

JOB COMPLETION REPORT

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Field Assistant

Project No. MO-1-R-2 Date 31 July 1960
Project Name: Oyster Investigations, Area MO-1.
Period Covered: 1 July 1959 to 30 June 1960. Job No. D - 3

Changes in the Profile of the Gulf Beach

Objectives: To plot the relief of the Gulf beach and of the sandbars immediately offshore. To examine this area as a habitat for bottom organisms.

Procedures: Soundings are being made at intervals along two piers projecting into the Gulf of Mexico (Figure I). These soundings are repeated after periods of a month or more, in order to note seasonal changes in underwater topography. Bottom organisms will be sampled in this area when the nature of the beach profile cycle becomes clearer.

Findings: A pair of sandbars appeared to move steadily offshore from the Bolivar Beach 1 mile southwest of Caplen from October 1950 to March 1960. After March they maintained a relatively constant position, so far as the available data shows; while profiles from the Galveston Beach at Galveston show an irregular profile and await further data for interpretation.

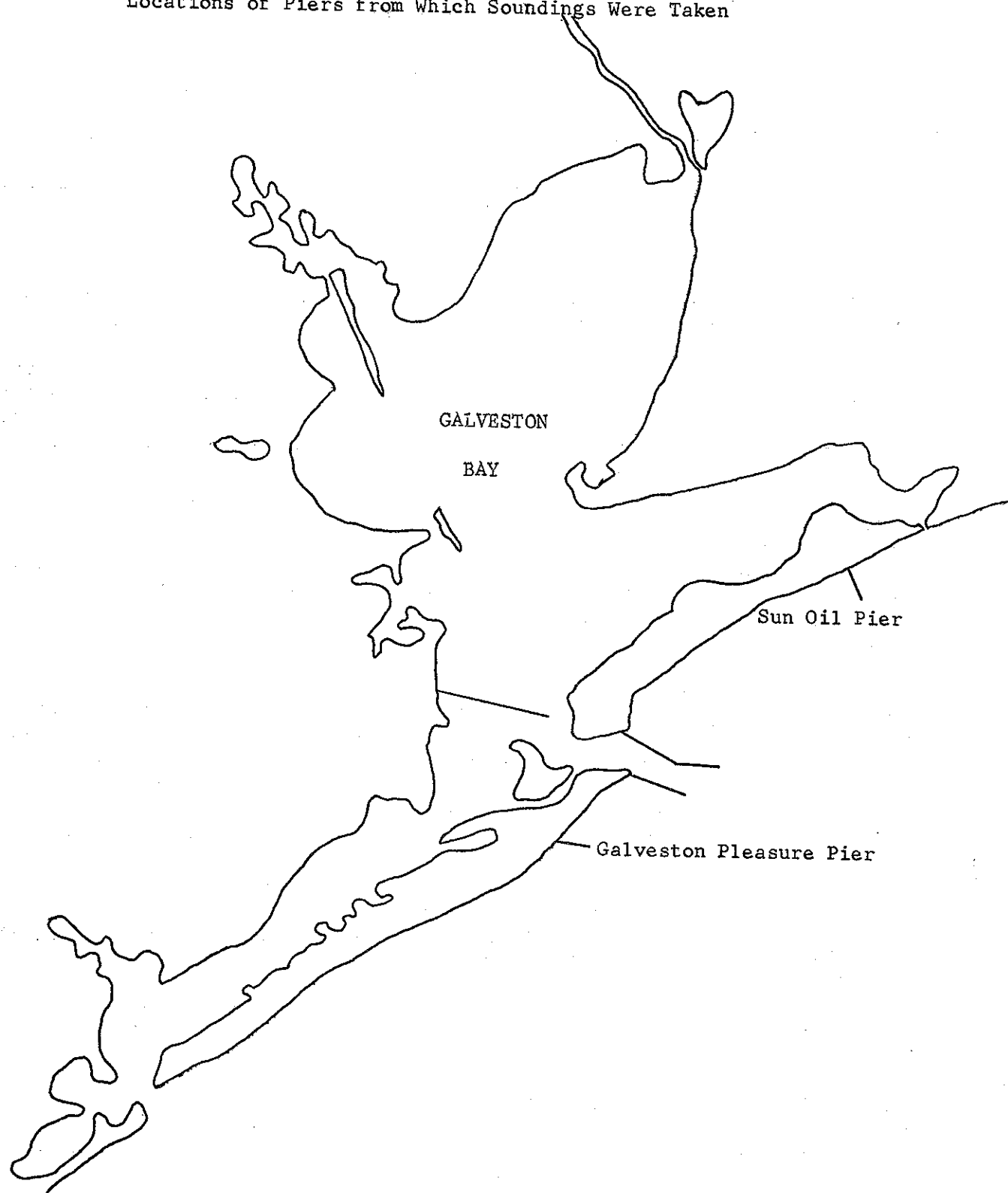
When invertebrate collecting was being planned for Job B-2b of this project, it was decided to sample the bottom organisms in the surf zone just off the beaches of Bolivar Peninsula and Galveston Island. Hedgpeth (1953, pp 182-185, fig. 38) describes the profile of the beach near Port Aransas, Texas and states: "The outermost, or largest, bar occurs on most Texas beaches at about 1,000 feet from shore. Its crest is 6-8 feet below mean low water, and the accompanying trough is 12-15 feet deep. The inner bars, usually two, are closer to shore and nearer to each other than to the outer bar, and are less than six feet below mean low water." On page 187, Hedgpeth says: "When the action of bars in storms is remembered, i.e., the shoreward movement and obliteration of the inner bars and seaward migration of the outer bar, it seems reasonable to conclude that these (Mellita quinquesperforata, Astropecten spp., Thyone briareaus, and Thyonactis sabanallensis) and other burrowing organisms occasionally found intact on the beach came from the longshore troughs." Accordingly it was planned to sample the bottoms of these longshore troughs with a fine-mesh mollusk dredge; and to check the profile of the beach with measurements made near the dredging stations.

On 11 September 1959 soundings were made at fifty-foot intervals along a free county fishing pier in Galveston. The soundings were recorded to the nearest foot and the resulting profile was so jagged that no troughs or bars could be recognized with any certainty.

On 8 October 1959, a day of very low surf, an attempt was made to dredge in the trough inshore of the outer bar that was believed to exist. However, the bottom was tested with a hand sounding rod seemed to grow progressively shoaler and no sudden deepening which would indicate a longshore trough was perceived either off Bolivar Peninsula or off Galveston Island. No dredging was done in the nearshore area, and it was decided to postpone biological

FIGURE I

Locations of Piers from Which Soundings Were Taken



collecting here until more could be learned of the underwater profile through pier soundings. Soundings were again made along the county fishing pier at Galveston on 23 October and also along the Sun Oil Company Pier 1 mile southwest of Caplen. Soundings on this date and subsequently were recorded to the nearest quarter of a foot and made at 25-foot intervals, resulting in a much smoother profile. A terrace near the water line and a single bar and trough were the only relief features discernable from these profiles. Since the county pier is less than 750 feet long and theoretically would not cross the outermost bar and trough if they were present, soundings were discontinued at this station.

Since 23 October 1959 at the Sun Oil Pier, and since 7 January 1960 at the Pleasure Pier (Seawall Boulevard and 25th Street, Galveston) soundings have been made at monthly or greater intervals. Measurements at these two stations will be continued.

Not enough profiles have been graphed at the Galveston Pleasure Pier to permit the making of any generalization, although 2 or 3 bars can be recognized in most of the profiles.

According to Shepard (1948, pp. 88-96), the profiles of most beaches are subject to regular seasonal changes. Winter, generally the season of highest waves and more frequent storms, erodes away much of the beach and produces a series of offshore bars. In summer the gentler waves build the beach out again and produce an offshore topography with less relief. The speed and amount of these changes are governed by many factors; including general slope of the beach, size of the sand grains, prevailing wave height, etc. In these respects, the beaches of Bolivar Peninsula and Galveston Island may be described as follows: fairly gentle slope ($1\frac{1}{2}$ -2%); rather fine sand (the characteristic that makes it possible to drive a car on these beaches); the most violent storms (hurricanes) come in the summer, but the most frequent ones are in the winter. An additional factor which might be a possible cause of abnormality in the seasonal cycle is the frequent occurrence of water low tides; this would tend to move farther offshore the portion of the beach which is directly subject to action of the surf.

In Figure II, four profiles selected from those taken at the Sun Oil Pier are superimposed, and an example is shown of the type of profile found at the Galveston Pleasure Pier.

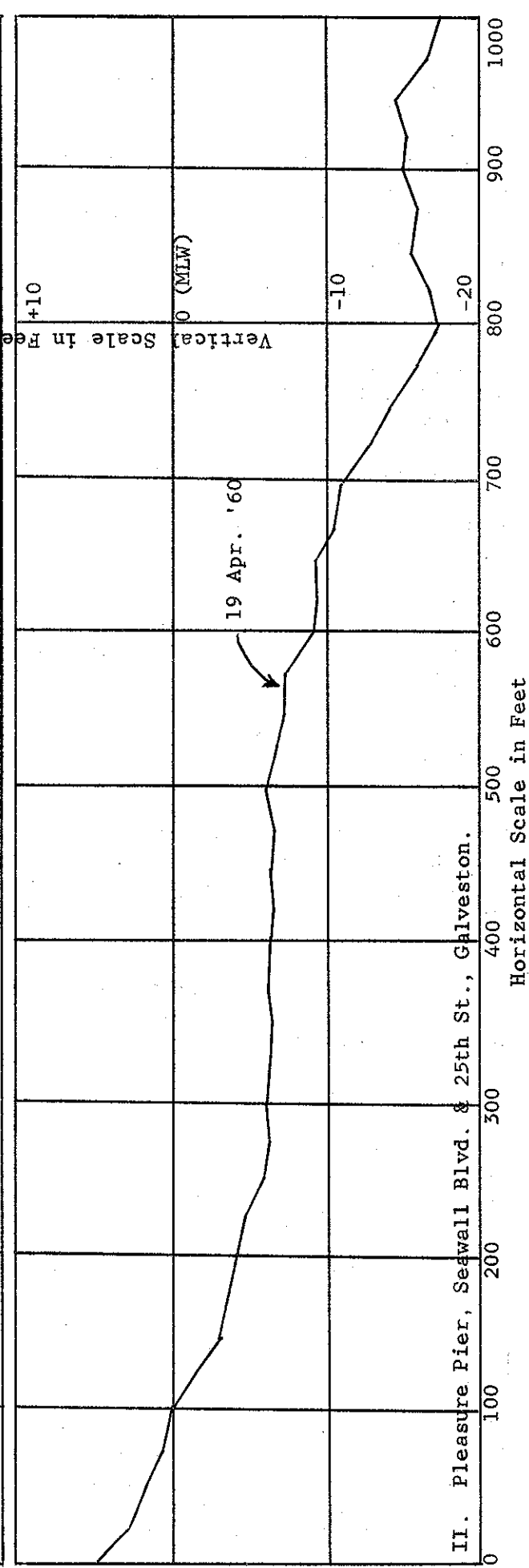
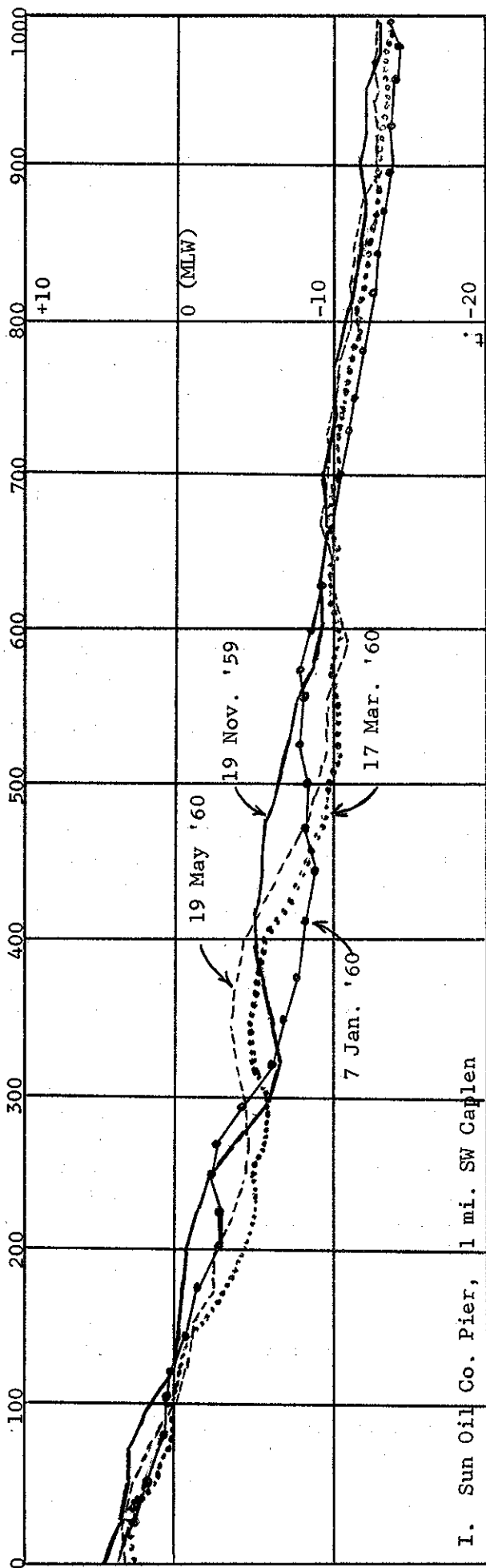
At the Sun Oil Pier in November there was a terrace at about 425 feet; beyond this bar the bottom sloped away fairly smoothly. In January the terrace had apparently been dragged out to form a bar at 250 feet, and the other bar was now at about 550 feet. By March there was a bar at about 350 feet and another of low relief at about 700 feet. If the interpretation that has been made of these results is correct, it appears that the outer bar moved 275 feet in 119 days, or about 2.31 feet per day, and the terrace that became an inner bar moved 150 feet in the same period, or about 1.26 feet per day.

After March, however, there seems to be no further offshore movement and analysis of additional data may show that this is the beginning of a reversed, onshore progression of the bars.

Alternatively, it could be argued that perhaps the hurricane of 25 July 1959 destroyed the normal profile of Bolivar Beach and that it required until March of 1960 for the beach to regain an equilibrium status. Additional year-round soundings, and especially soundings taken just before and after another hurricane, would serve to clarify this question.

FIGURE II

Selected Gulf Beach Profiles (0 to 1000 feet only)



This situation at Bolivar Beach appears to be different from that described by Hedgpeth at Port Aransas (see above). Here, at least for the period during which samples have been made so far, there seems to be an outer bar at 225 to 575 feet from the beach with a crest 4.75 to 9.75 feet below MLW; and a trough 5.5 to 10.75 feet deep. So far there has been but a single bar or terrace.

Samples of the bottom sediment were taken on occasion with an Ekman dredge along with the soundings. It was not possible to subject these samples to any sort of analysis except simple visual examination, and from such examination it appeared that the composition of the bottom was relatively constant from the foreshore (beach just above the waterline) to about 875 feet out from the water's edge -- consisting of quite fine compacted sand, with occasional silty deposits in the bottom of the troughs. Beyond the 875 foot point there were often deposits of broken mollusk shells and other calcareous material. Sand from the berm, or dry part of the beach, seemed a little coarser than that from the foreshore.

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LITERATURE CITED

- Hedgpeth, J.W. 1953. An introduction to the zoogeography of the northwestern Gulf of Mexico with reference to the invertebrate fauna. Publ. Inst. Mar. Sci. Univ. Texas, 3(1): 107-225.
- Shepard, F.P. 1948. Submarine Geology. New York: Harper & Bros. xvi, 348 pp., 106 figs., chart.