

Don Edwards SF Bay National Wildlife Refuge Exploration

Go on the Exploration at <http://www.kqed.org/quest/exploration/view/23>
 Download the "Print and Go" guide http://www.kqed.org/quest/dfiles/quest_print_go_don_edwards.pdf

QUEST SUBJECTS

- | | |
|---|--|
| <p>Life Science</p> <p>Earth Science</p> <p>Physical Science</p> | <p>Biology</p> <p>Health</p> <p>Environment</p> <p>Geology</p> <p>Weather</p> <p>Astronomy</p> <p>Physics</p> <p>Chemistry</p> <p>Engineering</p> |
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CA SCIENCE STANDARDS

Grade 5

Physical Sciences

1. Elements and their combinations account for all the varied types of matter in the world. (i)

Earth Sciences

3. Water on Earth moves between the oceans and land through the processes of evaporation and condensation. (a)

Grade 8

Physical Science

6. Principles of chemistry underlie the functioning of biological systems. (c)

Grades 9-12

Chemistry -- Acids and Bases

5. Acids, bases and salts are three classes of compounds that form ions in water solutions. (a)

Ecology

6. Stability in an ecosystem is a balance between competing effects. (a, b)

EXPLORATION NOTES

This Educator's Guide is designed to accompany the Don Edwards SF Bay National Wildlife Refuge Exploration (link above). QUEST recommends taking the Exploration online in the classroom and then going on a field trip to the site. To plan your trip, please visit <http://www.fws.gov/desfbay/>. Print out the "Print and Go" guide for Don Edwards SF Bay National Wildlife Refuge (link above) before you head out. For additional information on wetlands, please see the "Science" section on the Exploration Web site.

Click on "Launch Exploration" to start the online Exploration. Each number represents a waypoint or stop on the trail. Starting at **1**, click on each number to view the accompanying photo(s) and description(s). The virtual Exploration can be taken as a class or done in pairs. Please see Exploration Focus below for questions and activities that go along with each waypoint. Students can answer the questions on the QUESTions & ACTivities student page. Please note that activities are meant to be carried out at the Exploration site. Activities can be completed in pairs and afterward the whole class can discuss what they learned.

TOPIC BACKGROUND

What is salt and how is it produced? Sodium chloride (NaCl), or salt, is a chemical compound that occurs naturally in lakes and oceans. Three different processes can be used to make salt: it can be mined underground by drilling and blasting salt deposits; it can be mined from underground salt deposits and evaporated using a partial vacuum with steam heat in a process called solution mining and mechanical evaporation; and it can be produced through solar evaporation. The last method is the one used here in the Bay Area. Salt water is collected in shallow ponds and then evaporated by the sun and wind. As the water evaporates, it leaves a bed of salt on the bottom of each pond. Once all the water is gone, the salt is harvested, washed and packaged for use.

Wetlands are often used for salt ponds. Wetlands are areas covered by water all the time or at varying times during the year. They can be rich in biodiversity and are among the most productive ecosystems in the world. An immense variety of species of microbes, plants, insects, amphibians, reptiles, birds, fish and mammals make up the complex food webs that can be part of a wetland ecosystem. Wetlands play an important role in the ecology of a watershed. Their shallow water, high levels of nutrients and productivity make them ideal places for organisms to prosper that feed many species of fish, amphibians, shellfish and insects. Many species of birds and mammals rely on wetlands for food, water and shelter, especially during migration and breeding seasons.

Not only are wetlands important to a watershed and its organisms, but they perform many functions that benefit humans as well. They catch runoff from houses and buildings and filter out pollutants before they reach the ocean. Wetlands act as giant sponges to collect excess water and protect against floods and shoreline erosion. And last but not least, wetlands provide beautiful areas for viewing wildlife.

QUEST Media Connections

Create Your Own Exploration!

Follow these simple steps to design an Exploration with your students in your schoolyard or local park.

1. Choose up to 10 interesting sites around your schoolyard or local park to research and photograph. Consider selecting a theme or subject that unites them.

2. In groups, write captions for each photo, making sure to include interesting information.

3. Upload your photos to the Internet through Flickr or another photo site. www.flickr.com/

4. Follow the simple instructions on Google Maps to design your own Exploration using placemarks, lines and shapes (you'll have to open a free Google account first).
<http://maps.google.com/help/maps/mymaps/create.html>

5. You can also browse through the featured maps to get ideas for your Exploration.

6. Send other classes on your Exploration!

7. For older students, consider exploring Google Earth:
<http://earth.google.com/>

PRE-EXPLORATION

- Where does salt come from and how is it produced?
- Brainstorm ideas about what animals you might find in wetlands and marshes.
- What is habitat restoration?
- What do levees do?
- What are some of the different uses of salt besides enhancing the flavor of food?
- What important roles do wetlands play in an ecosystem or watershed?

EXPLORATION FOCUS

Waypoint 1a: What might be some of the reasons the SF Bay wetlands do not look as they did 100 years ago?

ACTIVITY Waypoint 1b: What evidence do you see of human influence in this area?

ACTIVITY Waypoint 1c: Stop and listen for birds -- perhaps you'll hear the clapper rail.

Waypoint 2a: What might be brought into the wetlands by the tidal flow?

ACTIVITY Waypoint 2b: What types of evidence of salt do you see?

ACTIVITY Waypoints 3a and 3b: Check out these sticks. What purpose did the sticks once serve? Who put them here?

ACTIVITY Waypoints 4a and 4b: What other interesting rocks, sticks and other objects do you see around here?

Waypoint 4c: What do you know about algae?

ACTIVITY Waypoints 5a and 5b: Look for other markings in the sand. Who or what might have made them?

Waypoint 5c: How is a sandpiper's beak built to look for food in the mud?

ACTIVITY Waypoint 6a: Look around you. What colors do you see?

Waypoint 6b: Why might the same pond look different at different times of the year?

Waypoint 6c: What do you know about microorganisms? Why are they important?

ACTIVITY Waypoint 7a: Look around for more evidence of microorganisms.

Waypoints 7b and 7c: What tools would you use to sample the water? What would you need in order to see a diatom?

ACTIVITY Waypoints 8a and 8b: Check out salt pond A15. What interesting features do you notice?

Waypoint 8c: Describe the different shapes and sizes of these microorganisms.

Waypoints 9a and 9b: Why do you think Drawbridge became a ghost town?

ACTIVITY Waypoint 9c: Can you find evidence of animals like the salt marsh harvest mouse living in the refuge?

POST-EXPLORATION

- **Create** your own salt pond restoration plan. What would be your concerns if you had to restore salt ponds back into wetlands? What research would you do before you started the process?
- **Watch** a video on how ecologists find lost wetlands (link on following page). Pick an area near your house or school and see if you can find out what it looked like in the past. Go to your local library and look for historic photos of the area.
- **Participate** in a wetlands restoration project through Save the Bay or another group doing restoration projects. Students can collect native plant seeds, grow plants in their nurseries, sow native plants along the shoreline, check water quality and monitor the health of wildlife populations.

Visit the marsh during the spring or fall migratory seasons and you might see brandt, pintails, mallards or canvasbacks. Other water birds that feed and live here include herons, seagulls, avocets and stilts.

LESSON PLANS / ACTIVITIES

Wetlands Time Machine

<http://www.kqed.org/quest/television/view/416>

- Watch a QUEST video segment on what historical ecologists are doing to recreate San Francisco Bay wetlands that existed decades ago.

Water Density PBS

<http://pbskids.org/zoom/activities/sci/waterdensity.html>

- Experiment with the density of salt water.

From Salt Ponds to Wetlands

http://www.kqed.org/quest/dfiles/119a_fromsaltpondstowetlands.pdf

- Watch this QUEST segment on the South Bay Salt Pond Restoration Project and use it with your students to help them understand the importance of wetlands and how some Bay Area salt ponds are being restored.

WEB SITES

San Francisco Estuary Institute

<http://www.sfei.org/wetlands/programs.html>

- Find out all about this wetlands program, including its objectives, history and recent discoveries.

Don Edwards SF Bay National Wildlife Refuge U.S. Fish & Wildlife Service

<http://www.fws.gov/desfbay/>

- This Web site contains information for visiting the refuge, including recreational activities, environmental education programs, documents and brochures.

ARTICLES / READING / RESOURCES

The Salty Water Solution

<http://www.kqed.org/quest/radio/view/525>

- Listen to one of QUEST's radio programs on osmosis and desalination to learn more about one Bay Area agency's idea to build the largest desalination plant in San Francisco.

South Bay Salt Pond Restoration Project

<http://www.southbayrestoration.org/>

- Find in-depth information for the salt pond restoration project, such as meetings and events, project description and management, maps and wetland resources.

Earth Observatory

http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=16685





- See some great images of the salt ponds in the South Bay.

Look for the



indicating resources from QUEST partner organizations

QUEST QUAD

FIELD TEST 	FIELD NOTES 
<p>Experiment with...</p> <ul style="list-style-type: none">⦿ Creating your own salt through evaporation<ul style="list-style-type: none">• Following the guidelines on the Salt Institute Web site below to experiment with salt evaporation. http://www.saltinstitute.org/42j.html⦿ Different types of salt<ul style="list-style-type: none">• What is the difference between table salt, kosher salt and sea salt? Look at them under a microscope.• Where does each one come from?• Try evaporating all three types of salt. Do they all evaporate at the same rate?	<p>While on the trail...</p> <ul style="list-style-type: none">• Take photos to share with the school and/or QUEST community.• Watch birds through binoculars.• Sit in one place and draw a map describing the sounds of the refuge.• Sketch salt ponds, plants and any animals you might see.
FIELD RESEARCH 	FIELD TRIP 
<p>Find out more about...</p> <ul style="list-style-type: none">⦿ Salt production<ul style="list-style-type: none">• What types of salt are there?• Where else can you find salt ponds?• What impact do salt ponds have on wildlife and surrounding areas?⦿ Habitat restoration<ul style="list-style-type: none">• Why do we conduct restoration projects?• What are common areas where habitat restoration occurs?• If you had to pick, what area would you choose to restore?	<p>After the trip...</p> <ul style="list-style-type: none">• Join the QUEST Flickr group and share photos at http://www.kqed.org/quest/photo• Comment on the existing Exploration photos.• Read and comment on related posts on the QUEST blog at http://www.kqed.org/quest/blog/• Enhance or share the field trip using Google Maps at http://maps.google.com/help/maps/mymaps/create.html• Design a class Exploration of your schoolyard or local park (see the QUEST Media Connections box).• Further explore Don Edwards SF Bay National Wildlife Refuge at http://www.fws.gov/desfbay/



QUESTions & ACTivities

At each of the Don Edwards SF Bay National Wildlife Refuge waypoints, answer the question or try out the activity.

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VISIT OUR PARTNERS

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www.bay.org

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Sciences
www.calacademy.org

Chabot Space and Science
Center
www.chabotspace.org

East Bay Regional Park
District
www.ebparks.org

Exploratorium
www.exploratorium.edu

Girl Scouts of Northern
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www.girlscoutsbayarea.org

Golden Gate National
Parks Conservancy
www.parksconservancy.org

The J. David Gladstone
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www.gladstone.ucsf.edu

Lawrence Berkeley
National Laboratory
www.lbl.gov

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www.lawrencehallofscience.org

Monterey Bay Aquarium
www.mbayaq.org

Monterey Bay Aquarium
Research Institute
www.mbari.org

Oakland Zoo
www.oaklandzoo.org

The Tech Museum of
Innovation
www.thetech.org

UC Berkeley Natural
History Museums
<http://bnhm.berkeley.edu/>

U.S. Geological Survey
www.usgs.gov

OTHER WAYS TO PARTICIPATE IN QUEST



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Fridays at 6:30am and 8:30am**



WATCH

**KQED Channel 9
Tuesdays at 7:30pm**