



# IN THE MUD

A GS NORCAL COUNCIL'S OWN BADGE PROGRAM

CADETTES, SENIORS & AMBASSADORS  
TO ENCOURAGE AND INSPIRE GIRLS TO EXPLORE  
THE WORLD OF THE SAN FRANCISCO BAY.



## PURPOSE

San Francisco Bay's mud provides habitat, food and shelter for hundreds of species of plants and animals. However, the Bay has seen many changes in the past 200 years. Development of the area has led to altered shorelines, increased pollution and the introduction of non-native plants and animals. With this Interest Project you will examine how the Bay has changed, explore the diversity of life at the bottom of the Bay and learn about the impact of non-native, or invasive, species.

## REQUIREMENTS

Complete the Required Activity and then one activity from the Learn, Do and Share sections. Create and complete one activity of your own design and reflect upon the whole process when you have finished using the reflection form.

All members of Girl Scouts of the USA are eligible to earn the In the Mud Badge.  
The In the Mud Badge is an official award and should be worn on the front of the vest or sash.

## ORDER INFORMATION

To order the In the Mud Badge please visit [www.girlscoutsnorcal.org](http://www.girlscoutsnorcal.org) and purchase the items online. Please note that shipping and handling will be added to all online orders.

Members of Girl Scouts of Northern California will not be charged for shipping and handling if they use the GS NorCal Council's Own Order Form and have badges shipped to the closest GS NorCal store in their area for members to pick up.

ORDER PATCHES ONLINE AT [WWW.GIRLSCOUTSNORCAL.ORG](http://WWW.GIRLSCOUTSNORCAL.ORG)  
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## IN THE MUD BADGE FOR CADETTE, SENIOR & AMBASSADOR GIRL SCOUTS

### REQUIRED

Non-native species have had an enormous impact on the ecology of the San Francisco Bay. Watch the short segment called “San Francisco Bay Invaders” from the QUEST television program found at <http://www.kqed.org/quest/television/view/332>. Watch the segment a second time and answer the following questions:

1. Dr. Cohen finds a bait box full of pile worms and seaweed. Where is it from?
2. How many tons of this non-native seaweed ends up in the Bay every year?
3. How does Atlantic cordgrass affect native marshes?
4. What are two other terms that are used in place of *non-native*?
5. How many different kinds of non-native organisms are in the Bay?
6. Name two problems caused by non-native species.
7. What is the name of the clam that contributed to the collapse of the Delta smelt fish population? What does the collapse of the Delta smelt mean to the ecology of the Bay?
8. What year was this clam first found in the Bay? How long until it was the most abundant clam in the North Bay?

### LEARN

1. Interview an adult that lived in the Bay Area 50 years ago. Ask them about their memories of the Bay and the shoreline. What is different? How have things changed?
2. Go on a field trip to your local marine science resource center. While you are there, you will take a sample of mud from the bottom of the Bay. Look for and identify any organisms that you find in the mud. How many of them are non-native? Using a field guide\*, find out where they came from and how long they have been in the Bay. Also note what they eat and if they have any predators. What impacts could these species have on the Bay’s ecology?
3. Scientists use settling plates as a way to monitor species of plants and animals in a body of water. A settling plate is usually a thick, flat piece of plastic (about 1 square foot) attached to a rope that is tied to a dock. The plate is weighted down and placed in the water. Read more about settling plates here: <http://www.calacademy.org/research/izg/SFBay2K/SPRP/WhatsSP.htm>. Larval animals that are free-floating in the water, such as sponges and mussels, will attach to the plate and begin to grow.

Create your own settling plate to monitor! The side of a plastic milk jug, a rope and some metal washers (for weight) will do the trick. Talk to a local marina about placing your settling plate over the side of their dock. You’ll want to find a location where it won’t be disturbed by people.

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After two weeks, revisit your settling plate. Remove it from the water to see which organisms have started to colonize. Using a field guide\* and a notebook, record the names of the organisms and how many are on the plate. With some organisms, such as sponges, it may be difficult to count individual animals. In this case, you can estimate the percentage of area that they cover. Monitor your plate every two weeks for a few months. What do you notice? How does a change in season affect what is growing on your plate?

4. The Gold Rush initiated major changes to the Bay and its watershed. Find 3 articles to read about the Gold Rush, the use of mercury in mining, and its effects on the Bay. You can find one article on Save the Bay's website at: <http://www.savesfbay.org/site/pp.asp?c=dgKLLSOwEnH&b=886641>. Then, make a list of household items that contain mercury or other toxic metals. After these items are through being used they should be taken to a household hazardous waste collection facility. Create a special box your family can use to collect these items when they are through being used. Finally, make a trip to your local household hazardous waste facility to dispose of your collection

### Do

1. The Scientific Method is a several-step process that scientists use for experimentation. Imagine you are a scientist and design an experiment to study the bottom of the Bay! Develop the steps of your experiment using the scientific method and answer the following:

**Question.** What do you want to study? Write a specific question that can be answered by completing an experiment.

**Research.** What kind of background research will you do? What is important to know before you begin your experiment?

**Hypothesis.** What do you believe the answer to your question will be?

**Experiment.** Write out the steps of your experiment. Be specific enough that someone could repeat your experiment by reading your instructions.

**Data.** What kind of data will you have? Will it be a count or a measurement?

**Analysis and Conclusion.** What will you find out? (This is where you see if your hypothesis is true or false.)

**Results.** How would you communicate your results to others? Would you make a chart? a poster?

2. Interview a scientist who studies the Bay. For example, you may choose a geologist who studies the sediment or pollutants in the mud, or a biologist who studies non-native species or an animal that lives at the bottom. Ask them about their educational background and how they became interested in their career. You may also want to ask them about a typical day on the job. What is it that they do on any given day? Do they spend most of their time outdoors collecting data, or indoors analyzing it.

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3. Read the introduction and the first chapter of the book *The Ohlone Way*, by Malcolm Margolin. In the first chapter, "Land and Animals," Margolin describes the San Francisco Bay Area when the Ohlone people lived here over 200 years ago. Create a poster that compares the historical scene of the Bay with that today.
4. Create a skit that shows how non-native animals are introduced into the Bay, what happens when their population multiplies and how their introduction could be prevented. Perform your skit for your family or a friend .

SHARE

1. Gather some friends to participate in a shoreline or marsh restoration project with a local organization. Help restore the Bay to what it once was!
2. Write a "public service announcement" (an ad for a newspaper or poster) about non-native species and their affect on the environment. Include information on how citizens can help stop the spread or introduction of non-native species. Submit your ad to your school or local newspaper for publication consideration.
3. Lead a brainstorming group on how to get rid of invasive species in the Bay.
4. Write your legislator either in your state or in Washington D.C. Share with them what you have been doing to explore and protect your watershed. Ask them what they are doing to protect and restore the Bay.

YOUR ACTIVITY:

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MY REFLECTION:

PART OF THE PROMISE AND LAW THAT RELATES TO WHAT I DID IN THIS BADGE

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You may be able to check out a field guide from your school or public library or borrow one from your local Audubon Center. Here are a few suggestions for field guides:

- ❖ Sibley, David. *The Sibley Guide to Birds* – for your area. National Audubon Society.
- ❖ Local Birds, Inc. – Useful flipbook, you can find it for your area at [www.localbirds.com](http://www.localbirds.com)
- ❖ *Backyard Birds, Pocket Naturalist* – for your area. Waterford Press.

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