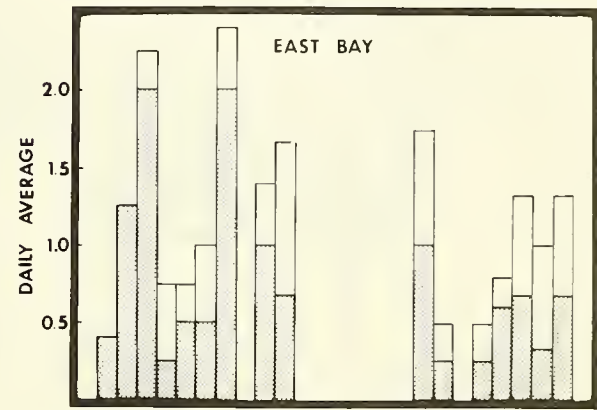
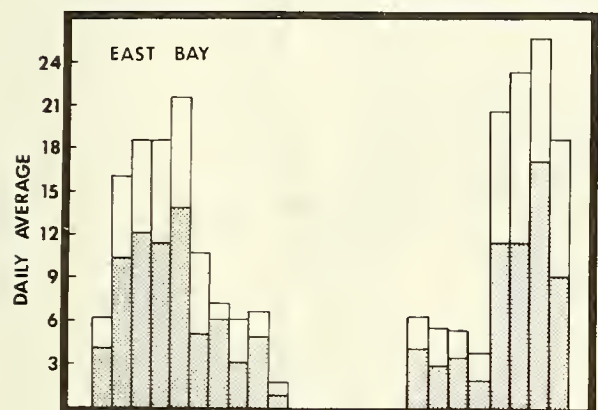
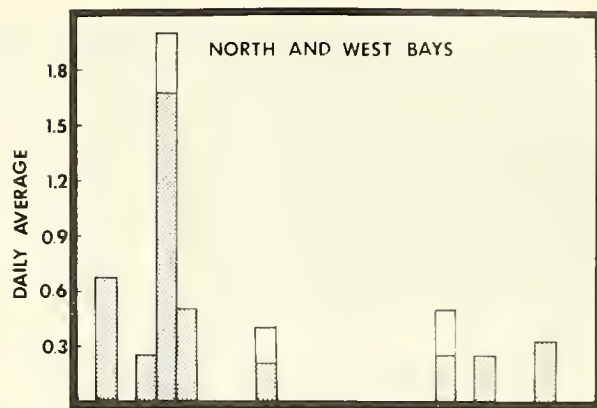
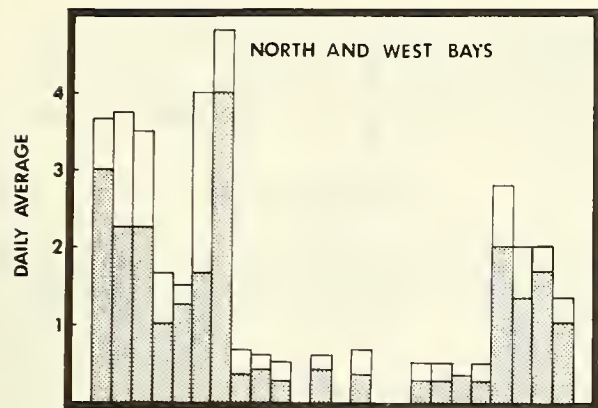


Figure 25.—Estimated average daily instantaneous numbers of commercial oyster fishermen (light) and boats (dark) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in coastal waters.

Figure 26.—Estimated average daily instantaneous numbers of transit commercial oyster fishing boats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in coastal waters.

expense as to preclude such an undertaking. For the same reasons no attempt was made to obtain an estimate of the total participation in a single activity. Still, the need by management for statistical data on public utilization of the area's living resources and space prevails. The fishery biologist often has to conduct relatively inexpensive surveys for short-term solutions to management problems. The results are not always reliable. This survey might best be regarded as explora-

tory in that the results are reasonably accurate, although not totally comprehensive, and were not overly expensive to obtain.

In this survey, estimates of the number of recreational and commercial fishermen and boaters were obtained by methods that permit direct comparison of expended effort for each fishery resource and boating activity in each of the major areas on weekdays, weekend-days, and months in 1973. The estimates were also made by type of

fishing platform and method of fishing. From these estimates the resource manager can appraise the competitive effort between recreational and commercial fishermen for the same resource, the time when the greater or lesser competition occurs, and where and how it occurs. The estimates also provide the manager with possible solutions to competitive problems by manipulating the time, place, and method of harvest.

Estimates of the economic benefits of daytime recreational angling were computed for two primary

reasons: one, for the public awareness of the monies spent by anglers for their recreation; and two, for managerial consideration in matters relating to an equitable allocation of the natural resources among user groups.

ACKNOWLEDGMENTS

I thank F. W. Bell and C. R. Futch for reviewing this manuscript, and the following laboratory staff members

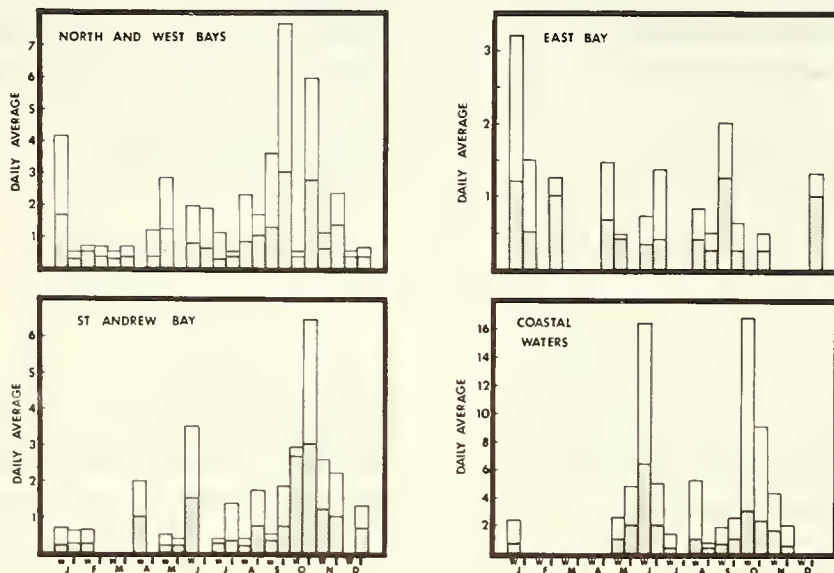


Figure 27.—Estimated average daily instantaneous numbers of commercial finfish fishermen (light) and boats (dark) by areas, weekday (W), and weekend-days (E) each month in 1973.

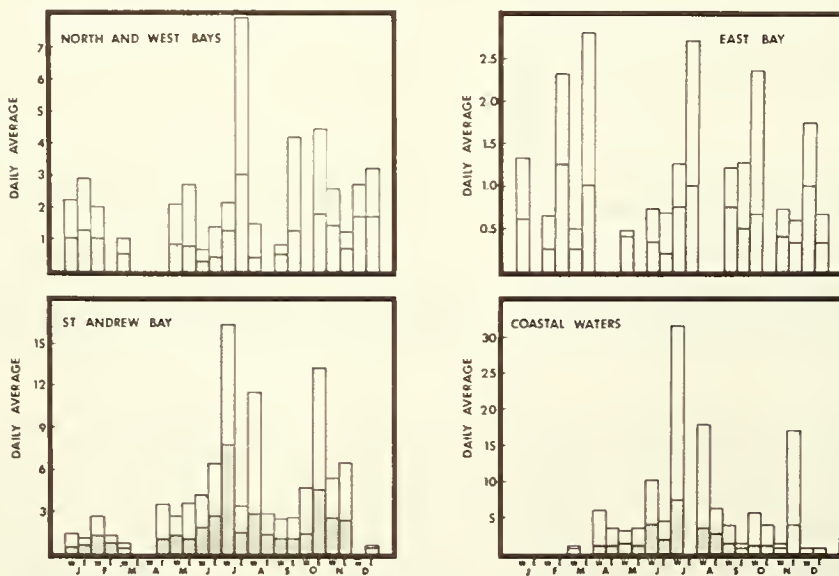


Figure 28.—Estimated average daily instantaneous numbers of commercial finfish fishing boats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973.

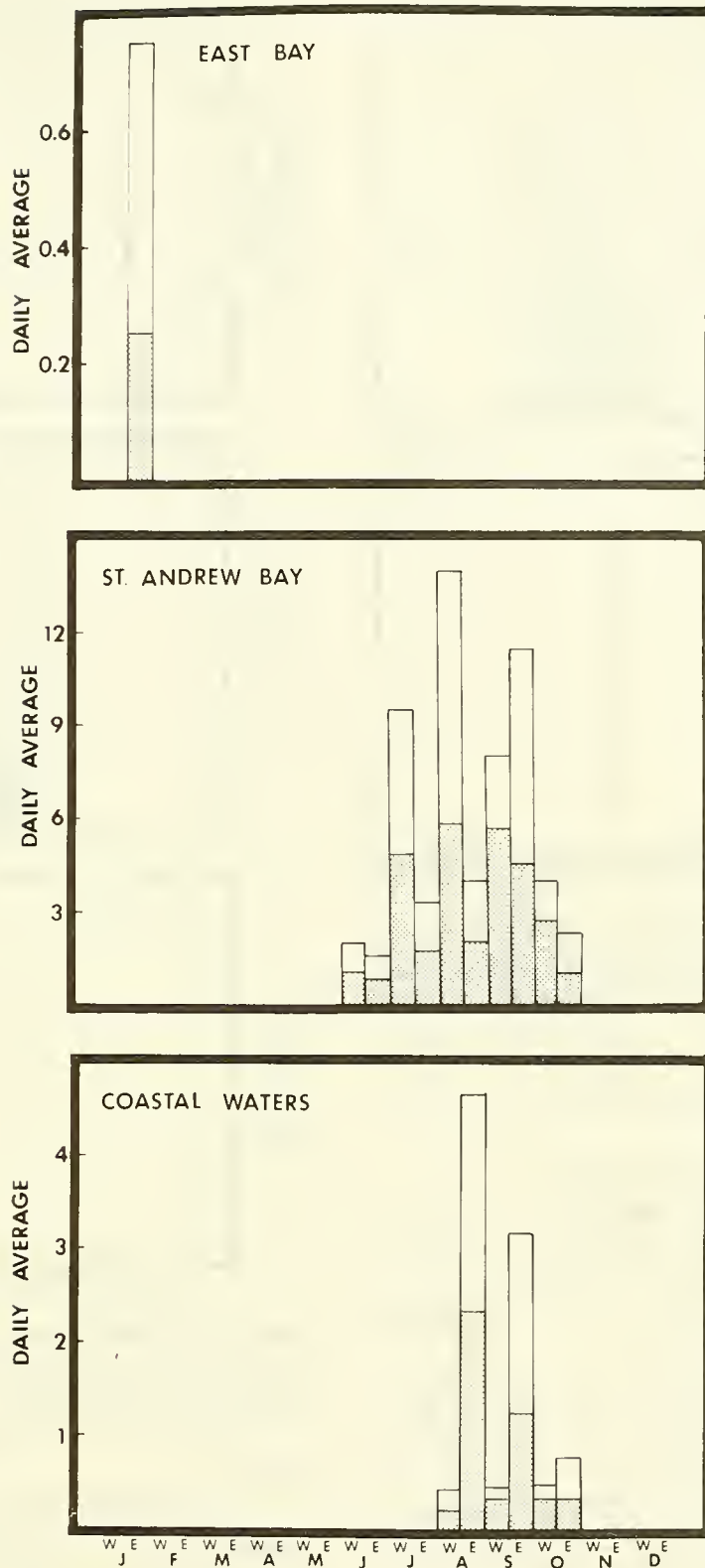


Figure 29.—Estimated average daily instantaneous numbers of transit commercial scallop fishermen (light) and boats (dark) by areas, weekdays (W), and weekend days (E) each month in 1973. None was observed in North and West Bays.

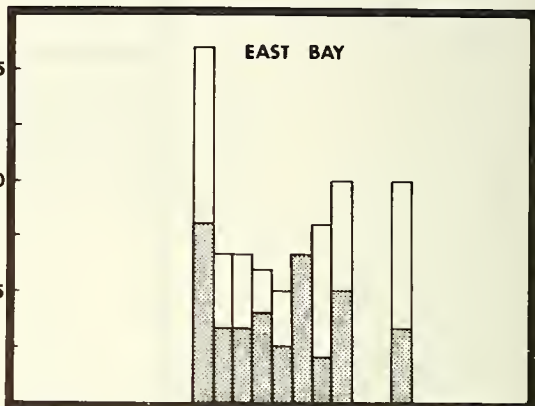
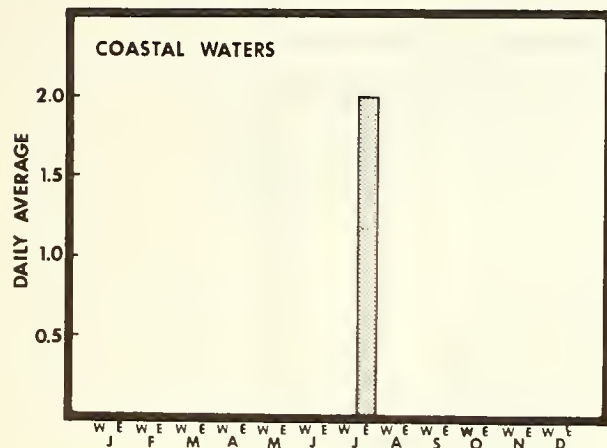
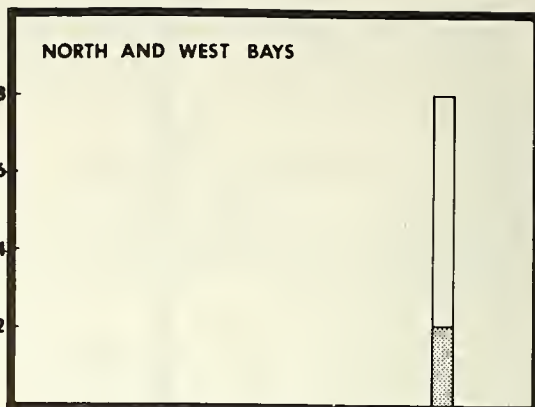
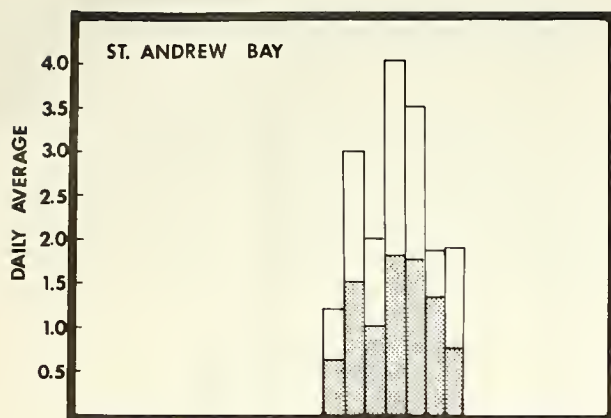


Figure 30.—Estimated average daily instantaneous numbers of transit commercial scallop fishing boats (dark) and occupants (light) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in North, West, and East Bays.

who helped conduct the survey: Dennis F. Anderson, Harold A. Brusher, Nelson L. May, David C. Muenzel, Leslie W. Touart, and W. Lee Trent.

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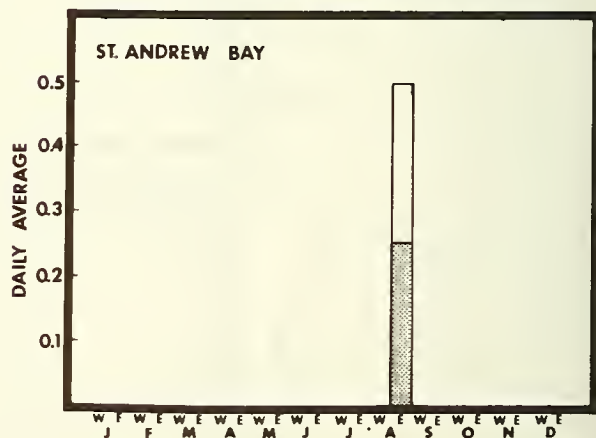


Figure 31.—Estimated average daily instantaneous numbers of commercial crab fishermen (light) and boats (dark) by areas, weekdays (W), and weekend-days (E) each month in 1973. None was observed in coastal waters.

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