

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

## Sanctuary Landscapes



The following is a true story from the *Madera Mercury* newspaper of Central California:

### Coast of California Searched for Buried Treasure of Pirates

March 7, 1924

According to Monterey legend, Carmel Bay and Stillwater Cove were favorite haunts of smugglers and pirates in the old days before Monterey became a Spanish settlement. The remains of an old Spanish galleon, believed to have been taken as a prize in the days when Sir Francis Drake's ships scoured the seas, has been found in Stillwater Cove. Old residents of Monterey have innumerable relics of the days when sea rovers put into Carmel Bay for shelter and fresh water. Iron rings and fragments of chains have been found on rocks now submerged, and, inland there are many strange marks carved on trees. Arrows and crosses cut in the trees of a deserted Indian village above Pebble Beach support the tradition that this once was the retreat of pirates. Gouverneur Morris, author, who lives in the town of Monterey, is one of those who believe that somewhere on the peninsula is buried treasure. One of his prized possessions is a great iron key of ancient Spanish make which he picked up on the shoreward edge of Pebble Beach golf course. He believes that this was the key to an old

treasure chest and he has spent many hours prowling about the rocky shore looking for the chest. There is some talk at Pebble Beach of organizing a company of property owners to institute a scientific hunt for treasure.

Article courtesy California Digital Newspaper Collection, Center for Bibliographic Studies and Research, University of California, Riverside: <http://cdnc.ucr.edu>



Monterey Bay peninsula in 2020;  
Adapted from Photo by Coolcaesar CC BY-SA 4.0

### Could You Find the Treasure?

1. Imagine you are one of the treasure hunters in 1924. You have identified Carmel Beach as a likely spot where the treasure chest lies. You do not have heavy equipment to help you dig on the sandy beach, but you have heard that at certain times of year there is less sand present, exposing areas of buried rocks and potentially, the treasure! When might there be less sand on the beach? Why do you think so?

2. Examine these photos of seasonal changes at California beaches. Do your observations of the photos support your hypothesis about the amount of sand on beaches? If not, how would you change your hypothesis?



Pinnacle Gulch, Greater Farallones National Marine Sanctuary in May 2010 (left) and January 2011 (right)

3. What differences do you see in the beaches? Describe what you see and potential reasons for seasonal variations.

4. Data shown to the right is based on a long-term study of sand movement at a beach near Carmel, California.

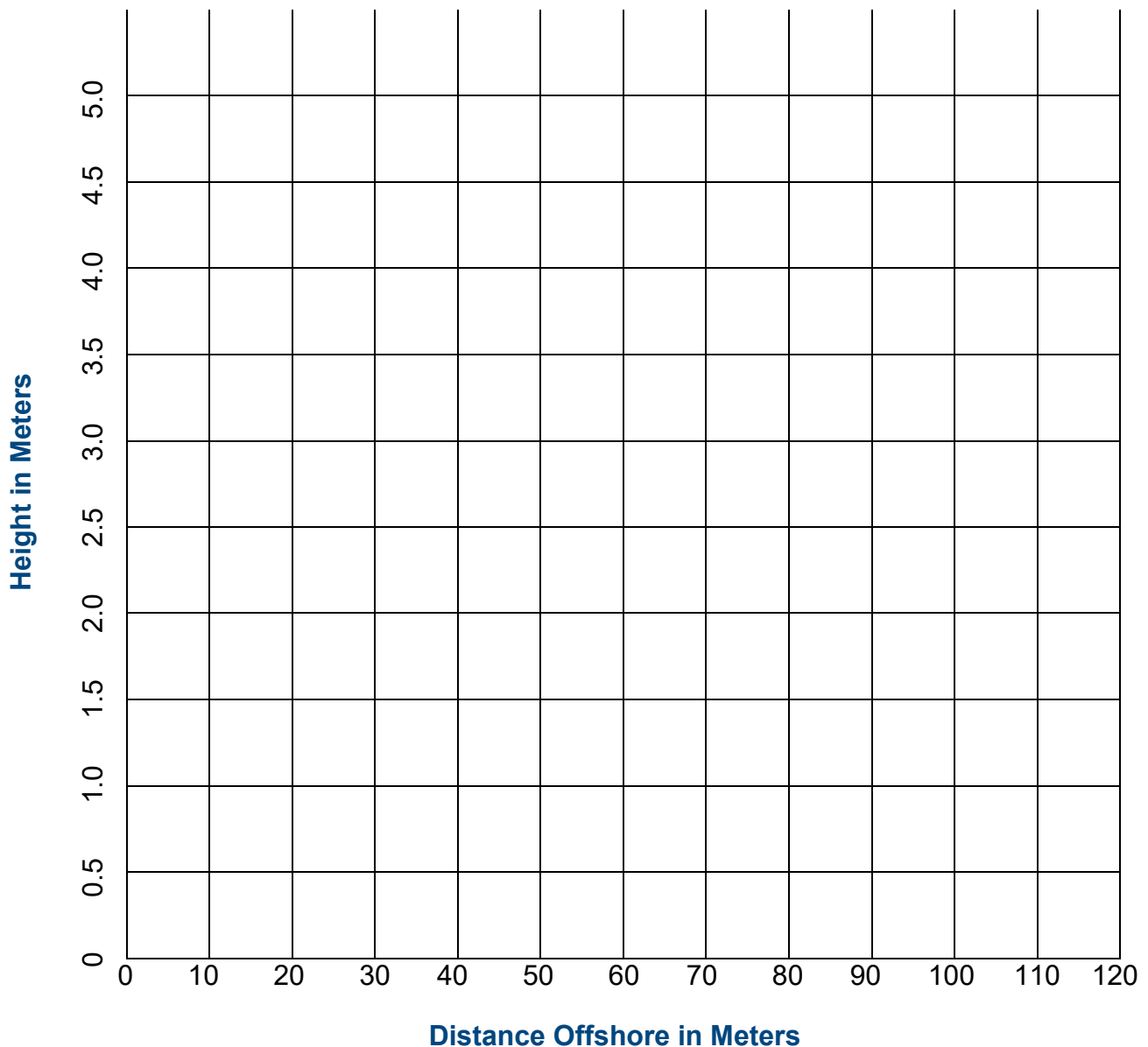
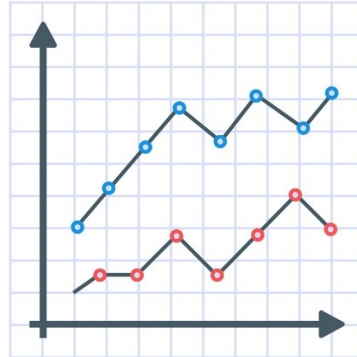
Plot the data on the graph on the next page or with a spreadsheet to show the seasonal difference in the **beach profile**. Like a profile of a human face, a beach profile is the shape of a beach when viewed from the side. The profile includes the slope of the beach from the top of the beach to the water line.

Distance offshore in meters (x-axis)	February beach height in meters (y-axis)	September beach height in meters (y-axis)
0	4.5	4.5
10	3.5	3.5
20	3.2	3.2
30	3.2	3.0
40	2.5	2.5
50	1.0	2.7
60	0.5	3.0
70	0	2.7
80	0	2.5
90	0	2.0
100	0	1.7
110	0	1.0

# Seasonal West Coast Beach Profiles

## Graph It!

1. **Add data points from the table** on the previous page using two different colors, one for February and one for September.
2. **Label the colors** in the legend.
3. **Connect the points** in the two sets of data with straight lines of the same colors. This will create **line graphs** that show the changes over time.



### Legend

Color for each line graph: ○ February Beach Height ○ September Beach Height

5. Imagine you are a Beach Watch volunteer that documented these seasonal beach changes:



Muir Beach in August 2010 (left), January 2011 (right): Where is there increased erosion and exposure of rocks?



Sharp Park, July 2010 (left) and May 2011 (right). Where is there more deposition of sand?  
All photos: Greater Farallones National Marine Sanctuary/Greater Farallones Association

6. Do the beach profile data/graphs match the observations shown in #2 and #5 above? Explain.
7. What **forces** are at work that affect how much or little sand is on the beach? Record your ideas below or in science notebooks in words and pictures.
8. How does the time of year affect how much sand is on the beach? What seasonal activities might impact beaches?
9. After exploring the slideshow and sanctuary websites, discuss the questions below and record your ideas in science notebooks:

- a. What advice would you give pirates that wanted to bury treasure? How might they avoid geologic and ocean forces that could expose it?
- b. In what national marine sanctuary(ies) shown to the right would you recommend they bury the treasure (and NOT bury it)? Explain your reasoning and use the terms **erosion**, **deposition**, **seasonal storms** and **tectonic plates** in your answer.



Locations of two West Coast and two East Coast sanctuaries; more at <https://sanctuaries.noaa.gov>.