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UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

COMMERCIAL FISHERIES RESEARCH AND DEVELOPMENT ACT

FINAL (Annual)
~~QUARTERLY~~ PROGRESS REPORT

State Texas

Sub-Project No. 2-12-R-1

Project Title An Evaluation of the Effects of Estuarine Engineering Projects

Sub-Project Title The Effects of Engineering Projects on Galveston Bay Estuaries

Period Covered April 25, 1966 - March 31, 1967

Prepared By Loy B. Johnson Jr. Date May 30, 1967

Approved By Tennent L. Leary Date MAY 31 1967

Statement of Project Accomplishment
(Instructions on reverse side)

The Texas Parks and Wildlife Department has contributed 100 per cent of the project costs and with funds new to the commercial fisheries research. The Bureau of Commercial Fisheries has agreed to reimburse the State for 75 per cent of the cost of the project.

(Continue on Additional Sheets)

INSTRUCTIONS FOR PREPARATION OF PROGRESS REPORTS

Reimbursement for costs of completed project work will be subject to the submission of satisfactory quarterly progress reports no later than 20 days following the close of a quarter.

Progress reports should be prepared as follows:

1. **SUB-PROJECT NO.: Indicate Bureau sub-project number.**

2. **PROJECT AND SUB-PROJECT TITLES: Titles should correspond with those on other project documents.**

3. **PERIOD COVERED: Indicate the quarter of the year covered by report.**

4. **PREPARED BY: Signature and title of principal investigator preparing report. Indicate date of preparation.**

5. **APPROVED BY: Signatures and title of project leader, coordinator, or other supervisory official. Indicate date of approval.**

6. **ABSTRACT: Summarize overall project accomplishments during the quarter covered by this report. In addition, indicate any problems encountered, progress in relation to time schedules, and recommendations for future work.**

7. **PHASE PROGRESS: Progress and accomplishments should be detailed for each phase of a research or development sub-project. Phase titles should correspond to those listed in the PS&E and Notice of Research or Development Project (Form 2-116b). Present complete results of research or development work, indicating procedures and techniques used, and recommendations useful to other researchers. Estimated phase completion dates should be indicated.**

8. **PUBLICATIONS: List all publications issued or in preparation, indicating titles, authors, publication media, and other pertinent data.**

Note: Quarterly reports on construction and coordination projects should adequately summarize progress and accomplishment only, inasmuch as a phase breakdown is not required on project documents.

The Effects of Engineering Projects on Galveston Bay Estuaries

Project: 2-12-R

Roy B. Johnson

The Effects of Engineering Projects on the Ecology of Jones Bay

INTRODUCTION

In 1962, construction was begun on the Texas City and Vicinity Hurricane Flood Protection Project, a program of the U. S. Corps of Engineers, which provided for a 16.2 mile-long earthen seawall along the western shoreline of Galveston Bay. This levee, with a maximum height of 23 feet above sea level, was designed to protect low areas from tidal flooding during storms.

In 1964, the Hitchcock Extension of the Hurricane Flood Protection was proposed, a plan consisting of an 11.4 mile-long levee to protect the city of Hitchcock and vicinity. A portion of this levee, if approved, will cross Jones Bay. Circulation in the bay will be provided by a closable tidal structure and culvert openings.

Work is being done prior to construction of the Hurricane Levee, and comparisons will be made during and following construction. The purpose of the study is to determine the effects of the Hurricane Levee on the fishery ecolc of the bay, so that procedures might be determined to minimize harmful effect in similar, future projects.

DESCRIPTION OF THE AREA

Jones Bay is located on the northeast end of West Bay, 5 miles west of Galveston, in Galveston County (Figure 1). It is 9 miles southwest of Bolivar Roads, the nearest pass to the Gulf of Mexico.

The bay is partially enclosed by Wilson Point, a marsh island, and a line of spoil islands along the Intracoastal Waterway. Average depth is approximately 3-4 feet, except for an oil well channel in the central bay (4-6 feet deep), and reefs, spoil deposits, and mud flats near Wilson Point and the Intracoastal Waterway, which are less than 3 feet deep. Major source of fresh water discharge are Basford Bayou and Highland Bayou.

Wilson Point and the lower portions of Basford Bayou and Highland Bayou are currently being developed into residential and resort housing areas (Figure 2).

METHODS

Gear used were a minnow seine (60 feet wide, with a mesh size of 3/4 inc stretched), a bar seine (6 feet wide, 1/2 inch mesh) and a drag seine (750 or 1,350 feet long, 2 inch mesh). Each gear type was pulled a standard distance to collect a sample. Other samples were collected with a modified Ekman Dred with a coring tube, and by hand.

Figure 1: Diagram of Jones Bay showing location of sampling stations.

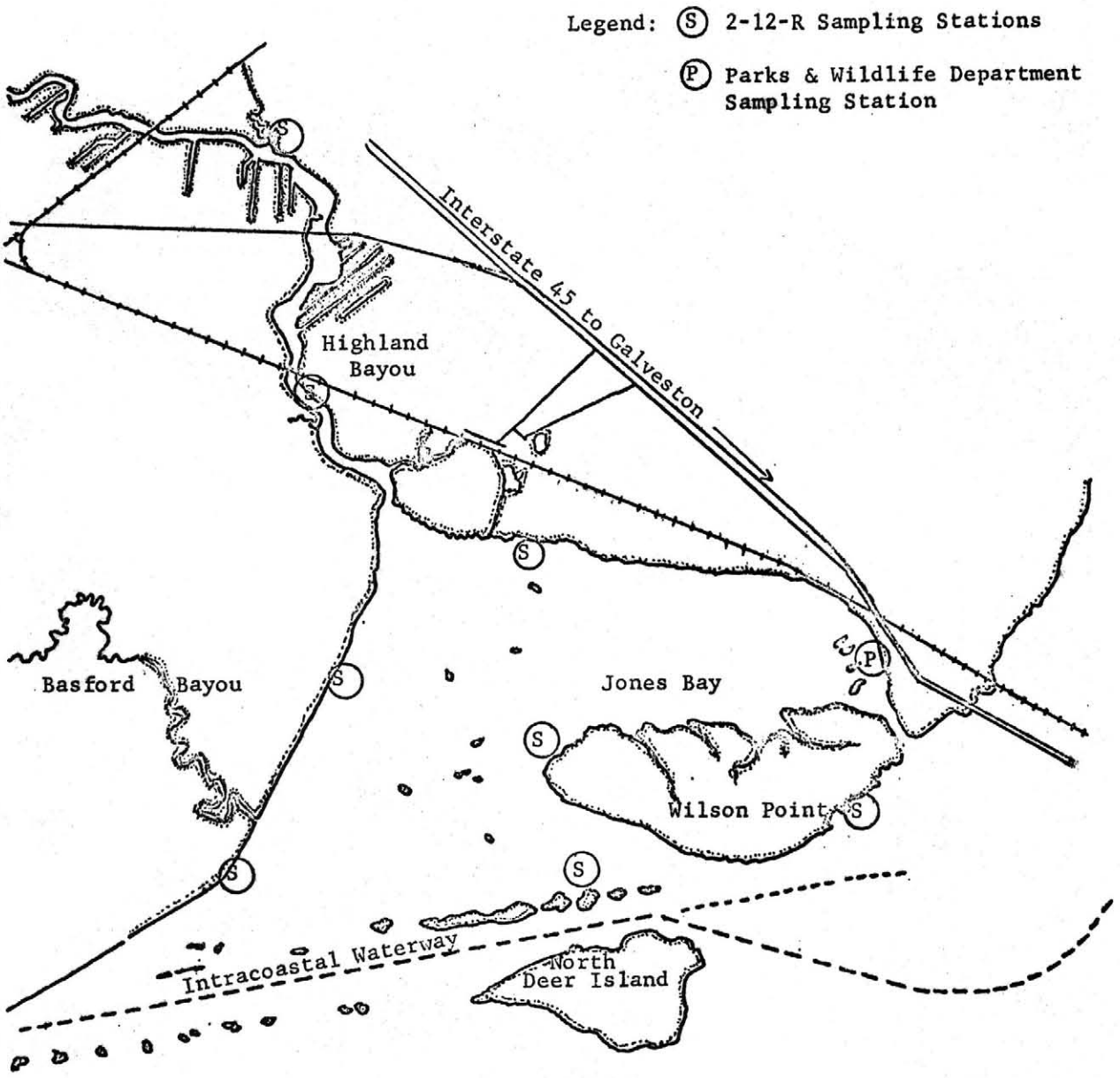
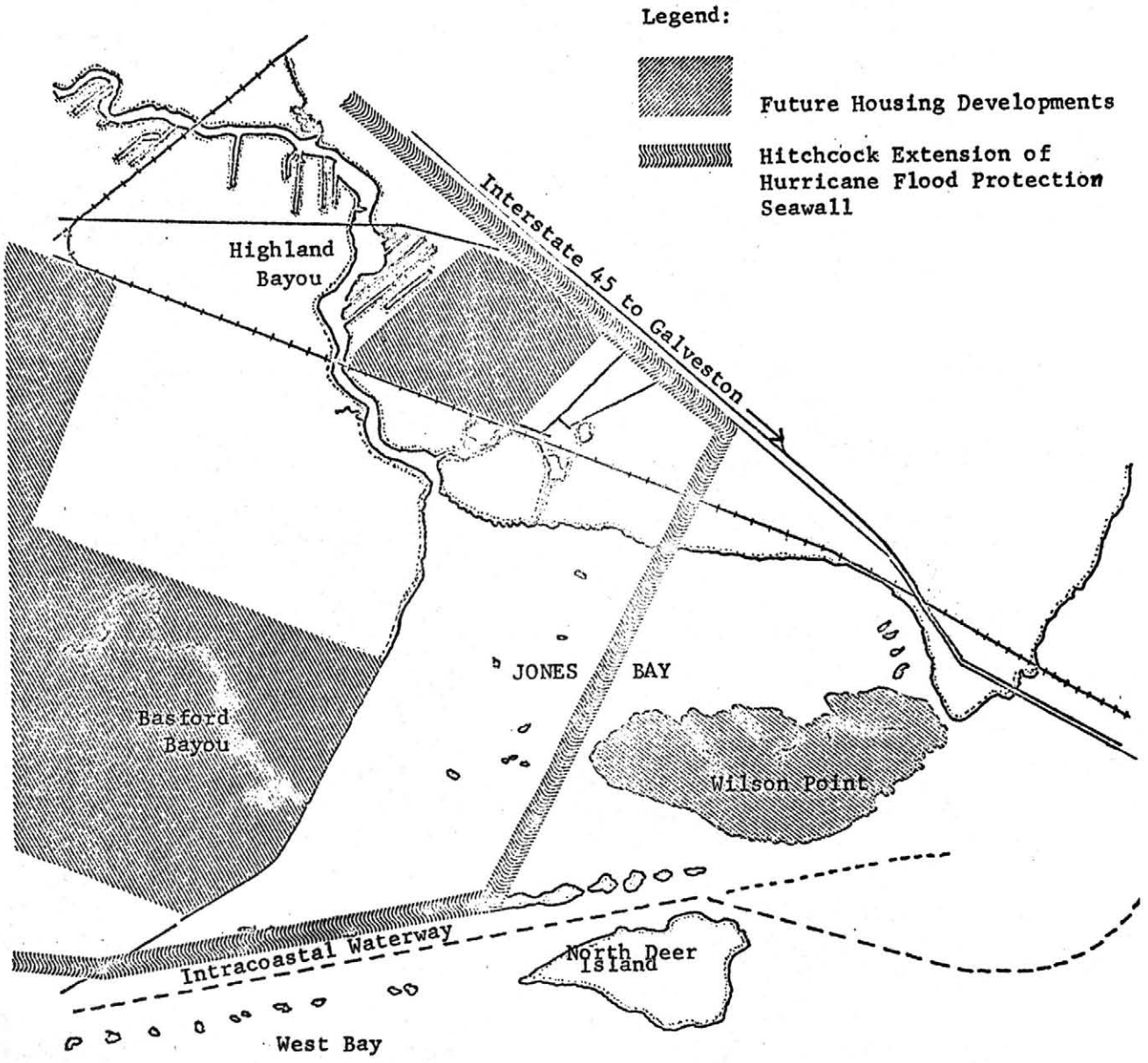


Figure 2: Diagram of Jones Bay indicating future modifications



Six seine stations and one bar seine station were sampled at least monthly, and two other bar seine stations were sampled through October. Random samples were collected in other areas throughout the year. Drag seine samples were collected at 2 regular stations and at random locations from May through November.

Sediment samples were collected with a bottom dredge and coring tube, and portions of dredge samples were dried and labelled for future reference and analysis. Surface water samples were collected for salinity and turbidity analysis. Salinity was determined using an American Optical Goldberg Refractometer. The refractive index was converted to salinity in parts per thousand. Turbidity was determined in per cent light transmission using a Bausch and Lomb colorimeter.

FINDINGS

Hydrographic Conditions

Average salinities from regular bay stations were low (10.3 - 13.6 ppt) in May and June, during a period of heavy rainfall, and increased steadily to 28.2 - 29.6 ppt in March, 1967 (Figure 3). Salinities in the bay varied 2 to 5 ppt between stations, depending upon diurnal tidal movement.

An average horizontal gradient of approximately 9 ppt existed between a station in Highland Bayou and a station near the Intracoastal Waterway from August to March. In October and March, however, salinities increased in Highland Bayou to 22.2 and 27.8 ppt respectively during high fall and spring tides, compared to salinities of 23.9 and 30.0 ppt near the Intracoastal Waterway.

Water temperatures ranged from less than 10.0°C. in January and February, to 34.0°C. in August. Average water temperatures recorded during field studies are shown in Figure 4.

Vegetation

Species of the green algae Caldophora and Enteromorpha were abundant from late fall to early spring. Maximum growth of these plants was associated with low tides, cool temperatures, and clear water (between cold fronts). Windrows of these algae were found along shorelines and on oyster reefs in February and March.

Sparse patches of shoal grass, Diplanthera wrightii, an important marine phanerogam in high salinity areas, were found along the northwest shore of the bay and near the south shore of Wilson Point and the Intracoastal spoil areas. Jones Bay appeared to be marginal for growth of this species, possibly due to low salinities. Widgeon grass, Ruppia maritima, was abundant in isolated low salinity marshed but was not found in the bay.

Marsh plants populated most of the shoreline of the bay, and were abundant in low marshes. Principal species were cord grass, Spartina alterniflora, salt grass, Distichlis spicata, and glasswort, Salicornia spp.

Figure 3: Average Salinities by Sampling Period, Jones Bay, April 1966 - March 1967.

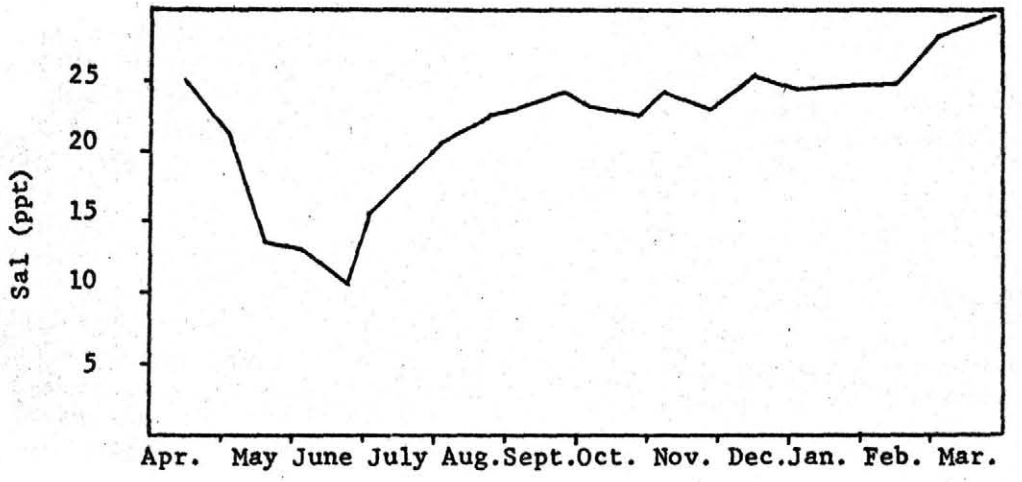
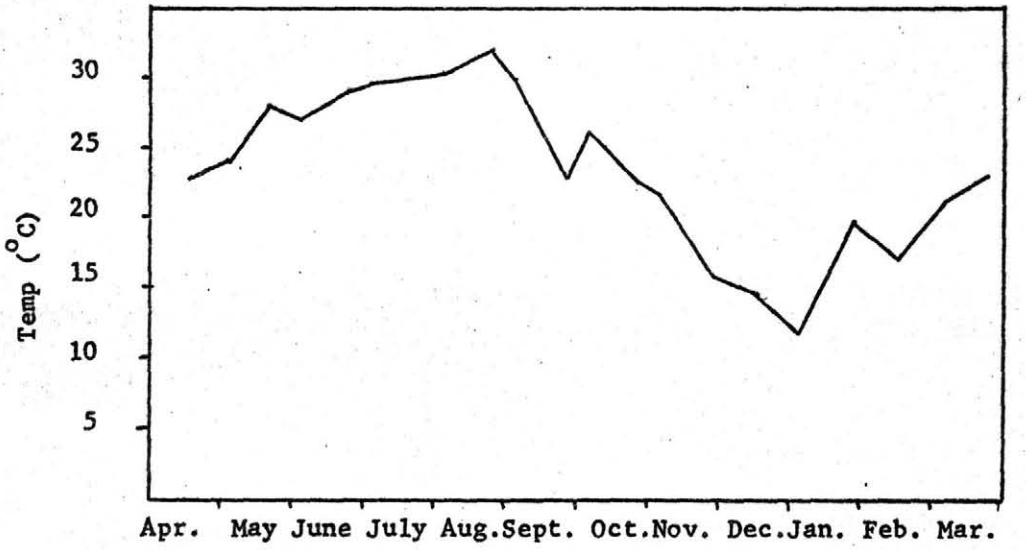


Figure 4: Average Surface Temperatures by Sampling Period, Jones Bay, April 1966 - March 1967.



Invertebrates

The relative abundance of major groups of organisms taken by minnow seine is presented in Table 1. Seasonal abundance of major species is shown in Figure 5.

Brown shrimp, Penaeus aztecus, were taken in moderate numbers from April to July. Small brown shrimp 20-30 mm were common in April and May, while larger juveniles were abundant through July. Maximum sizes were approximately 90 mm, however, most of the shrimp apparently left the bay before reaching this size.

White shrimp, P. setiferus, were collected in small numbers during July and August, and were abundant from September to November. Movement from inland nursery areas was suggested by the abundance of white shrimp (60-80 mm) near the months of bayous in late September and late October.

Grass shrimp, Palaemonetes pugio, an important forage species was extremely abundant in marshes, and shallow Spartina beds. During spring and summer, catches of thousands of grass shrimp in standard samples were common.

Blue crabs, Callinectes sapidus, were taken throughout the year in all salinities. Juveniles less than 20 mm were common only during April and October. In March 1967, numerous crabs from 25-60 mm were taken in the bay, in an apparent movement from marshes. Protected marshes served as nursery for juvenile crabs as well as habitat for adult crabs.

Oyster reefs were found throughout the bay and lower portions of Highland Bayou. Associated with reefs in the low salinity areas were the mussel, Congeria leucophaeta, and mud crabs, Eurpanopeus depressus. Stone crabs, Menippe mercenaria, Porcellanid crabs, Petrolistes armatus, and conchs, Thais haemastoma, were detected on higher salinity reefs near the Intracoastal Waterway.

Large specimens of the southern quahog, Mercenaria campechiensis, were collected along the Intracoastal and Wilson Point. None were found along bay margins influenced by drainages.

The pelecypods Mulinia lateralis, Ensis minor, Tagelus divisus, and Cyrtopleura coastata were common in the bay.

Fishes

Large numbers of juvenile redfish, Sciaenops ocellata, 75-200 mm total length, were present in samples in early spring and summer (Figure 6). They were collected in greatest abundance in sloughs on Wilson Point, an area generally representative of marsh areas surrounding the bay. A second year class, comparatively small, was detected during winter. Major feeding areas of older redfish appeared to be mouths of bayous and sloughs and shell reefs. The largest collection of larger redfish (354-450mm) was near the mouth of Basford Bayou in November.

Juvenile speckled seatrout, Cynoscion nebulosus (75-150 mm), were taken

Table 1: Summary of major groups of organisms collected by minnow seine from Jones Bay, April, 1966 - March 1967.

	Total Number	No./ Sampling Period
(A) Commercial Crustaceans		
Penaeus setiferus (White shrimp)	5,347	281.4
P. aztecus (Brown Shrimp)	1,775	93.4
Callinectes sapidus (Blue crab)	428	22.5
Total	7,550	
(B) Year Class 0 Food and Game Fish		
Sciaenops ocellata (Redfish)	66	3.5
Cynoscion nebulosus (Speckled seatrout)	43	2.3
Paralichthys lethostigma (Southern flounder)	31	1.6
Pogonias cromis (Black drum)	17	0.7
Total	157	
(C) Major Forage and Other Fish Species		
Brevoortia patronus (Largescale menhaden)	1,978	104.1
Micropogon undulatus (Atlantic croaker)	1,029	54.2
Leiostomus xanthurus (Spot)	814	42.8
Mugil spp. (Mullet)	409	21.5
Fundulus grandis (Gulf killifish)	180	9.5
Galeichthys felis (Sea catfish)	114	6.0
Cyprinodon variegatus (Sheepshead minnow)	101	5.3
Lagodon rhomboides (Pinfish)	69	3.6
Spaeroides nephelus (Southern puffer)	57	3.0
Bairdiella chrysura (Silver perch)	43	2.3
Citharichthys spilopterus (Spotfin whiff)	33	1.7
Fundulus similis (longnose killifish)	31	1.6
Total	4,858	

Figure 5: Seasonal abundance of major species taken in minnow seine (ave. no./month), Jones Bay, April 1966 - March 1967.

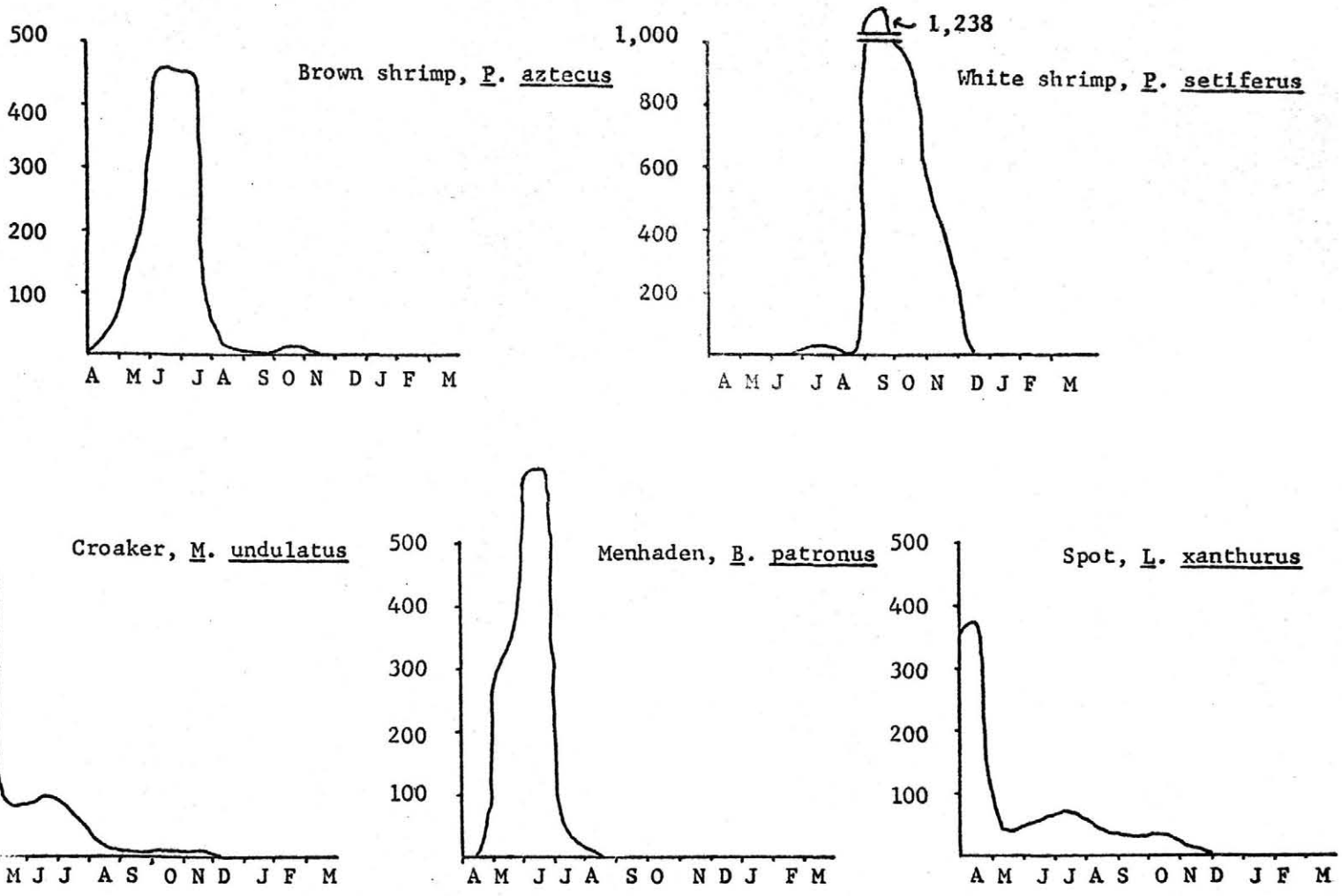
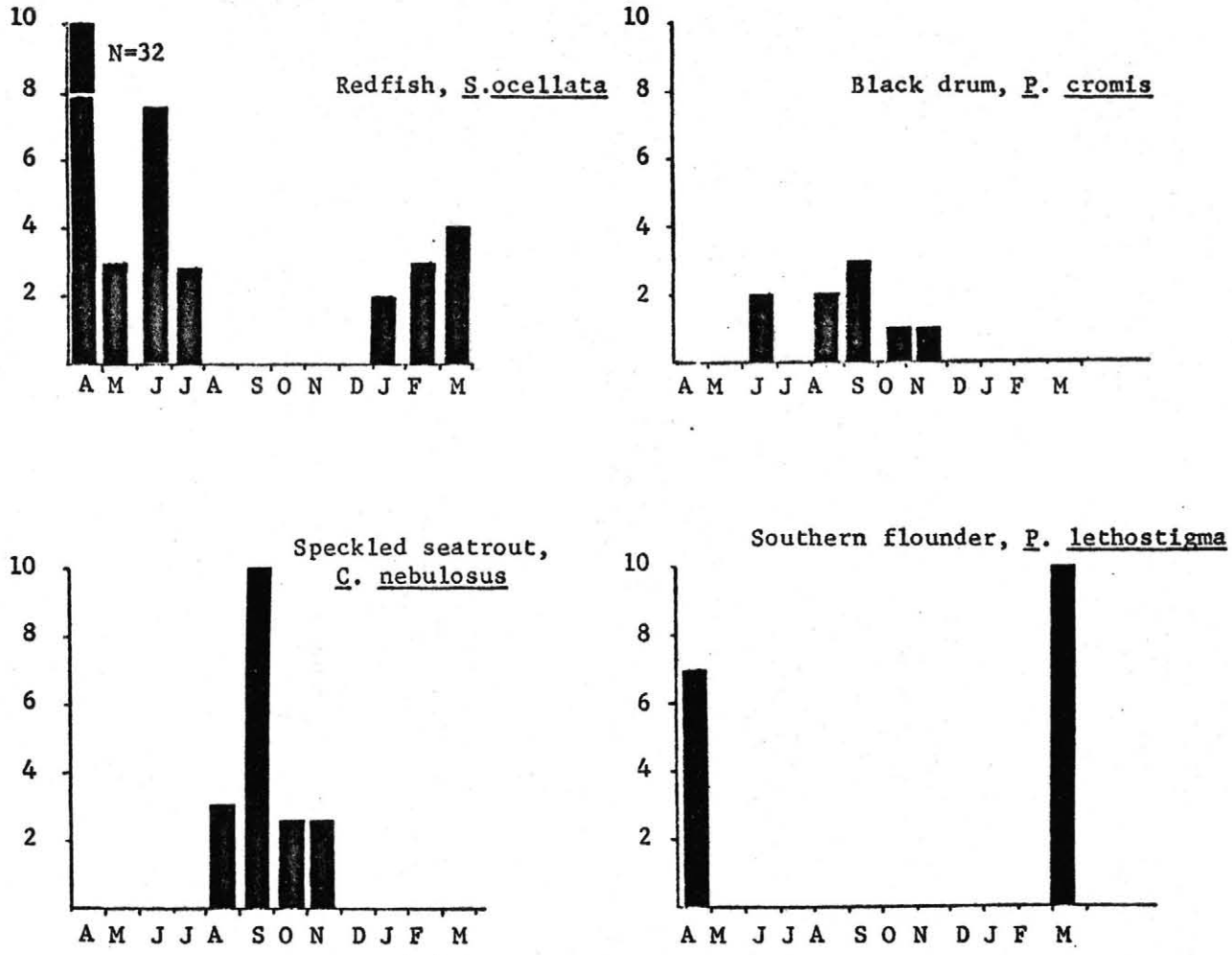


Figure 6: Seasonal occurrence of juvenile good and game fish (ave. no./period), Jones Bay, April 1966 - March 1967.



in summer and fall. Catches of larger seatrout (230-330 mm) were made in the bay in June. Older seatrout were not regularly caught, but were observed in sport catches.

Juvenile flounder, Paralichthys lethostigma, were taken in samples during early spring, and were, as in the case of redfish and seatrout, particularly common in marshes. Juvenile black drum, Pogonias cromis, were present in samples in summer and fall, but were not abundant, probably due to the fact that they occupied areas further inland than those sampled. Large numbers of black drum from 150 to 225 mm were taken in drag seine samples in the bay in November.

Largescale menhaden, Brevoortia patronus, Atlantic croaker, Micropogon undulatus, spot, Leiostomus xanthurus, and striped mullet, Mugil cephalus, were the most abundant fish collected (Table 1), and were present throughout the estuary in all salinities. Of these, menhaden and mullet are considered important food items of sport and commercial fish. Cyprinodontes, also important food organisms, were collected and observed in large numbers in the bay and drainage areas. The most common of these were the sheepshead minnow, Cyprinodon variegatus, and the Gulf killifish, Fundulus grandis.

Other species commonly taken were the sea catfish, Galeichthyes felis, pinfish, Lagodon rhomboides, and puffers, Sphaeroides nephelus.

RECOMMENDATIONS FOR FUTURE STUDY

It is recommended that present procedures be continued, and that further surveys be made to determine the occurrence of fishery species in the major watersheds which will be affected by construction of the Hurricane Protection Levee.

Because channel dredging will increase in the future, it would be of value to determine the role of these channels on the fishery ecology of the bay.