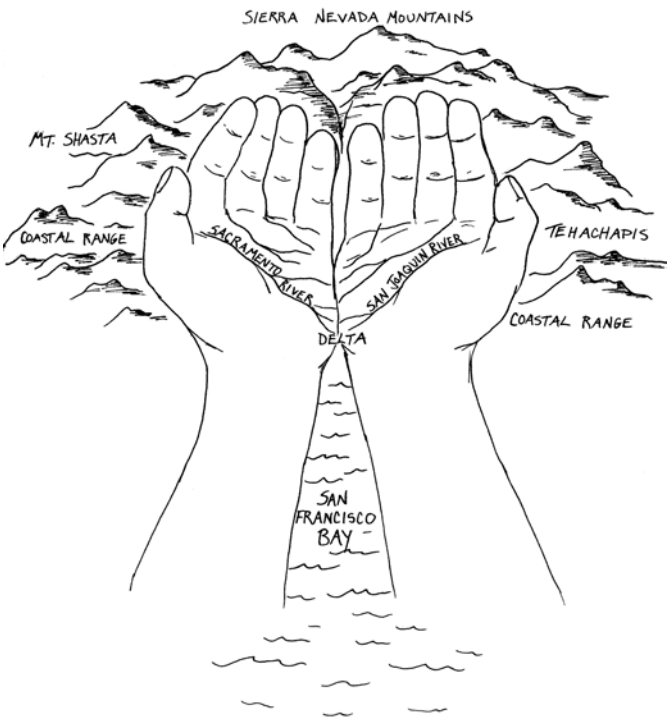
SAVE THE BAY

Watershed Journal



Save The Bay's
Canoes In Sloughs and
Community-Based Restoration Programs

This journal belongs to: _____

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Sense of Place

The excerpt below describes how the Bay Area looked prior to European settlement. After you read it, take some time to quietly observe your surroundings. Then write down a description of this place based on your observations.

"Modern residents would hardly recognize the Bay Area as it was in the days of the Ohlones.... The intermingling of grasslands, savannahs, salt- and freshwater marshes, and forests created wildlife habitats of almost unimaginable richness and variety.... Flocks of geese, ducks, and seabirds were so enormous that... they were said to rise 'in a dense cloud with noise like that of a hurricane....' Packs of wolves hunted the elk, antelope, deer, [and] rabbits. Mountain lions, bobcats, and coyotes... were a common sight. And... there was the grizzly bear.... These enormous bears were everywhere, feeding on berries, lumbering along beaches... and stationed along nearly every stream and creek during the annual runs of salmon... There were mussels, clams, oysters, abalones, and sea otters in profusion...."

--Malcom Margolin, *The Ohlone Way*

Place I'm describing: _____

I saw... _____

_____

I heard... _____

_____

I smelled... _____

_____

I touched... _____

_____

The things I touched felt... _____

_____

How do you think things in the marsh might taste? Why?

_____

How does this place make you feel?_____

_____

_____

_____

Sense of Place

Now that you have spent some time observing your surroundings, draw a picture of your favorite scene, plant, or animal in the space below. Or draw a self-portrait of you in your canoe.

San Francisco Bay History

12,000 years ago -- The "Bay" is a dry valley. The coastline is 30 miles farther west than it is today.

10,000 years ago -- Glaciers from the last ice age begin to melt, and the sea level starts to rise. Over thousands of years, water floods through the Golden Gate, filling up the Bay.

Between 4,000 and 10,000 years ago -- Native Americans (Ohlones) begin to populate the Bay Area.

2,000 years ago -- The Bay's original tidal salt marshes and mudflats begin to form from accumulating sediments.

1769 -- Spanish explorers are the first Europeans to discover the Bay.

1776 -- The first Spanish mission is established in San Francisco. About 10,000 Ohlone people live in the Bay Area.

1830s -- Within 50 years of European settlement, Ohlone population is nearly decimated by disease and the Spanish mission system.

1848 -- Gold is discovered in the Sierra Nevada. Beginning of Gold Rush and California's population explosion.

1850s -- Bay's tidal salt marshes reach their greatest expanse, then begin to shrink because of increasing human impacts.

1860-1920s -- Population increasing. Wetlands are converted to become farms and pastures; fisheries and birds are overharvested; industry increases and water quality problems develop in the Bay.

1930s-1940s -- Half of remaining wetlands are diked to become salt ponds; freshwater diversions drastically alter Bay ecology; residential areas fill most of the Bay's remaining tidal wetlands.

1960s -- Water quality continues to deteriorate as a result of increasing use of fertilizers, pesticides, oil refineries, and dredging.

1961 -- Save The Bay is founded.

1972 -- Passage of the Clean Water Act, which begins to slowly help improve the Bay's water quality.

1976 -- Last full-blooded Ohlone dies.

1990 -- Bay Area population reaches 7.5 million. As a result of bay-fill and development, the Bay is one-third its original size.

2002 --With help from state and federal governments and local environmental organizations, public wildlife agencies acquire 16,500 acres of salt ponds from Cargill, Inc. This marks the beginning of the largest wetland restoration project on West Coast.

A Creative Bay History

Now that you have read a little bit about the Bay's natural and cultural history, take some time to think about the place where you canoed or did restoration. In the space below, draw a picture or write a description that tells the story of that place. Try to answer the following questions: *What did the land, plants, animals, and people look like 1,000 years ago? 300 years ago? 100 years ago? What has changed about the place? What has stayed the same?*

This page illustrates a creative history of _____.

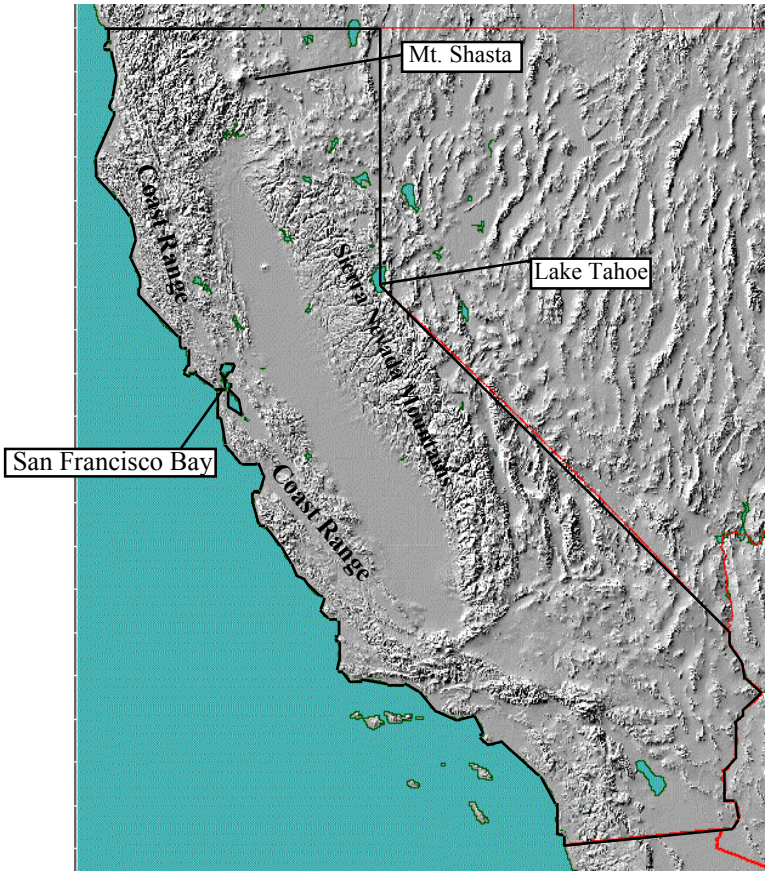
(write the name of the place here)

What's flowin' in the watershed?

Define the word ***"watershed***." _____

_____

On the map, trace the outer borders of the San Francisco Bay watershed. In other words, where does the water that drains into the Bay come from? *Hint: 40% of the State of California drains into the Bay.*



What are the two major rivers that drain into the Bay? Find them on a map in your classroom, then draw them on the map above.

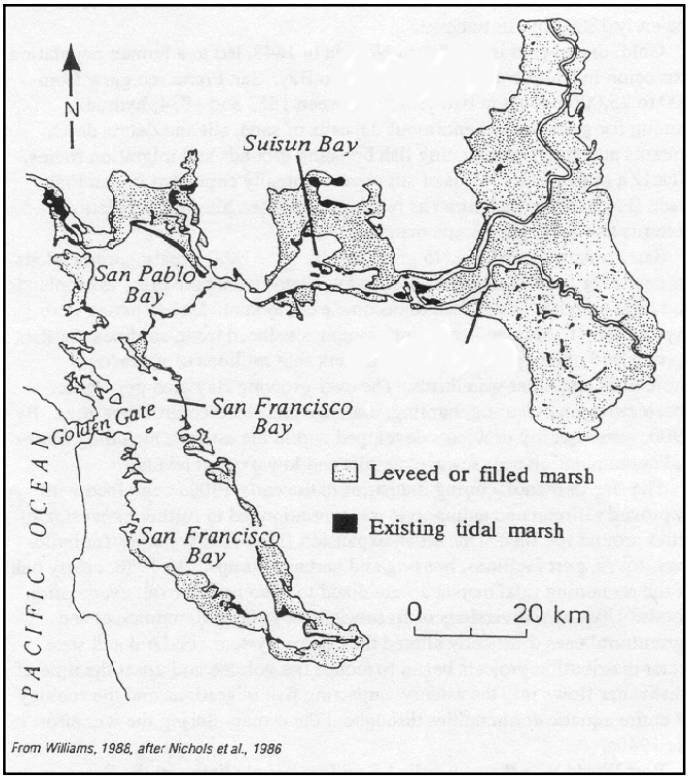
Name three things that might flow all the way from the Sierra Nevada to the Bay. _____

_____

Does it matter to you if the creeks near Mount Shasta are polluted? Why or why not? _____

_____

The San Francisco Bay Estuary: A Closer Look



1) Look carefully at the map above.
   - Draw an X at two places where water enters the Bay.
   - Draw a triangle where your home is located.
   - Draw a square where your school is located.
   - Draw a star at the site of your canoe or restoration trip.
   - Draw in at least three of the six bridges that cross the Bay.
   - Label the two major rivers that enter the bay

2) Two types of water are in the Bay. _____ water comes in from the ocean. _____ water comes in through the Delta from the creeks, streams, and rivers in our watershed. The term for these two types of water mixed together is _____.

3) The San Francisco Bay is:
   a) entirely enclosed by land.
   b) mostly enclosed by land.
   c) surrounded on all sides by the Pacific Ocean.

4) Three elements combine to make an ***estuary***: (1) fresh water and (2) salt water (mixing together) that are (3) mostly enclosed by land. Is the San Francisco Bay an estuary? _____

Mapping the Slough

In the space below, draw a map of the slough you canoed through. First, draw the twists and turns of the channel. Then, draw in the different plants you saw along the way. If you heard sounds as you paddled, draw those in too. Draw in any human-made features. Finally, draw in the different animals you noticed - invertebrates, mammals, birds. Don't forget to draw yourself in at your favorite spot! *Hint: you might want to make a key for your map in the box at the bottom of this page.*

Key

What good is a wetland, anyway?

Wetlands are one of the most productive ecosystems on Earth. They are filled with *biotic* (living) organisms and *abiotic* (non-living) matter. Because of these biotic and abiotic elements, wetlands play a very important role in the ecology of the San Francisco Bay Estuary.

What makes up a wetland?

1) Write down three examples of *biotic* organisms you might find in a wetland. _____

2) Write down three examples of *abiotic* elements you might find in a wetland. _____

Why are wetlands important?

1) Why do you think a wetland might be compared to a sponge? *(Hint:what do you use a sponge for?)*

_____

2) Wetlands are considered nature's nurseries. These things are all found in wetlands: salmon fry, seal pups, and bird chicks. What do wetlands have that baby animals need?

_____

3) San Francisco Bay's wetlands are found at the bottom of the watershed. Based on what you know about the human activity that happens in our watershed, what, besides water, might flow into our wetlands? _____

4) What role might wetlands play by being at the bottom of the watershed? (*Hint: water flowing out of wetlands is usually cleaner than water flowing into wetlands.)* _____

_____

5) What do wetlands provide for all these endangered species – the California clapper rail, the salt marsh harvest mouse, and the burrowing owl?_____

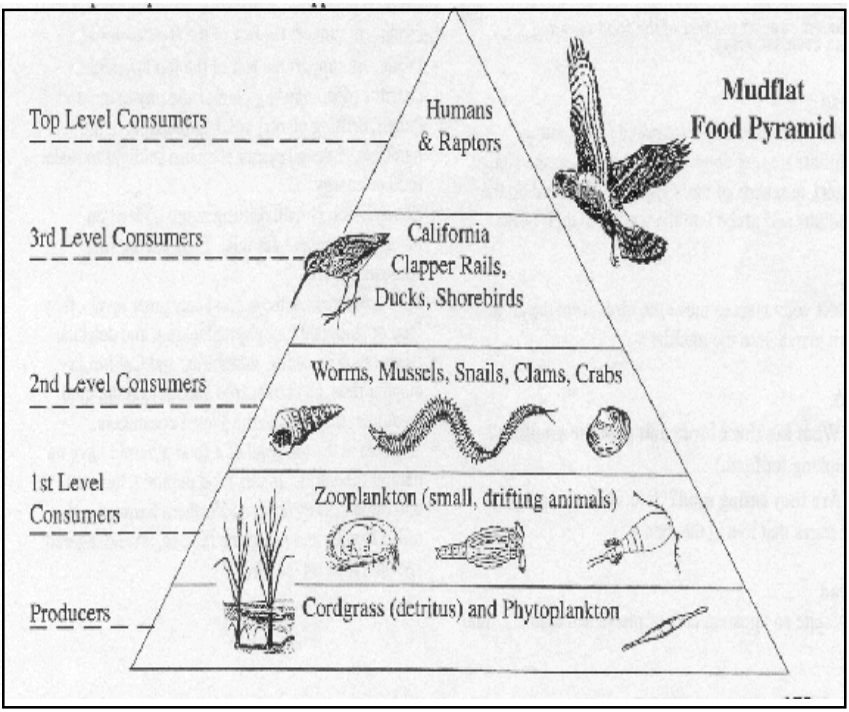
6) Based on your answers to the questions above, circle all the words that describe what wetlands do and why they are important.

filter water *prevent floods* *provide habitat* *nurseries*

7) Are wetlands important to you in your life? Write down one reason why or why not. _____

_____

Everybody Eats: The Food Pyramid



Study the food pyramid above, then answer these questions.

1) What does every animal in the food pyramid depend upon?

_____

2) What is one second level consumer you could find in a local park?

_____

3) Where do fish belong on this food pyramid?

_____

4) How do you think this food pyramid would be affected by pollution draining down through the watershed?

_____

5) Name two other producers you saw in the wetlands.

_____

6) According to the pyramid, most habitats need (circle one):

a) a lot of producers to support a few consumers -OR- b) a few producers to support a lot of consumers

All Things Connected: The Food Web

Now that you have looked at the food pyramid, check out the "circle" of producers, consumers, and non-living (abiotic) elements (like air, sun, and water) listed below. How are these things connected to one another? Draw lines between them to show how all of these things depend on one another for survival. *Each element should be connected to at least two other things.*


worms


sun

harbor seal

oyster

SOIL


northern harrier


cordgrass

Spin-A-Web

HUMANS


salmon


clapper rail

WATER

snail


black-necked stilt

salt-marsh
harvest mouse


pickleweed

AIR

leopard shark

Biodiversity of the Bay

Biodiversity is the number and variety of organisms found within a specified geographic region. Let's take a look at the biodiversity of San Francisco Bay wetlands.

Write down three different types of each of the following wetland residents that add diversity to our Bay.

Birds	Invertebrates	Plants	Fish	Mammals
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Could you add more examples to each of the above lists? In other words, are there more plants and animals in the Bay than you listed above? _____

Based on your answers above, do you think the San Francisco Bay Estuary has a lot of biodiversity? Why or why not?

_____
_____
_____
_____

Name three things that could cause the population of one of the above wetland residents to decline or become extinct. _____
_____

If the population of one of the above wetland residents declined or became extinct, how would it affect the rest of the residents?

_____
_____
_____

Is biodiversity important? Why or why not? _____
_____
_____
_____

Chain Reaction

Choose a wetland resident from the list on the previous page. In the space below, write a short story about what happens if the population of that species declines or becomes extinct. How would it impact the population of other species? How many other species would be impacted? How would it affect the biodiversity of the wetland? Could a decline in the biodiversity of the wetland impact the biodiversity of another habitat? *(Hint: If you need help, look at the food web that you created on the previous page - what happens to other species if you take away one member of the food web?)*

Adapted for Survival

Adaptations are behavioral or physical changes that occur in a plant or animal in response to changes in the environment. In order to survive, organisms are specially adapted to live in their habitat.

Write down three examples of animal or plant adaptations (i.e. ducks have webbed feet to help them move through the water):
1) _____

2) _____

3) _____

What environmental changes might cause plants or animals to adapt? Write down your ideas. _____
_____
_____

Wetland plants and animals have very unique adaptations that help them live in muddy, wet, sometimes salty, marshy environments.

1) Name two environmental elements that wetland *plants* are specially adapted to withstand: _____
_____

2) Name two environmental elements that wetland *animals* are specially adapted to withstand: _____
_____

How would YOU adapt?
What is one adaptation you wish you had? How would it make your life easier? Draw a picture or write a description of yourself with your new adaptation.

Plants, Plants, Plants

In the space below, draw a picture of a plant you saw in the wetland.

1) The name of this plant is _____.

2) Describe its leaves and stem (size, length, color, feel, etc.):

_____

_____

3) How is this plant adapted to survive in the wetland?

_____

_____

4) The first thing I noticed about this plant was _____

_____

_____

Wings, Bills, Feathers, and Feet

In the space below, draw a picture of a bird you saw in the wetland.

1) The name of this bird is _____.

2) Describe the way it looks (body and bill size, color, wing and foot shape, etc.): _____
_____
_____

3) How is this bird adapted to survive in a wetland?
_____
_____

4) The first thing I noticed about this bird was _____
_____
_____

What, No Backbone?!

An *invertebrate* is an animal that does not have a backbone. Invertebrates make up 97% of all the animals in the world! Can you think of some examples of invertebrates? In the space below, draw a picture of a invertebrate you saw in the wetland.

1) The name of this invertebrate is _____.

2) Describe the way it looks (body size, color, shape, etc.):

_____

_____

3) How is this invertebrate adapted to survive in a wetland?

_____

4) What and how do you think this invertebrate eats? Why?

_____

5) Instead of backbones, invertebrates sometimes have outer skeletons. What is the name for this outer skeleton? Does this invertebrate have one? _____

_____

6) The first thing I noticed about this invertebrate was _____

_____

_____

The Scientific Method

The *scientific method* is a series of steps that can be used to logically solve problems. These steps are outlined below.

Observe

Good scientists notice the world around them and are curious about what is happening.
Example: The water in this wetland looks like brown and feels slick.

Question

Based on your observation, raise a question about what is going on around you.
Example: Is the water in this wetland polluted?

Hypothesis

Based on your observations, make an educated guess to answer your question. This guess, or initial answer, should be a testable explanation for your observation.
*Example: The water in this wetland **is** polluted because it looks very dirty.*

Research

Use research to determine how the hypothesis will be tested. How will you test for pollution in a wetland? What kinds of pollutants will you test for? Where will you conduct your experiments?
Example: My research tells me that three common indicators of pollution in SF Bay are phosphate, dissolved oxygen, and pH levels.

Experiment

Perform the experiment to see if the hypothesis is confirmed. Conduct your experiment more than once, and record your results carefully! Try to make more observations.
Example: I will test the phosphate, dissolved oxygen, and pH levels. I will do the tests three times and in three different places.

Results

Record and analyze your results so you can clearly reflect on what they mean. It might help you to make graphs, draw pictures, or write a paragraph about what you discovered.
Example: The pH level in all three test sites was _____.

Conclusion

Your conclusion summarizes **what you learned** and explains **why you got the results** you did. Your conclusion should answer your question and explain whether or not your hypothesis was supported. Were there flaws in your hypothesis? Were there experimental errors? If your hypothesis was not supported, what are some other possible explanations for your observation?.
Example: The water in this wetland is [polluted/not polluted] . The reason for this conclusion is _____. This result [supports/does not support] my hypothesis.

Water Quality and Wetland Health

On your canoe or restoration trip, you will have the opportunity to test the quality of the water in a San Francisco Bay wetland. Water quality testing is important because it helps us:

* ***Evaluate*** the Bay's environmental health and its ability to support aquatic and terrestrial (land) life.

* ***Analyze*** the ways that humans directly and indirectly impact the Bay.

* ***Observe*** direct connections between pollutants found in the Bay and human activities happening throughout our watershed.

* ***Understand*** how wetlands function and why they are important.

* ***Think*** about how our own actions and behaviors impact the Bay.

Using the steps of the scientific method, answer these questions:

1) What is one *observation* you have made about the water in the Bay? _____

_____

2) Based on that observation, what is one *question* you have about the water in the Bay? _____

_____

_____

3) Based on your observations, what is your guess about the answer to that question; what is your *hypothesis?*

_____

_____

4) Where could you do research to find out more about the water quality of the San Francisco Bay?_____

_____

5) What of *experiments* could you do to answer your question?

_____

_____

Water Quality - _____ (fill in site name here)	
OBSERVATIONS	
Site Description	
Time	
Tide (high or low)	
Wind	
Weather	
SEDIMENT NOTES smell, color, texture	
WATER QUALITY	
Temperature (C)	
Salinity (ppt)	
Phosphates	
pH	
Dissolved Oxygen	
Water Color	
Pollution/Trash	
ANIMALS	
Birds	
Mammals	
Invertebrates	
Fish	
Reptiles	
PLANTS (note tide zone)	
OTHER NOTES	

Water Quality - _____ (fill in site name here)	
OBSERVATIONS	
Site Description	
Time	
Tide (high or low)	
Wind	
Weather	
SEDIMENT NOTES smell, color, texture	
WATER QUALITY	
Temperature (C)	
Salinity (ppt)	
Phosphates	
pH	
Dissolved Oxygen	
Water Color	
Pollution/Trash	
ANIMALS	
Birds	
Mammals	
Invertebrates	
Fish	
Reptiles	
PLANTS (note tide zone)	
OTHER NOTES	

How Clean is Our Watershed?

Now that you have tested the water quality in a few different places, take some time to look over your results.

1) Which place has the overall best water quality? What evidence do you have to support this claim? Why do you think the water quality is better here than in other places? _____

_____

_____

2) Which place has the overall worst water quality? What evidence do you have to support this claim? Why do you think the water quality is worse here than in other places? _____

_____

_____

3) What do you think has the greatest impact on water quality in the San Francisco Bay watershed? Why? _____

_____

_____

4) What was your hypothesis about the water quality in the Bay? Was your hypothesis supported by your water quality test results?

_____

_____

_____

5) Were there any flaws in your experimentation? If yes, what were they? What would you do differently next time?

_____

_____

_____

6) Were you surprised by any of your test results? Why or why not?

_____

_____

_____

7) What is your conclusion about the overall water quality/health of the San Francisco Bay watershed? _____

_____

_____

Facing Extinction

Using words from the list below, fill in the blanks to learn about some of the Bay's most famous endangered species. *Hint: If you do not recognize some of the words, look them up in the glossary at the back of this journal!*

endangered species	*wetlands*	*habitat*
salt marsh harvest mouse	*restoration*	*mammal*
food	*crabs*	*camoflage*
pickleweed	*young*	*cordgrass*
California clapper rail	*fill-in*	*brackish*

An _____ is a plant or animal whose population is declining so fast that the species is facing extiction. There are more than 60 endangered species in the San Francisco Bay-Delta Estuary. Many of these depend on the Bay's _____, or marshes, for shelter, _____, and raising their _____.

Here are a few facts about two of the Bay's most famous endangered species. The _____ is a small bird that likes to live in _____, which is a tall, leafy plant that provides good _____. This bird likes to eat small fish and invertebrates, such as _____ .

The _____ is one of the Bay's smallest endangered species. It is so small it could sit on the end of your pencil! It is a _____, which means it is warm-blooded and has hair or fur. This little creature eats only one thing: _____, a plant with a very salty taste that is also edible for humans. It's also one of the only animals in the world that actually drinks _____ water, a mixture of salt and fresh water and the kind of water found in most of the Bay's wetlands.

Both of these species are endangered because of a loss of suitable _____, or homes. The more we humans _____ wetlands for our own use, the less space these creatures have to live. One of the ways we can all help protect the Bay's endangered species is to participate in _____, which helps create new wetlands and clean up existing ones.

Invasion of the Habitat Snatchers!

Non-native species are plants or animals that are brought here from other places. Some non-native species are *invasive*, which means they take over habitats and out-compete native species.

Why do you think invasive species might be a bad thing for the San Francisco Bay Estuary? _____

_____

_____

Try to think of three invasive species (plant, invertebrate, and another type of animal) in or around the Bay (you might need to do some research on your own or ask for help from a teacher). Then make up a story about where they came from and how they got here. Be creative, but not ridiculous. There is no "right" answer!

> ***Example:*** Fennel, an invasive plant, was brought here by the Italians, on boats from Italy. The Italians were homesick, and wanted to use this spice in their cooking to remind them of home.

Plant name: _____

How it got here: _____

_____

_____

Invertebrate name:_____

How it got here: _____

_____

_____

Other type of animal name:_____

How it got here: _____

_____

_____

What do you think you can do to help stop the spread of invasive species? _____

_____

How do you think people in the Bay Area can help eliminate invasive species in the San Francisco Bay? _____

_____

Habitat Restoration and Stewardship

People who live, work, and play near the Bay have a common interest in ensuring environmental protection and quality of life. In community-based projects, people work together to develop plans and goals for local ecosystem protection. Save The Bay has a community-based restoration program, where local students and adults are involved in wetland stewardship projects. But what does all of this mean?

What is *restoration*?

Restoration is the return of a functioning native ecosystem to degraded natural areas. The goal of restoration is to repair ecological damage, create a healthy, self-regulating system, and provide habitat for fish and wildlife.

What does the word restoration mean to you? Why do you think habitats like wetlands in San Francisco Bay need to be restored?

_____
_____
_____
_____

***wardship*?**

p is behavior that exhibits a long-term commitment and
rsonal responsibility. One method of stewardship in-
nteering for projects in the community, like helping to
plants for wetland restoration projects.

Why do you think it's important that Bay Area citizens become stewards of the Bay? Who is responsible for the health of the Bay?

_____
_____
_____
_____

Stewards of the Bay

Citizens who participate in stewardship projects can and do make a significant difference. In fact, Save The Bay was started 40 years ago by a small group of concerned citizens who cared about protecting the Bay. Thanks to the work of these Bay stewards, today the Bay is a cleaner, healthier place, with more wildlife habitat and better environmental protections.

> *"Never doubt that a small group of dedicated individuals can change the world. Indeed, it's the only thing that ever has."*
> -- Margaret Mead

Brainstorm a list of things you can do to become a steward of the Bay (or another special place).

1) _____
_____

2) _____
_____

3) _____
_____

4) _____
_____

5) _____
_____

> *"At some point, the will to conserve our natural resources has to rise up from the heart and soul of the people -- citizens themselves taking conservation into their own hands and, along with the support of their government, making it happen."*
> -- Mollie Beattie

The Threatened Bay

The San Francisco Bay is the largest estuary on the Pacific Coast, and an ecosystem found nowhere else on earth. But this unique environment is threatened every day by human activities. Using words from the list below, fill in the blanks to learn about the environmental threats facing the Bay. *Hint: If you do not recognize some of the words, look them up in the glossary !*

wetlands	*oil*	*fertilizer*
freshwater	*pollution*	*invasive*
agriculture	*expanding*	*heavy metals*
biodiversity	*development*	*non-point source pollution*

1) Over 90% of the historic _____ in the San Francisco Bay-Delta have been lost or altered by_____ along its shores. This has decreased the number of species, or _____, in the Bay.

2) People inadvertently pollute the watershed and Bay every day. Cars leak _____, and people use too much _____ on gardens, lawns, and golf courses. When it rains, these pollutants run down through the watershed and into the Bay. This kind of pollution is called _____ .

3) Two types of water make up an estuary. Today, there is much less _____ coming into the Bay from the watershed. A lot of this water is now diverted to the Central Valley for _____, or farming.

4) The Bay's ecology has been changed by _____ species that were introduced to the Bay in ship ballast water, through human travels, and by intentional introductions.

5) Point-source _____ in the Bay comes from agriculture, treated wastewater, and commercial industry, including oil refineries.

6) With the Bay Area's growing population, our urban areas are _____, which decreases the amount of open space.

7) There are still a lot of _____ _____, like mercury, in the Bay. Some of these come from former military bases and industries and some are still around from the Gold Rush.

What Can You Can Do to Save The Bay?

We make choices every day that impact our surroundings. Because we live in a watershed, most of what we do impacts the San Francisco Bay in one way or another. Start thinking about how what you do in your everyday life might impact the Bay and the wetland you visited, then answer the questions below. *(Hint: refer to the previous page for ideas about threats facing the Bay.)*

1) How would taking a shorter shower impact the Bay?

_____
_____
_____

2) Why would recycling glass and plastic help the Bay?

_____
_____
_____

3) Why does carpooling or taking public transportation help the Bay?

_____
_____
_____

4) Now think about 3 other things you can do to help save the Bay. Write them down, and write down why these things will help make the Bay a better place. Be creative and specific ("don't pollute" will not do for an answer!). And remember, almost everything you do impacts the Bay!

1._____
_____
_____

2._____
_____
_____

3._____
_____
_____

Slough Haiku

Haiku is an ancient form of Japanese poetry. Haiku poems can be about anything, but they traditionally invoke an aspect of nature or the seasons. In Japan, these poems are valued for their lightness, simplicity, openness, and depth. In the space below, try your hand at haiku poetry. At least one of your haikus should be about the San Francisco Bay.

How to write a haiku:

1st line - five syllables . . . . *Tide rising, up, up,*
2nd line - seven syllables . . . *Through the soft, misty morning*
3rd line - five syllables . . . . *Birds dancing in flight.*

Journal Entry Pages

Journal Entry Pages

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Glossary

Abiotic: the non-living components of an ecosystem (i.e. light, soil, water, air).

Acid: any substance that has a pH level below 7, or that has more free hydrogen ions (H+) than Hydroxide ions (OH-). Common acids are substances like lemon juice, vinegar, and battery acid.

Adaptation: a change in the structure or behavior of a species over time in response to a change in its environment.

Algae: simple, aquatic plants without roots, stems, or leaves, but with chlorophyll.

Anadromous: an animal that is born in fresh water, spends most of its adult life in salt water, and migrates back to fresh water to spawn.

Aquifer: an underground lake or pond containing fresh water.

Base: bases, or alkaline substances, are characterized by their bitter taste, slippery feel, and pH level above 7. Soap and baking soda are examples of bases.

Bay fill: the process of dumping soil, garbage, and other materials into the Bay and wetlands in order to change them into dry land on which to build.

Benthic organisms: species that live in the substrate (mud, sand, etc.) on the bottom of lakes, ponds, oceans, and tidal zones.

Bioaccumulation: the process by which certain substances (usually pollutants) accumulate in higher and higher concentrations within living organisms as they make their way up the food chain.

Biodiversity: the number of different species of living things in an area. The more variety among the different kinds of living things, the higher the diversity.

Biome: a major regional or global biotic community, such as a grassland or desert, characterized chiefly by the dominant forms of plant life and the prevailing climate.

Biotic: the living components in a habitat (e.g., plants, vertebrates, invertebrates, etc.).

Brackish water: containing a mix of fresh and salt water.

Catadromous fish: an animal that is born in salt water, spends most of its adult life in fresh water, and migrates back to salt water to spawn. Opposite of anadromous.

Consumer: organisms that cannot make their own food and are dependent on other living organisms (i.e. plants or animals) as a source of energy.

Decomposer: an organism (i.e. bacteria) that breaks down dead plants and animals into more basic elements, releasing nutrients.

Detritus: decomposing plant and animal material.

Dike: a low wall, made of dirt, used to separate sections of a body of water from the the main body; dikes are often used to make salt ponds, golf courses, airports, shoreside parks, and housing.

Dissolved oxygen: the amount of oxygen in the water, measured in parts per million, or ppm. Although most fish can survive low levels of dissolved oxygen for short periods of time, most fish need at least 5 ppm to be healthy and grow.

Dredging: the removal of sediments from the estuary floor (or other body of water).

Drainage: 1) a watershed, or 2) the ability of a substance to pass water through it. Gravel has good drainage, while clay has poor drainage.

Ebb tide: the return of tide water toward the ocean; the out-going tide.

Ecology: the study of the interrelationship of organisms and their environments.

Ecosystem: the plants and animals living in an area together with their surroundings, considered as a system of relationships.

Endemic: native to a specific region and found only in that one area (i.e. endemic plants and animals).

Erosion: the process by which land surfaces are worn away by the movement of water, wind, waves, etc.

Estuary: a semi-enclosed body of water where fresh and salt water mix.

Exoskeleton: A hard outer structure, such as the shell of an insect or crustacean, that provides protection or support for an organism.

Expiration: the act of breathing out; exhalation; often refers to plants releasing oxygen.

Extinction: the wiping out of an entire species of plant or animal.

Food web: an assemblage of organisms in an ecosystem, including plants, herbivores and carnivores, showing the relationship of "who eats whom."

Flood tide: the return of tide water toward the land; the incoming tide.

Groundwater: water that has percolated through the land's surface and resides in aquifers or underground waterways.

Habitat: the native environment of an animal or plant; a habitat must include food, water, shelter, and space.

Halophyte: a plant adapted to living in a saline environment.

Hydrophyte: a plant adapted to living in wet conditions.

Invasive species: a species that invades or encroaches upon a habitat, outcompeting native species.

Levee: a low wall, made of dirt, used to separate sections of a body of water from the the main body; levees are often used to make salt ponds, golf courses, airports, shoreside parks, and housing.

Limiting factor: any environmental factor (food, pollution, etc.) whose presence or absence prevents the growth of a plant or animal population.

Marsh: an area of soft, wet, low-lying land, characterized by grassy vegetation; a transition zone between water and land.

Migration: when animals (i.e. fish, birds, butterflies, or whales) instinctively travel from one place to another often over great distances, to mate or reach feeding grounds.

Mitigation: improving one area in order to compensate for the damaging of another.

***Native species**:* any plant or animal that originated within a particular ecosystem; indigenous

Niche: the particular set of environmental conditions that a specific species has evolved to inhabit most successfully.

Non-native species: any plant or animal species that was introduced into an ecosystem by humans; one that did not inhabit that ecosystem historically.

Non-point source pollution: widespread overland runoff containing pollutants; the contamination does not originate from one specific location, and pollution discharges over a wide land area.

Nutrient: any substance which provides energy for growth (such as food, vitamins, minerals). When materials decompose, their nutrients are released.

Pacific flyway: route followed by birds migrating along the West Coast between South America and Alaska.

pH: the acidity or alkalinity of the water. pH is measured on a scale of 0-14; less than 7 is acidic; 7 is neutral; over 7 is basic.

Phosphates: nutrients found naturally in soil and water. Plants and animals need phosphates to grow. Phosphates are found in fertilizers, human and animal waste, and some soaps.

Photosynthesis: the process by which green plants use the sun's energy to produce glucose (food) from carbon dioxide and water; the by-product of this process is oxygen.

Phytoplankton: single-celled plant-like organisms that drift in the water current.

Plankton: organisms that drift in the water current (i.e. animal and plant-like organisms; often small).

Point source pollution: pollutants discharged from any identifiable point, including pipes, ditches, channels, sewers, tunnels, and containers of various types.

Pollutants: anything that lessens or spoils the quality of the water, air, or land that it touches.

Producers: an organism with chlorophyll which uses light energy (photosynthesis) and nutrients to make its own food; the first level in food chains; plants are producers

Restoration: the return of a functioning native ecosystem to a degraded natural area.

Run-off: water that flows over or through the land in a watershed.

Salinity: the saltiness of the water, measured in parts per thousand, or ppt. For example, fresh water is 0 ppt and the water in the ocean is 35 ppt. The water in the Bay is a mix of fresh and ocean water, with varying salinity.

Scientific method: a series of steps (including observation, question, hypothesis, experimentation, results analysis, and conclusion) that can be used to logically solve problems.

Sediment: dirt, silt, or sand that flows off the land and settles to the bottom of a waterway or is suspended in the water.

Spawn: method of reproduction used by fish in which the female lays eggs and the male fertilizes them.

Slough: a slow moving meandering channel through a marsh; sloughs have muddy banks and are created by tides; natural irrigation channels or waterways.

Stewardship: behavior that exhibits a long-term commitment and sense of personal responsibility; one method involves volunteering for projects in the community.

Tides: the "rising and falling" of the ocean due to the gravitational pull of the moon and the sun on the earth.

Trophic level: a group of organisms that occupy the same position in a food chain.

Turbidity: a measurement of how much sediment, plankton, or other organic matter is suspended in the water.

Watershed: the area of land that drains into a river and its tributaries; the area of land from which rain or melting snow drain into a river, stream, or other body of water.

Wetland: transitional areas between land and water. Three physical features characterize wetlands: standing water, saturated soils, and hydrophytic (water-loving) plants.

Zooplankton: animals that drift in the water current; often small.

Notes/Ideas

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