

Cape Scientists Probe Sand Secrets To Learn Rate Of Shore Erosion

By Paul Koch

Over the last four years, while most Cape Enders enjoyed the well-protected comfort of their homes during frequent Winter northeasters, research assistants Herman Tasha and Graham Giese could be found on the Back Shore on the grimmest of days and nights accumulating data for Woods Hole Oceanographic Institution from New Beach, Race Point, High Head, Highland Coast Guard Station and Nauset.

They were busy with a project initiated by the Office of Naval Research under the stimulus of the late Professor Henry C. Stetson. One purpose of the project was to find out how much change takes place over a period of time along this coastal stretch of the Atlantic.

The project was carried out in its first three years by Carlyle Hayes, beginning in 1954. His field group used a jeep and dory almost exclusively during its studies and encountered many difficulties with launchings and efforts

to remain at sea during storms. The group stayed at the Anchor and Ark at the time and were more than once grateful for the privilege of having very early morning meals and late dinners at the old Hubert's Restaurant on Bradford Street.

Mr. Tasha and Mr. Giese picked up where the first group left off, remaining under the continuing direction of principal investigators Dr. John M. Zeigler, Professors Robert L. Miller of the University of Chicago, Marshall Schalk of Smith College and Sherwood Tuttle of the University of Iowa.

To establish the rate of change along the shore line, they made careful measurements with a surveyor's transit. The trouble with this method was that during storms and heavy rain or at night not only did a valuable instrument take a beating but one could not see through the fog and spray well enough to read the numbers. They found it better to drive a line of pipes across the beach and simply

measure the height of the sand each day. To find out if cutting and filling took place with a particular kind of wave they also measured surf height and surf period each day. Associated wind velocity and direction was read from an anemometer placed on the roof of Herman Tasha's house.

Avoid High Waves

When it was impossible to get to some of these pipes because of breakers, the researchers risked getting drenched, oftentimes losing, in wading out to take readings. When an occasional wave came along that looked a bit high they pulled themselves up the Philadelphia rods, staying until the wave went by.

There were about 45 such pipes spread out from backshore to mean water, from New Beach to Nauset. Although there were frequent lulls in weather conditions it was more often the case that bitter maelstroms of sand and spray driven by freezing winds were on hand to greet the two assistants.

By finding the sand elevation at each stake or pipe during these periods it was possible to determine maximum and average changes along the beach, which would later provide scientists

with an idea of the cut and fill along the shore.

Sometimes a single storm would produce a change of four feet at the midpoint between bluff and low water at one point and variation above or below that elevation at other points, due to a prevailing wind, wind velocity and surf height.

In addition to accumulating data to describe beach behavior in these coastal erosion studies, material gathered on the spot aided the construction of descriptive profiles on contour changes.

Research assistants Mr. Tasha and Mr. Giese, working under the direction of Chief Scientist John Zeigler and assisted in compilations by Carlyle Hayes and Mrs. Barbara Gill, were actually following in the footsteps of other surveyors of the area, notably Major Graham of the Army Corps of Engineers who made initial surveys in 1833, the hydrographic surveys of 1856 and the coast surveys of Henry Marindin for the U. S. Coast and Geodetic Survey during 1887, 1888 and 1889. While today we know the Back Shore to be a relatively continuous segment of beach, Major Graham's charts of 1833 show it to be lined with about 15 active inlets between the High Land and Race Point. Major Graham's survey was made because Provincetown was in constant fear of the ocean breaking through near Plum Island and filling in East Harbor. After hydrographic studies were completed in 1856, Henry Marindin and his party extended the studies in 1887 to the shore from Nauset to Long Point.

Mr. Marindin wanted to know how much the coast had changed between 1856 and 1889. He measured lines across the beach and dunes every 1,000 feet apart from Nauset to Long Point. Then he compared his lines with the source lines drawn on the map of 1856. He left oaken posts to establish his points and although Mr. Tasha and Mr. Giese have re-established his origins by plane table triangulation, they have never found any of the posts. They measured erosions between 1889 and 1960.

Use Early Figures

In re-establishing the points of origin from which each profile was measured they used the latitude and longitude figures Mr. Marindin had recorded. Then they determined the elevations at these points by transit and Philadelphia rod and known points of elevation.

Finally they ran a profile from each point of origin using Mr. Marindin's azimuth or direction

and marked the original points with concrete monuments.

According to the Hydrographic Survey the object of Mr. Marindin's survey which began in August of 1887 was to add to earlier studies by including studies of slopes of bluffs, sections of barrier sands or beach, and submerged contours out to four fathoms of water.

Throughout the 3 year period of 1887-1889, Mr. Marindin's party camped near each site where the work was being done. He used Civil War surplus including tents that were always blowing away or apart during storms. The group got ample water by digging holes at the foot of cliffs along the beach.

Lacking sufficient funds for a horse, the party had to manage renting one at a rate they could afford and finally found one in Orleans.

The only dory available to them was in New Bedford and that came up by Old Colony Railroad. The dory was necessary to make soundings starting from the break line and taken offshore, continuing the profile line from the last reading taken on the beach at low tide.

At least Mr. Tasha and Mr. Giese had a modern Navy jeep to come and go on the project and equipment and methods somewhat more advanced than those Mr. Marindin's party had to use, but nonetheless, the charts now based on the material these assistants have gathered over the last four years will never indicate the discomfort of frozen hands and feet, the numerous flat tires, engine difficulties, days and nights working long mathematical problems indoors and out.

What's Been Learned

Through all these compilations it is known that the average erosion from Nauset to the Highland Coast Guard Station takes place at the rate of 2½ to 3 feet a year. Knowing the height of cliffs and the rate of erosion a volume measurement of 25 cubic yards for every yard of cliff has been established.

In the 17,000 yard section of beach between Nauset and Highland approximately 500,000 cubic yards is eroded or washed out in a year.

According to Dr. Zeigler, "By knowing how many cubic yards a year is eroded, we might find out for one item, how long it took to build the spit that reaches and forms Provincetown Harbor."

The total volume of sand in the

Province Lands, according to this study has been figured at around 1,840,000,000 cubic yards, below and above water from the local ocean depth average of 180 feet.

Going on certain assumptions, one may conclude that the entire Province Lands could have been deposited in about 4,000 years.

While the seven year study ended this month, conclusions from the study will not be published and made accessible until a future date.