

JOB REPORT

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Project Name: Basic Resurvey of the Upper Laguna Madre

Period Covered: April 1, 1958 - June 14, 1959 Job No. A-2

Resurvey of the Macroscopic Flora and Fauna of the Upper Laguna Madre

Objectives: To determine changes in an enclosed bay under reduced salinity conditions.

During most of the period from 1951 to 1956 the upper Laguna Madre was strongly influenced by drouth conditions which prevailed over the entire state. Reports were prepared showing what conditions prevailed during this period of low rainfall. This drouth was alleviated by heavy rainfall in 1957 and 1958 and by March, 1958 the area under discussion was no longer hypersaline. The present resurvey was initiated in order to determine the magnitude of change in physical conditions and the effect of these changes on the flora and fauna of the region. It is not intended to be as comprehensive as the previous survey but rather to lay down a foundation for more specialized projects. However any other future projects should be supplimented by a continuation of the basic survey at least on a minor scale.

Physical Changes in the Environment.

Salinity checks were made at the same stations used in 1951-56 and on the same scale, that is, once monthly whenever possible. These data are condensed in Fig. I. A graph has been prepared showing the high, low and mean salinity by month during 1953 and 1958-9 (Fig. II). It is apparent that hypersalinity returns quickly to the lagoon during periods of high temperature in spite of early heavy rainfall. However, it is equally apparent that conditions do not remain critical for as long a period and that the mean for the year is greatly reduced. Of particular interest is the fact that hypersalinity in 1958 did not originate in Baffin Bay as in 1951-6. It originated instead on the large shallow flats east of the Intracoastal Waterway - from Intracoastal Marker 83 to Marker 139 and on the flats east of the landcut, Fig. III.

Analyses of bottom and top water showed that there was little striation of salinity at the regular stations but that such striation did occur in the Intracoastal Waterway (Fig. IV). There is still strong evidence that the bar near Marker 83 and the basin north of it play effective roles in providing barriers to mixing of water from Corpus Christi Bay and that which might be termed "indigenous" to the Laguna Madre. It would appear that the hypersaline water from the flats flowed northwestward into basins and canals and sank until it completely filled

the areas south of Marker 83. There is evidence of some mixing of these waters between Marker 27 and 87 with the greatest amount near Marker 27 but decreasing southward. Certain differences appeared in the structure of the water outside the canal and north of Marker 87. Stations on the east side of the canal (26, 28, 29, 31) often had higher salinity than did those on the west side. (25, 27, 30). This might be interpreted as the reduction of circulation by solid spoil banks on the east side.

Water temperature ranged from 2-35 degrees centigrade during the year and several minor kills of fish and vegetation occurred.

#### CHANGES IN FLORA AND FAUNA

##### Flora

As was shown in the 1956 report there is a definite extension of range for various angiosperms during the periods of optimum conditions for each species. This occurred in 1958 and 1959 when Ruppia maritima became abundant on flats and along channels and present in very narrow fringes as far south as the Point of Rocks. However, in spite of heavy seeding in 1958 much of the lagoon remained devoid of angiosperms during the spring of 1959. It appears that factors other than salinity and temperature are operative in restricting expansion of range of this type vegetation. As usual, Diplanthera wrightii succeeded Ruppia maritima as the water temperature rose.

Several alga became abundant in the upper reaches of the lagoon apparently as a direct result of reduced salinity although nutrient conditions may have improved during periods of heavy runoff. These algae include Gracillaria blogetti, Hypnia musciformis, Digenia simplex and Cladophora fascicularis.

Acetabularia crenulata, though abundant in spots, did not appear to have increased its biomass greatly in 1958-9. Certain blue green algae, such as Anabema majoralis was found to occur in high concentrations in high salinity water but it was probably present in the previous survey and not observed.

#### FAUNAL COMPONENTS

##### CHECK LIST OF SPECIES ADDED SINCE PREVIOUS SURVEY

##### Invertebrates

Several invertebrate species were discovered which were not found during hypersaline periods, and some of these must have moved into the area as a direct result of lowered salinities. Newly discovered macroscopic species are listed with no attempt to separate them below phylum.

##### Phylum Coelenterata

Bougainvillia niobe Mayer was collected as it entered the Laguna Madre from either end. It was most abundant from January through April. Identification was by Dr. C.E. Cutress of the United States National

Museum. The hydroid form was frequently taken along with vegetation in set gill nets particularly at Station 30.

Dactylometra quinquecirrha - often very abundant.

#### Phylum Nemertea

Nemerteans have become much more abundant but identification has been difficult.

#### Phylum Annulata

All species were identified by Dr. Olga Hartman. At least two of the three listed appear to have displaced Nereis palagica occidentalis during the period of low salinity.

Haploscoplos fragilis Stimpson. This species was found in clay lumps near Station 30 and in the piling habitat.

Heteromastus filiformis (Claparede). One only, found in clay lumps near station 30.

Arenicola cristata Stimpson. The first notice of this species in the upper Laguna Madre was in May, 1959 when an individual 10 centimeters long was found under an old box in the water. This large individual apparently divided or separated to produce a smaller one which grew rapidly and began moving about in one hour. In June, 1959 information arrived from the Smithsonian Institution that one small specimen was included in a batch from the clay lumps. Subsequent searches indicated that the species may be widespread. However, the small form produced by division in no way resembled the individual from the clay lump.

#### Phylum Arthropoda

Several zooplanktonic forms were noted but identification is incomplete.

Parasitic copepods became much more numerous and included the following species not previously reported.

Argulus sp. This was abundant in the mouth of mullets and was identified by Dr. Thomas E. Bowman, Smithsonian Institution, who states that it is possibly a new species.

Charopinus sp. (nov.?) embedded in gular region of black drum. Listed by Dr. Bowman as almost certainly a new species.

Lepeophtheirus sp. This was found commonly on the surface of Paralichthys lethostigma and was identified by Dr. Bowman.

Caligus latifrons.

Brachiella gulosa

Both of these species were taken from the gular region of Sciaenops

ocellata and were identified by Dr. David Causey of the University of Arkansas.

Amphipods were found to be very numerous in dead vegetation along the shoreline. Several have been identified but there are doubtless several other forms present. The number of species present is a distinct change from the 1951-6 period. Dr. Bowman identified the first four species.

Grubia filosa was taken near Pita Island in numbers. Grubia sp. was found on the shore near Station 30.

Corophium sp. was found near Station 30 in September, 1958.

One identified member of the Family Talitridae was found at this same station.

Amphithoe rubricata was very abundant under vegetation.

Erichsonella attenuata

E. filiformis

Both species were found near Pita Island in May, 1958.

Numerous individuals of the Order Mysidacea were found but have not been keyed. Of the isopods only Sphaeroma quadrientatum was found to be new to the area although the incidence of Nerocila accumulata increased sharply during periods of low salinity.

Hippolyte sp. was the only new shrimp found but it was relatively abundant near Pita Island.

Members of the Family Paguridea became very abundant and apparently entered from Corpus Christi Bay.

Several different species of mud crabs were found and there was evidence of succession from 1951-6. Different forms found included:

Eurypanopeus depressus

Panopeus herbstii.

Menippe mercenaria. Small ones only but very abundant.

Petrolisthes armata. This species was not rare but was restricted in its habitat to places where rocks or boards offered shelter.

Sesarma cinereum. One only was found, under a board near the boat house.

Squilla empusa. Only a few taken.

## Phylum Mollusca

Few species were added but differences in the habitat of the two dominant forms, Mulinia lateralis and Anomolocardia cuneimeris, were noted. During periods of low salinity both forms moved up onto the sandy points of spoil areas where they congregated in masses. As salinity increased they moved back into the vegetated basins and became more scattered. Except for the masses on the spoils the number of individuals declined greatly. Different forms listed include:

Cyrtopleura costata L. This was found only near the edge of channels about 10 inches under hard sand bottom but was present throughout the year.

Ensis minor. One only was found at the edge of the Intracoastal Canal on March 16, 1959. Salinity was then 29.0 o/oo.

Brachidontes existus (L.). This species became abundant on pilings as far south as station 30 was disappeared at salinity above 40.0 o/oo.

Crassostrea virginica. Oysters were observed in a few scattered spots such as the boat basin at Red's Fish Camp.

Modiolus sp. One only, found near Pita Island in May, 1958.

Loligo brevis. Squid, in April, 1959, became almost as abundant as shrimp.

## Phylum Chaetognatha

Arrow worms were noted in several plankton samples.

## Phylum Bryozoa

Encrusting bryozoa became very abundant on everything sessile and on some things non-sessile. They were found throughout the area during periods of low salinity and may have been "seeded" from blue crabs.

## Phylum Brachipoda

Brachiopods were found to be numerous in grassy areas but scarce in non-vegetated areas. Some of these have been collected and are being studied by personnel of the Institute of Marine Science.

## Phylum Chordata

Two species of Ascidiaria were collected at salinities of 20-35 o/oo on the grass flats and attached to pilings.

## CLASS PISCES

No attempt has been made to separate by family the new fishes listed, as it is not deemed necessary for this portion of the report.

Adinia multifasciatus - This killifish became locally abundant from the causeway to Marker 51.

Hippocampus (zosterea) - Only one was found in 1958, near Tyler's Basin, but many were reported from the Intracoastal Waterway in April, 1959.

Micrognathus crinigerus - Three were taken in Tyler's Basin in May, 1958.

Polydactylus octonemus - This species became very abundant, especially in the landcut.

Centropomus undecimalis - Individuals up to 350 mm. were found in October, 1958 near Pennescal Point. Year Class 0 (40-75 mm) fish were killed by a freeze in December, 1958.

Chasmodes bosquianus. The striped blemy occurred infrequently in samples taken near Pita Island.

Rissola marginata - Specimens were frequently taken in trawling operations near the causeway.

Ogilbia sp. - This followed the pattern of the above species.

Citharichthys macrops - A few specimens were obtained from Tyler's Basin in April, 1958.

#### CHANGES IN COMPOSITION OF MAJOR SPECIES.

A few species found in 1951-6 were not found in 1958-9. These included Nereis pelagica occidentalis, Polydora ligni and Bagre marina. There were also considerable changes in the composition of the major fauna. The upper Laguna Madre in its changed conditions was at times physically similar to an area near a Gulf pass. Of course there were still fewer Gulf species than would be found in an area such as Little Redfish Bay. There was, however, a trend against extreme sizes and concentrations and toward smaller individuals and more species. Observations, both in 1951-6 and 1958-9 indicate that the length of time a body of water is hypersaline may govern its populations to a large extent. Examples of this are the extremely heavy spawning of trout, the appearance of very small sheepshead, and the spread of molluscs in 1959 (second year of low salinity) instead of 1958. It is possible that one of the major affects of a pass into the Laguna Madre would be similar to that achieved by several years of reduced salinity. There would probably be changes in the time of imigration and emigration). Some of the changes in concentrations of fish are discussed briefly.

Pogonias cromis - Populations of black drum were so reduced that the only centers of abundance were on the east flats and at scattered locations in Baffin Bay. These populations appeared to be 50 percent or less of those in hypersaline years. Apparently it is no coincidence that drum tag returns have been coming from further afield and that

extra large schools of drum appeared in the Gulf at times when over-populations were normally present in the Laguna Madre. Heavy spawning, however, indicates that this effect may be temporary.

Cynoscion nebulosus - Net catches and sports fishermen catches indicate that there has been an increase in the number of moderate size trout (350-450 mm.) and a reduction in the catch of trout over 650 mm. long. The average size now appears to be near that of fish from Aransas Bay. The total trout biomass is probably greater than in 1951-6.

Sciaenops ocellata - Larger redfish have been little affected by the changes in salinity but there may be a decline in the future. This statement is based on the fact that the normal large schools of Year Class 0 redfish did not appear in the lagoon in 1958 or 1959. This is spite of the fact that there was evidence from other bays that spawning was successful in the Gulf boat years.

Micropogon undulatus - Croakers were reduced in number throughout the year in every area except near Yarbrough Pass. This latter area appears to be affected somewhat by the nearness of Pass Mansfield.

Paralichthys lethostigma - There has been a very real increase in numbers of flounder, possibly ten-fold over 1951-6.

Galeichthys felis - Catfish have increased their numbers enormously and are of definite nuisance scope to fishermen.

Lagodon rhomboides - There has been about a two-fold increase in populations of pinfish, probably coincidental with the increase in plant biomass.

Anchoa mitchilli - This species has almost completely displaced A. hepsetus.

Callinectes sapidus - The increased population of blue crabs has been startling. There was about a ten-fold increase in 1958 and at least a four-fold increase in 1959, over 1951-6. Spawning may have taken place in the lagoon but probably most of the breeding couples observed migrated out of the area.

Attempts were made to evaluate standing crops of fishes by using standard five minute tows with a ten foot otter trawl. Unfortunately, the boards used were too small and the net spread varied with current, depth, winds and bottom type. No truly comparable data could be obtained but there was enough to indicate entirely different composition of fauna in the two halves of the upper Laguna Madre.

#### SUMMARY

A resurvey of the Upper Laguna Madre in 1958-9 showed that the mean annual salinity for all stations had been reduced from 51.0 o/oo in 1953

to 33.0 o/oo. Such hypersalinity as did occur in 1958 originated, not in Baffin Bay as in 1951-6, but on the very shallow east flats. Little salinity striation was noted at the regular stations but it was evident in portions of the Intracoastal Waterway. There was often a horizontal striation of salinity with a fairly sharp dividing point near Marker 83.

Water temperature varied from 2-35 degrees centigrade and several minor fish kills occurred. Fish entered the lagoon at a later date than usual probably because of the severe winter.

During this period of lower salinity few additional fish species appeared but about 15 different invertebrates were noted and there was apparent succession of species. There was a sharp increase in the number of flounder, pinfish, small trout, and blue crabs and equally sharp decreases in the number of black drum, larger trout, and small redfish.

Vegetation extended its range only slightly over previously noted extensions, but exceptionally heavy concentrations of Ruppia maritima were noted. Red and green algae became very abundant.

There was an overall increase in plant biomass but probably a decrease in fish biomass, the difference possibly being taken up by invertebrates. Factors other than salinity and temperature are governing distribution of vegetation. The upper Laguna Madre consists of two separate entities, the first being the vegetated areas north of Marker 83 and the second being south of this point.

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Date Approved

9 Sept. 1959



FIGURE I

Salinity by Stations During Year 1958-59  
Readings in ‰

Date	25	26	27	28	29	30	31	32	34	35	36	37
	Stations											
April, 1958	26.0	26.0						35.5	39.5	45.0	45.0	28.5
May, 1958	45.0	44.7					47.5	45.0	41.8	46.0	46.0	38.5
June, 1958	44.0	47.4	44.4	47.5	46.0	44.0	45.1	41.9	41.8	46.0	46.0	43.7
July, 1958	41.9	44.7	42.5	44.5	43.8	41.9	45.6	41.9	39.7	44.1	44.3	41.0
Aug., 1958	49.3	49.4	51.9	49.4	51.4	50.9	51.6	47.8	47.9	44.9	49.1	49.0
Sept., 1958	31.0	34.0	32.0	37.5	41.0	42.4	43.8	46.8	47.8	750	750	48.0
Oct., 1958	26.3	26.1	27.0	22.4	28.4	28.5	28.5	28.5	36.4	32.1	39.4	39.0
	26.5B	26.1B	27.0B	23.8B	28.7B	28.9B	28.8B	28.5B	36.5B	33.3B	39.4B	39.1B
Nov., 1958	27.5	25.3	29.0	27.0	30.0	30.5	30.5	31.3	31.5	31.5	30.0	26.5
Dec., 1958	25.8	24.5	26.0	24.5	28.0	28.0	28.5	28.8	30.5	29.8	30.0	30.5
Jan., 1959	21.9	21.3	21.4	21.2	22.7	23.5	22.0	22.3	23.1	23.6	23.8	22.9
Feb., 1959	21.9	21.2	16.0*	21.4	20.3*	21.0	19.7*	19.6	21.0	19.4	19.9	20.6
March, 1959	25.9	27.0	25.6	27.4	26.7	25.6	25.3	25.3	25.3	26.0	25.8	26.2
April, 1959	27.2	27.9	25.9	27.2	26.9	28.0	27.4	26.2	27.4	26.8	27.4	27.6
May, 1959	29.7	32.2	29.9	31.8	31.0	30.3	31.4	30.8	32.0	33.2	33.0	33.7

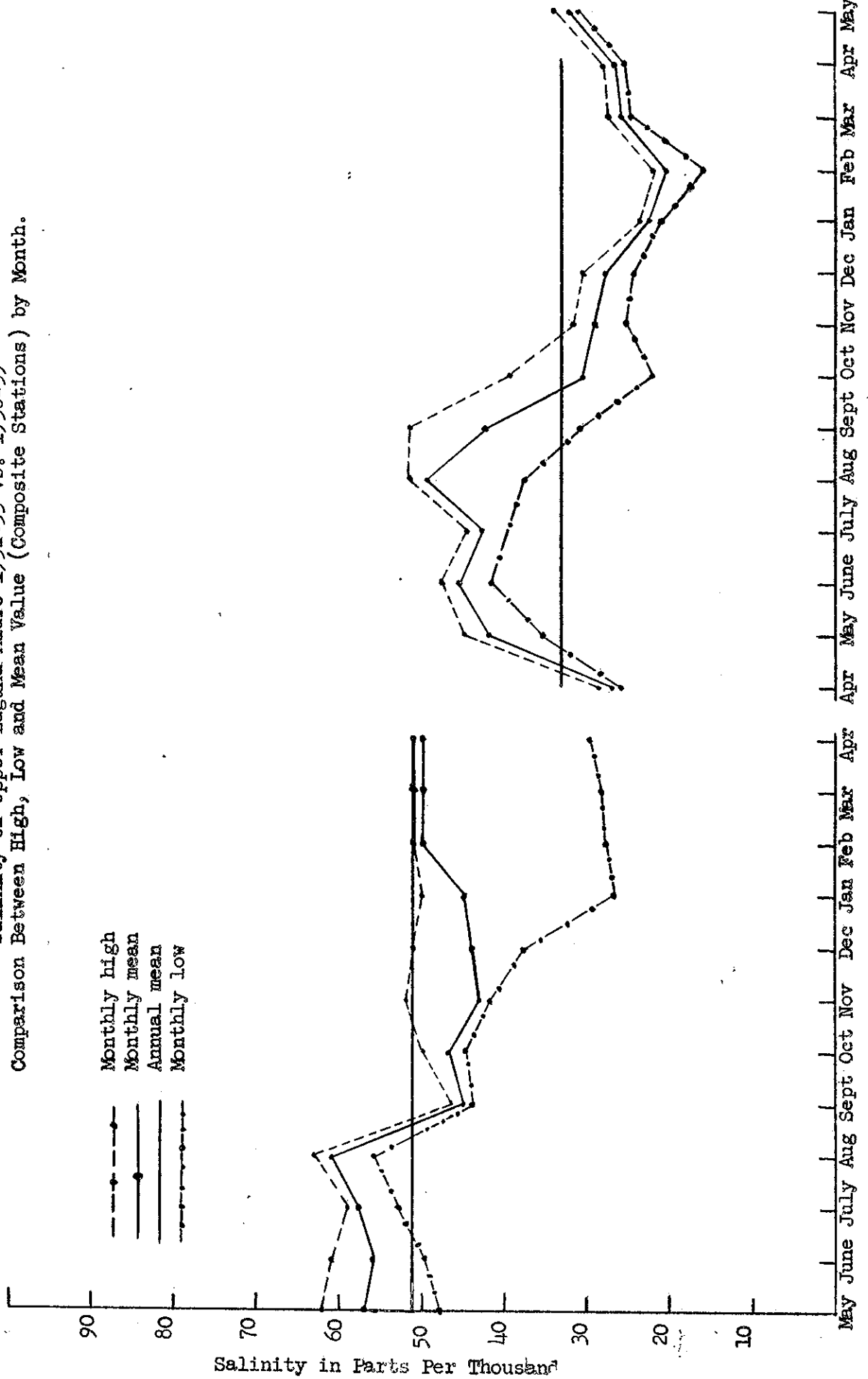
Special Salinities

Date	MK17	MK27	M37	M47	M57	M67	M77	M87	M97	M107	M117	
	Stations											
Aug., 1958		37.1	38.9	42.5	51.5	51.0	51.1	50.8	51.8	49.1	47.5	46.7
July, 1958	35.5	36.0S	32.8	32.5	35.0	33.0	35.0	40.0	44.0	46.8	46.8	750
	37.0B	36.8B	32.8B	36.0B	37.8B	41.0B	41.0B	41.0B	46.0B	48.0B	750	

B - Denotes bottom samples.

\* - Sample taken during rain - probably does not represent true salinity

FIGURE II  
 Salinity of Upper Laguna Madre 1952-53 vs. 1958-59  
 Comparison Between High, Low and Mean Value (Composite Stations) by Month.



1952-3

1958-9

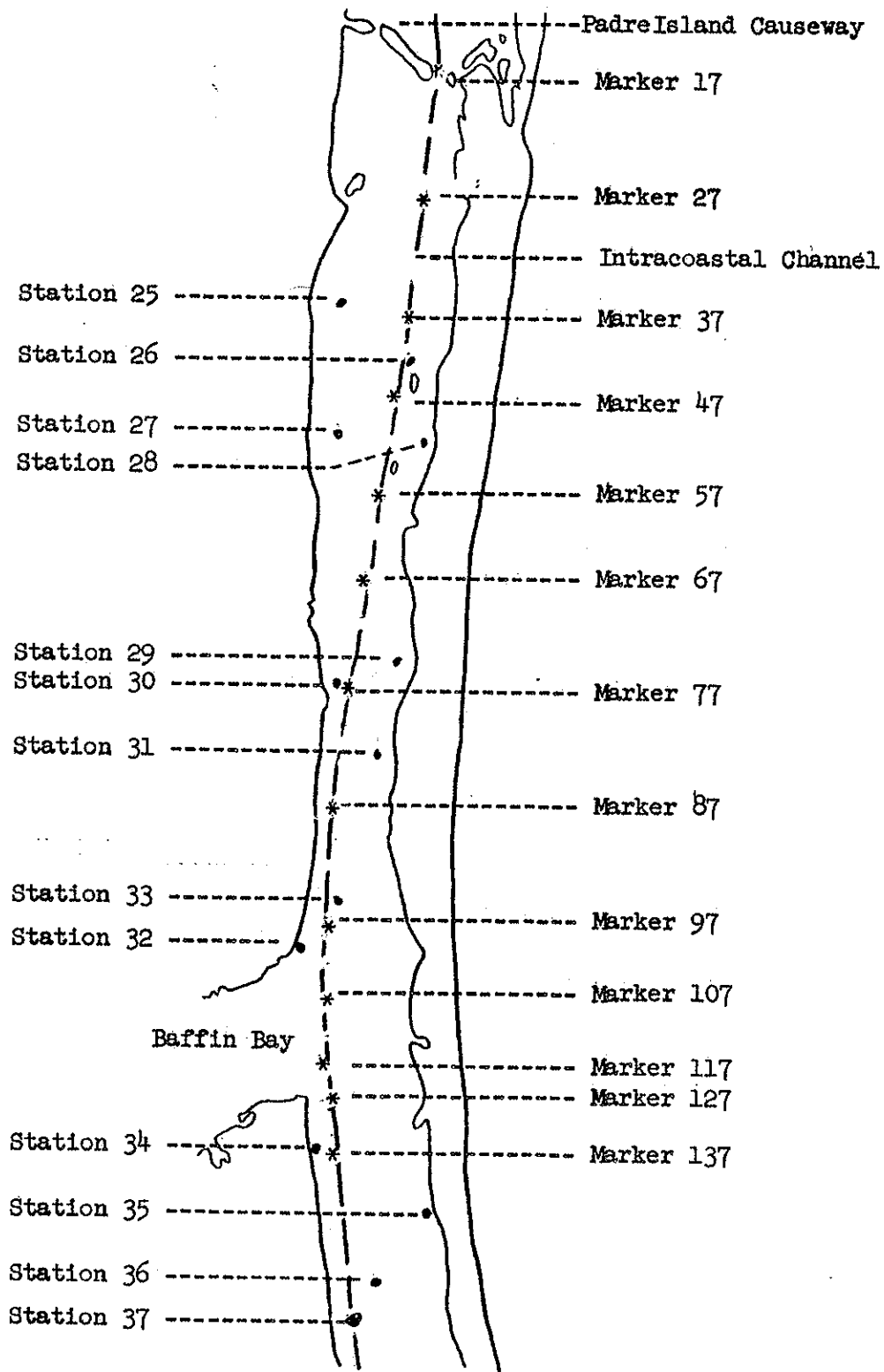


Figure III

Station Locations in Reference to Intracoastal Waterway Markers

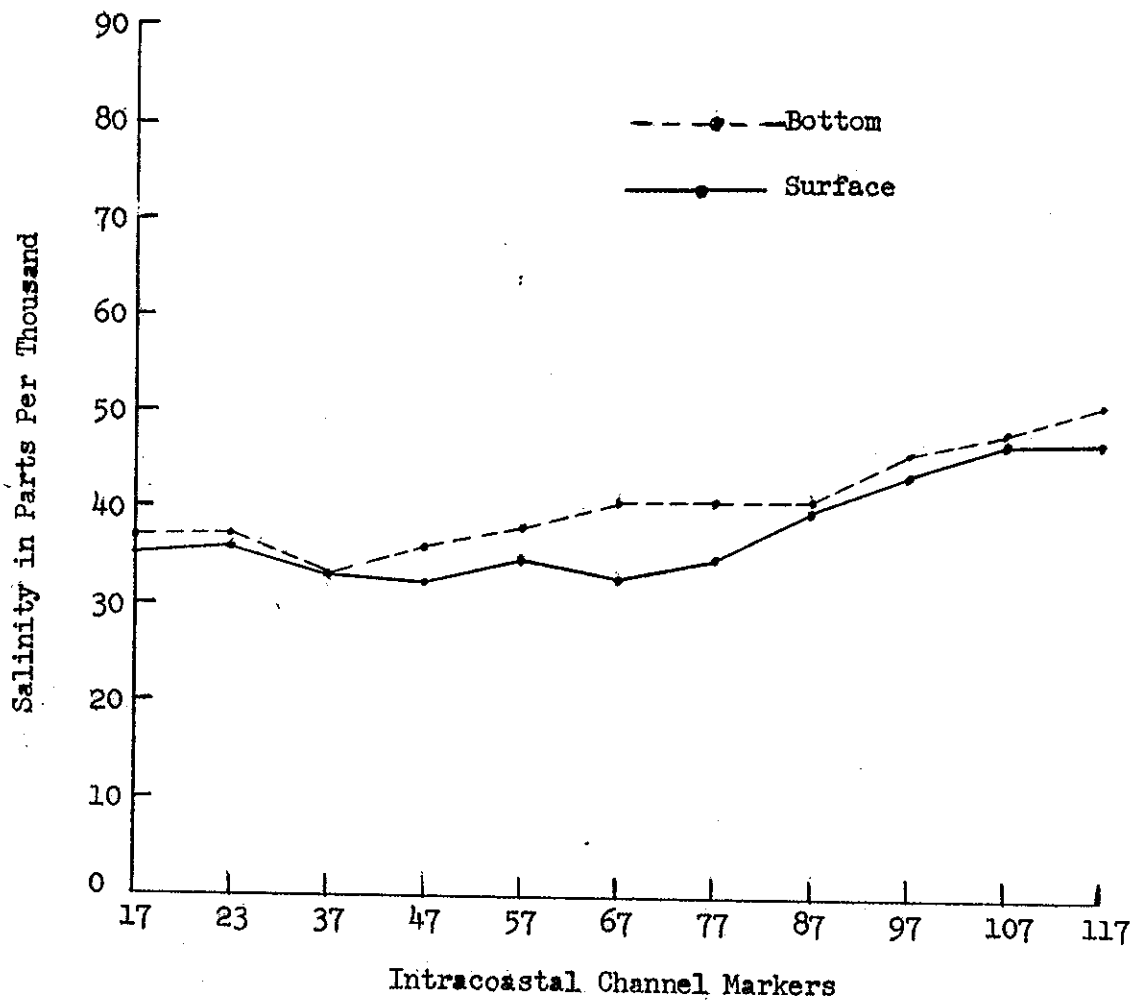


FIGURE IV

Comparison of Surface and Bottom Salinity in Intracoastal Waterway, July, 1958.