



NOAA Sentinel Site Program – SET Inventory

The work described below is the result of a metadata inventory of Surface Elevation Tables (SETs) that are currently installed within the boundaries of the five NOAA Sentinel Site Cooperatives. This project was undertaken to aid the Sentinel Site Program in its goal of developing a place-based understanding of changes in coastal sea level and inundation. Surface elevation tables are mechanical devices consisting of benchmark poles permanently installed in the ground, portable leveling arms that attach to the benchmarks parallel to the ground surface, and measuring pins which are inserted through the arm to measure the distance between the ground surface and the arm (Figure 1). Because SETs measure relative elevation changes accurately and precisely, they have become the tool of choice for scientists and managers who are interested in the response of coastal wetlands to changes in relative sea level. These instruments have been installed throughout the coastal zone by researchers from government agencies, academic institutions, non-governmental organizations and private engineering and consulting firms. By identifying all of the SETs within a region and bringing together those who installed them, we are able to capitalize on existing resources to address questions about relative sea level rise over a broad geographic expanse with fine scale resolution. Further, this analysis lays the groundwork for strategic placement of future SETs to address gaps in current coverage.



Figure 1. SET with measuring pins

Database Development. At the beginning of this effort, one to two individuals with knowledge of local SET data were identified from each Sentinel Site (Figure 2). Collectively, this group agreed on the fields of data that would be included in the final database effort. After entering their own data, these individuals either contacted or provided contact information for other known SET owners in their regions. Every respondent was asked to provide further contacts and this type of word-of-mouth networking yielded the majority of our data. Additional data contacts were identified through advertising this effort at national professional meetings (Coastal and Estuarine Research Federation, National Estuarine Research Reserve System annual meetings) and through regional list serves. While the data gathered here may not be complete

we feel confident that the vast majority of SET owners in each region has been identified and contacted.

We asked for information on all SETs within a region, not just those that are actively monitored. As a result, some of the SETs included in this analysis have not been measured for more than a decade. The amount of data submitted for each SET ranges from a simple



Figure 2 NOAA Sentinel Site Cooperatives

station name and geographic coordinates to a full suite of details concerning elevation, vegetation type and reason for installation. In all, we identified 576 SETs spanning a wide range of geomorphic/hydrologic settings. The results provided below include all of the data collected through February 2014.

RESULTS BY SENTINEL SITE

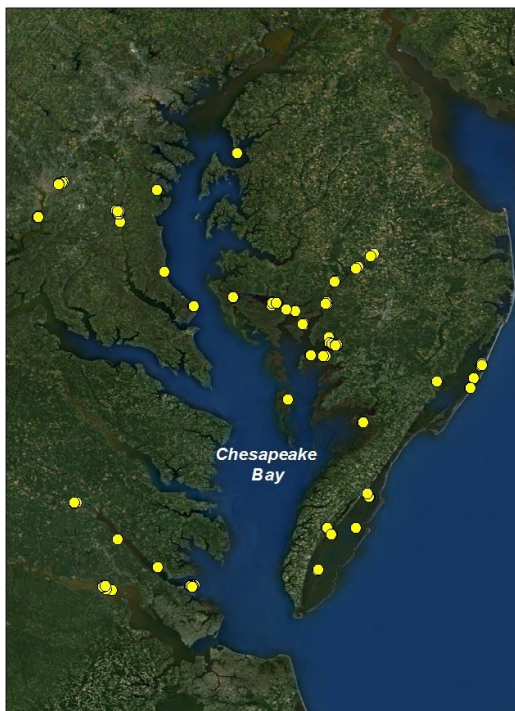


Figure 3. Chesapeake Bay Sentinel Site

Chesapeake Bay – This Sentinel Site includes the tidal regions of the Chesapeake Bay system and the barrier island complex of Virginia and Maryland. In all, 362 SETs have been identified within this region to date. The majority of SETs in this region are currently actively monitored. Several (47) were installed in or prior to the year 2000 and thus provide a data record of ≥ 15 years. The dominant plant communities represented are *Spartina sp.* (135 SETs) and *Schoenoplectus americanus* (70 SETs). Other plant communities represented include: *Distichlis spicata*, *Bidens laevis*, *Juncus roemerianus*, *Nuphar latea*, *Peltandra virginica*, *Phragmites australis*, *Salicornia sp.* and pine forest.

The distribution of SETs in Chesapeake Bay is shown in Figure 3. Yellow dots indicate SET locations. In many cases, each dot represents multiple SETs as replicate treatments within

each field site are too close together to map as distinct points. The geomorphic settings represented within this region range from back barrier to tidal freshwater marsh. Elevations were reported for 40% of sites and hydrologic zones for 43%. These data are summarized below.

Hydrologic Zone (# of stations in each)			
# of Stations Reporting	Low Intertidal	Mid Intertidal	High Intertidal
308	35	146	127
Elevation (m NAVd 88)			
# of Stations Reporting	Range	Mean	Median
185	-0.69 - 1.266	0.409	0.326

Hawaii – We were not able to locate any SETs within the Hawaiian Islands Sentinel Site.

North Carolina - The North Carolina Sentinel Site encompasses the central N.C. Coast, extending inland to the northern banks of the Neuse River and eastward to Cape Lookout National Seashore (Figure 4, white line denotes boundary). Currently, 77 SETs are installed in this region. With the exception of one group (installed in 1992), all were installed in 2004 or later and are currently actively monitored. As in the case of Chesapeake Bay, each yellow dot on the map represents multiple SETs, in some cases as many as 6. The geomorphic settings represented here are back-barrier lagoons and estuarine marshes and the dominant plant communities represented are limited to *Spartina sp.* and *Juncus roemerianus*. Elevations were reported for 60% of SETs and hydrologic zones for 100%.

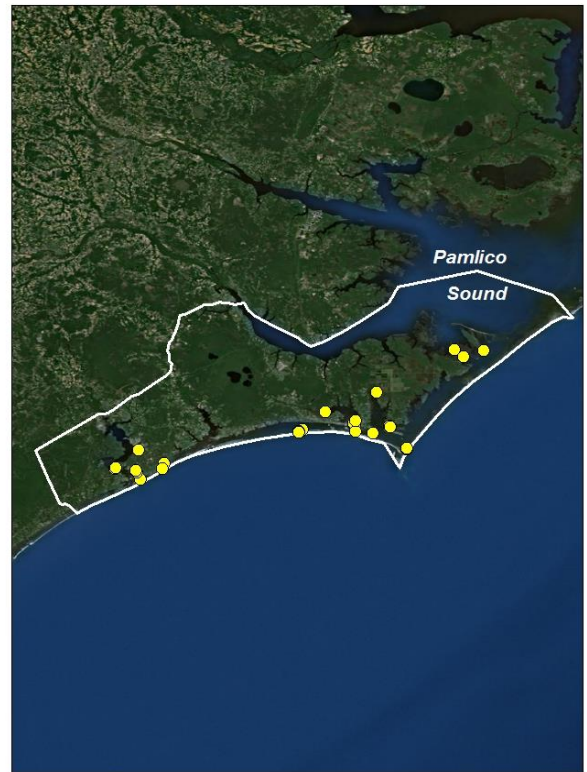


Figure 4. North Carolina Sentinel Site

Hydrologic Zone (# of stations in each)			
# of Stations Reporting	Low Intertidal	Mid Intertidal	High Intertidal
77	18	28	31
Elevation (m NAVd 88)			
# of Stations Reporting	Range	Mean	Median
50	-0.432 – 0.826	0.169	0.161

San Francisco Bay – The San Francisco Bay Sentinel Site includes San Francisco and San Pablo Bays and their outer coasts and extends inland to the confluence of the Sacramento and San Joaquin Rivers. We have identified 98 SETs currently installed within these boundaries (Figure 5). Many of these (54) were installed in the period between 1997 and 2009 as part of a large research project designed to compare natural and restored wetlands. These sites are not currently monitored but the SETs are believed to be intact and usable. Of the 98 total SETs, 8 reported data on elevation which ranged between 1.49 and 1.91 m NAVD88, hydrologic zone (split evenly between low and high intertidal) and dominant plant community (*Spartina sp.* and *Sarcocornia sp.*).

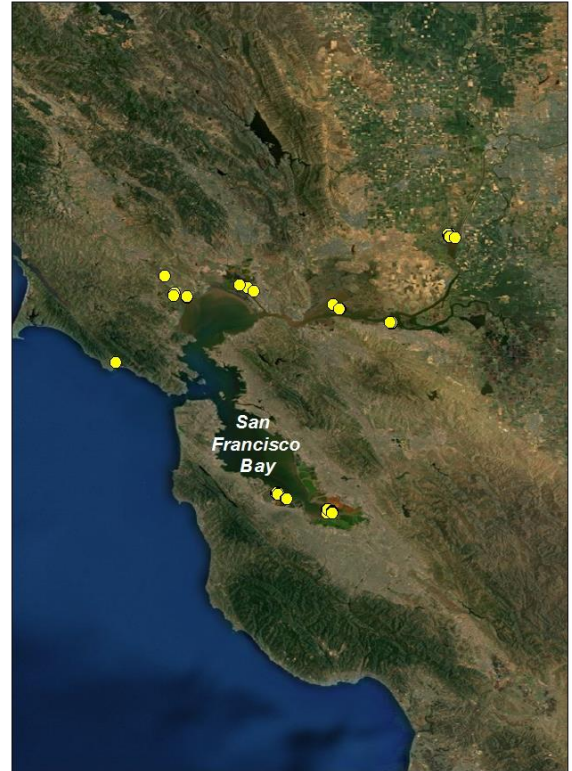


Figure 5. San Francisco Bay Sentinel Site



Northern Gulf of Mexico – The NGOM Sentinel Site encompasses the entire coastal region stretching from the Pearl River on Mississippi/Louisiana border to the Suwannee River SETs within this geography (Figure 6). We are aware of SETs within the Weeks Bay NERR site but as of this edition have not received data from these. Elevations were reported for 25 of the 39 SETs, and hydrologic zones for 35. The dominant plant communities represented in this region include *Cladium jamaicense*, *Juncus roemerianus*, *Spartina spp.* and cypress.

Figure 6. Northern Gulf of Mexico Sentinel Site

Hydrologic Zone (# of stations in each)			
Low Intertidal	Low Intertidal	Mid Intertidal	High Intertidal
35	3	6	26
Elevation (m NAVd 88)			
# of Stations Reporting	Range	Mean	Median
25	0.19-0.91	0.41	0.38

CONCLUSIONS

The results presented here include all data gathered through February 2014. New SETs are being installed with increasing frequency thus this report reflects only current conditions. It is our hope that knowledge of existing SET locations will guide future installations so gaps in coverage may be addressed. Further, we see this inventory as an initial step toward bringing together the SET research community in each region for the purpose of coordinated monitoring efforts. Such efforts could be targeted at understanding long term trends within each region, or identifying the impacts of discrete temporal events like hurricanes and nor'easters. We believe that the fine scale resolution that can be acquired from such a coordinated effort will be invaluable for understanding and responding to the impacts of future sea level rise, a primary objective of the NOAA Sentinel Site Program.