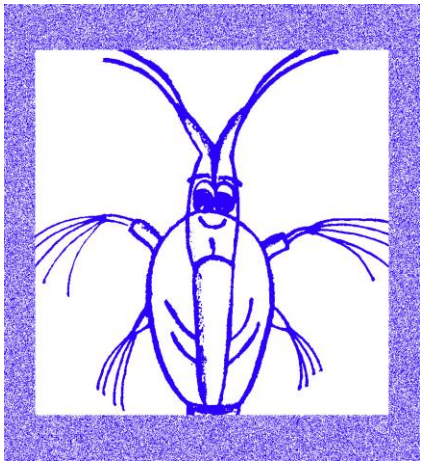
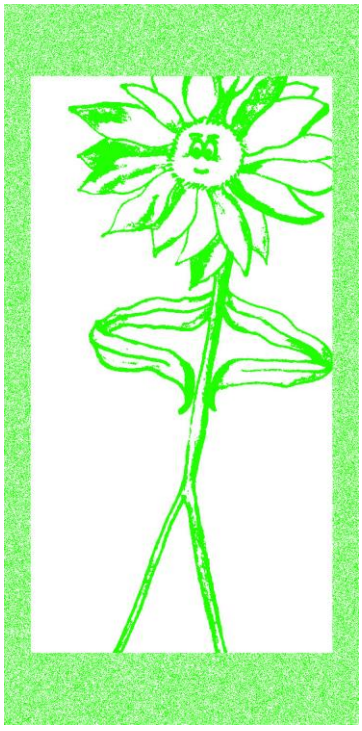
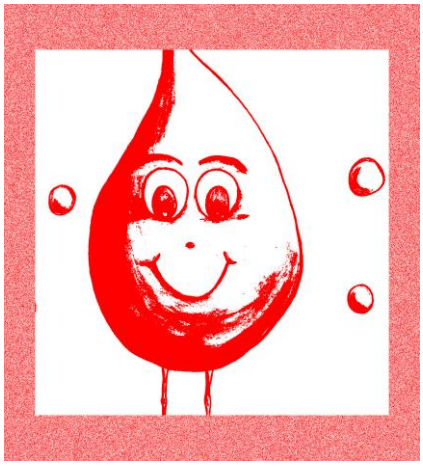
# THE TIJUANA ESTUARY EXPLORERS

## TEACHER'S GUIDE

Building Tomorrow's Future...One Student at a Time







## ACKNOWLEDGEMENTS

California State Parks and the staff at the Tijuana Estuary have made this guide possible.


## COLLABORATORS

US Fish and Wildlife Service San Diego NWR Complex
http://www.sandiegorefuges.fws.gov

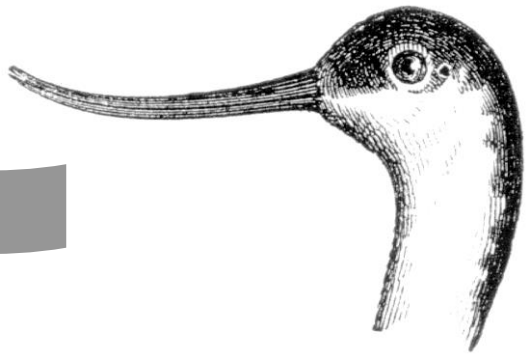
Tijuana River National Estuarine Research Reserve
http://www.trnerr.org





# GUIDE AT A GLANCE

# INTRODUCTION



## HOW TO USE THIS GUIDE

Dear Educator:

The purpose of this guide is to provide you with comprehensive science, reading and writing lessons that will introduce you and your students to the habitats of the Tijuana River National Estuarine Research Reserve (Tijuana Estuary). To use this guide and visit the Reserve, you must first participate in a teacher training at the Tijuana Estuary (*Call 619-575-3613 to make your reservation*).

After the teacher workshop, you can schedule your 2 ½ hour field trip visit with your students. **REMEMBER TO PROVIDE YOURSELF WITH PLENTY OF TIME TO TEACH THE PRE-LESSONS AND REVIEW THE BACKGROUND INFORMATION BEFORE TAKING THE CHILDREN TO THE RESERVE.** All students **MUST** read the Estuary Explorers journal prior to the field trip and complete the pre-lessons.

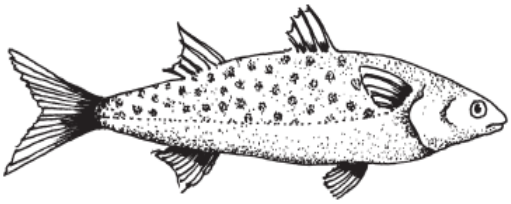
On the day of the field trip, your students will explore two to three areas of the Reserve. The visit will focus on plant, bird and plankton observations. You will also have the option of including a watershed activity during your visit or prior to the field trip.

In the next few pages, you will find the goals of the program along with the California State Standards that are covered through the Estuary Explorer lessons.

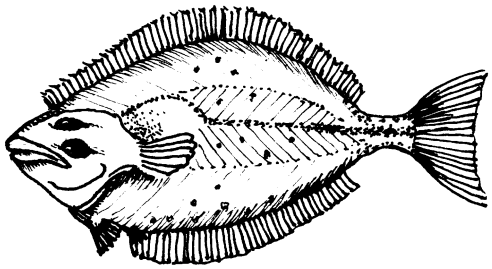
We look forward to exploring this critical wetland habitat with you and your students.

Ecologically yours,

Tijuana Estuary Staff



# INTRODUCTION



## TIJUANA ESTUARY RESERVE

### Tijuana River National Estuarine Research Reserve (TRNERR)

The Tijuana River National Estuarine Research Reserve preserves, protects, and manages the natural and cultural resources of the Tijuana River Estuary by focusing on research and education with compatible recreation and resource use. TRNERR is a 2,500-acre Reserve located in Imperial Beach, San Diego County. The Reserve encompasses beach, dune, mudflat, salt marsh, riparian, coastal sage scrub, and upland habitats surrounded by the growing cities of Tijuana, Imperial Beach, and San Diego. Critical issues confronted by the Reserve include endangered species management, management of the wastewater from Mexico, sediment management, and the integration of recreation and habitat conservation and restoration.

### National Estuarine Research Reserve System

The National Estuarine Research Reserve System (NERRS) is a network of protected areas established for long-term research, education, and stewardship. Through a partnership between the National Oceanic and Atmospheric Administration's Estuarine Reserves Division and the coastal states, the NERRS plays a critical role in sustaining the nation's estuaries and coastal communities. There are currently 29 Reserves located throughout the United States, comprising more than one million acres of estuarine land and water. Reserves conduct research, monitoring, restoration, education, and training designed to improve our understanding and management of estuaries.

# INTRODUCTION

## COOPERATING AGENCIES

Tijuana River National Estuarine Research Reserve is a partnership between the United States and the State of California that links the National Oceanic and Atmospheric Administration (NOAA), California State Parks, and the U. S. Fish & Wildlife Service. California State Parks operates the Visitor Center and maintains Border Field State Park. The U.S. Fish and Wildlife Service manages the Tijuana Slough Wildlife Refuge. The two agencies cooperate to ensure seamless management of the Reserve's natural resources while furthering the Reserve's educational and interpretive programs. In addition, several regional agencies and local municipalities share ownership and management responsibilities at the Reserve.

### NOAA's National Estuarine Research Reserve System

The National Estuarine Research Reserve System is a network of 29 protected areas established for long-term research, education and stewardship. In addition to providing essential habitat for wildlife, the system offers educational opportunities and serves as living laboratories for scientists to protect and enhance coastal wetlands far beyond the boundaries of each individual reserve.

### California State Parks

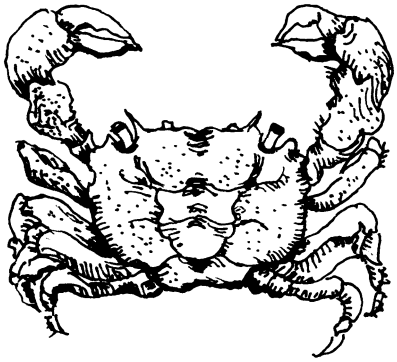
The mission of California State Parks is to provide for the health, inspiration, and education of the people of California by helping preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation.

### U. S. Fish and Wildlife Service, National Wildlife Refuge System

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

# INTRODUCTION

## PURPOSE AND GOALS



The purpose of the *Tijuana Estuary Explorers Teachers Guide* is to assist teachers in preparing their students for a two-hour exploratory and hands-on field trip at the Tijuana Estuary in Imperial Beach.

Teachers receiving this guide will also participate in a mandatory teacher training that will provide them with critical information and lesson plans for 3rd – 5th grade students.

All teachers will receive enough Student Field Journals for their students at the end of the teacher training. For additional Journals, teachers must call in advance.

**Goals**

- To provide more hands-on opportunities (especially in "the field")
    - Plankton Catch
    - Building a Watershed
    - Salt Marsh Plant Bingo & Observation
    - Going Birding

- To provide school-based conservation projects
    - Take Action Magnet

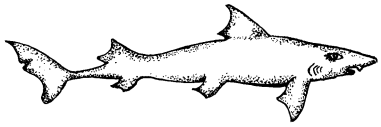
- To teach how wetlands and watershed relate to humans and their quality of life
    - Journal in-class questions

- To provide activities and curricula that complement state standards
    - Program overall supports 3rd-5th grade standards

- To conserve endangered species and their habitats
    - Did you know … section of journal
    - Take Action Magnet

# INTRODUCTION

## SUMMARY OF ESTUARY EXPLORERS



**1) Pre-Lessons – Vocabulary Bingo**

SUMMARY

Students will play a bingo game that teaches them vocabulary words that will support the reading of the Estuary Explorers field journal, their field trip to the Tijuana Estuary and follow up activities.

LEARNING OBJECTIVE

Students will learn the definitions of vocabulary words pertaining to the Tijuana Estuary Explorers program.

**2) Pre-Lessons – How to Teach the Student Journal**

SUMMARY

Students will read and discuss why scientists keep field journals and how they can create one through writings and drawings.

LEARNING OBJECTIVE

Students will read the fictional journal of Pablo and Silvia Hernandez and conduct research to answer *Did You Know* questions.

**3) Pre-Lessons – Estuary Explorers Field Notes Reading Lessons**

SUMMARY

Through reading five journal entries about the Tijuana Estuary and its watershed, students will gain critical knowledge about the natural environment of this reserve. Students will also answer *Did You Know* questions that will further explore the flora and fauna of the Tijuana Estuary.

LEARNING OBJECTIVE

Students will learn about native birds, salt marsh plants and plankton found at the Tijuana Estuary. Students will learn what a watershed is and how it contributes to an estuary.

**4) Field Lesson – Building a Watershed**

SUMMARY

Students will build a watershed while reading a short story about how water travels through the water cycle.

LEARNING OBJECTIVE

Students will learn what a watershed is, how people impact it, and what watershed they live in.

**5) Field Lesson – Plankton Catch**

SUMMARY

Students will collect water samples and using discovery scopes they will identify plankton in the samples.

LEARNING OBJECTIVE

Students will learn that plankton are important organisms that live in the estuary water and support the food chain.

**6) Field Lesson – Going Birding**

SUMMARY

Working in pairs, students will take turns identifying a bird in the field and describe its behavior, beak, feet and other characteristics. Using a bird field guide, students will work together to identify the bird species and illustrate it.

LEARNING OBJECTIVES

Students will learn how to identify native bird species and record their behaviors.

**7) Field Lesson – Salt Marsh Plant Activity**

SUMMARY

Students will identify salt marsh plants through a plant bingo activity and read plant clues to determine if they are an excreter or accumulator. Students will also choose one plant to observe and record its physical characteristics.

LEARNING OBJECTIVES

Students will be able to distinguish how salt marsh plants adapt to a salty environment, know the difference between and describe the physical characteristics of an accumulator and excreter, and learn two endangered species of birds who are dependent on salt marsh plants.

# INTRODUCTION

# CONNECTIONS TO CURRICULUM STANDARDS

## 3RD GRADE STANDARDS

LIFE SCIENCE *HEREDITY: INHERITANCE AND VARIATION OF TRAITS*
3-LS3-1.
Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

- **Salt Marsh Plant Bingo**
- **Going Birding**

3-LS3-2.
Use evidence to support the explanation that traits can be influenced by the environment

- **Salt Marsh Plant Bingo**
- **Going Birding**

LITERACY
ELA-Literacy.RI.3.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 3 topic or subject area*.

- **Student Journal**

CCSS.ELA-Literacy.RI.3.7
Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

- **Student Journal**
- **Watershed Activity**

CCSS.ELA-Literacy.RF.3.4 (a-c)
Read with sufficient accuracy and fluency to support comprehension.

- **Student Journal**
- **Vocabulary Bingo**

WRITING
CCSS.ELA-Literacy.W.3.4
With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose. (Grade-specific expectations for writing types are defined in standards 1-3 above.)

- **Student Journal**

# INTRODUCTION

# CONNECTIONS TO CURRICULUM STANDARDS

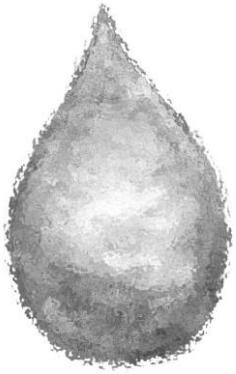
CCSS.ELA-Literacy.W.3.7
Conduct short research projects that build knowledge about a topic.

- **Student Journal**

CCSS.ELA-Literacy.W.3.10
Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

- **Student Journal**

## 4th GRADE STANDARDS



LIFE SCIENCE FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES
4-LS1-1.
Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

- **Salt Marsh Plant Bingo**

LITERACY
ELA-Literacy.RI.4.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 4 topic or subject area*.

- **Student Journal**

CCSS.ELA-Literacy.RI.4.7
Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

- **Student Journal**
- **Watershed Activity**

# INTRODUCTION

# CONNECTIONS TO CURRICULUM STANDARDS

CCSS.ELA-Literacy.RF.4.3 (a)
Know and apply grade-level phonics and word analysis skill in decoding words.

- **Student Journal**
- **Vocabulary Bingo**

CCSS.ELA-Literacy.RF.4.4 (a-c)
Read with sufficient accuracy and fluency to support comprehension.

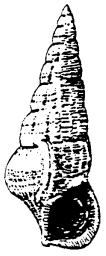
- **Student Journal**
- **Vocabulary Bingo**

WRITING
CCSS.ELA-Literacy.W.4.4
Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

- **Student Journal**

CCSS.ELA-Literacy.W.4.7
Conduct short research projects that build knowledge through investigation of different aspects of a topic.

- **Student Journal**



## 5th GRADE STANDARDS

LITERACY
CCSS.ELA-Literacy.RI.5.4
Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

- **Student Journal**

CCSS.ELA-Literacy.RI.5.3 (a)
Know and apply grade level phonics and word analysis skills in decoding words.

- **Student Journal**
- **Vocabulary Bingo**

# INTRODUCTION

# CONNECTIONS TO CURRICULUM STANDARDS

CCSS.ELA-Literacy.RI.5.4 (a-c)
Read with sufficient accuracy and fluency to support comprehension.

- **Student Journal**
- **Vocabulary Bingo**

WRITING
CCSS.ELA-Literacy.W.5.4
Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

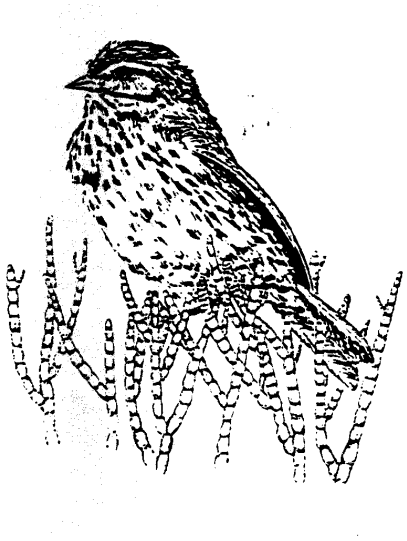
- **Student Journal**

CCSS.ELA-Literacy.W.5.7
Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

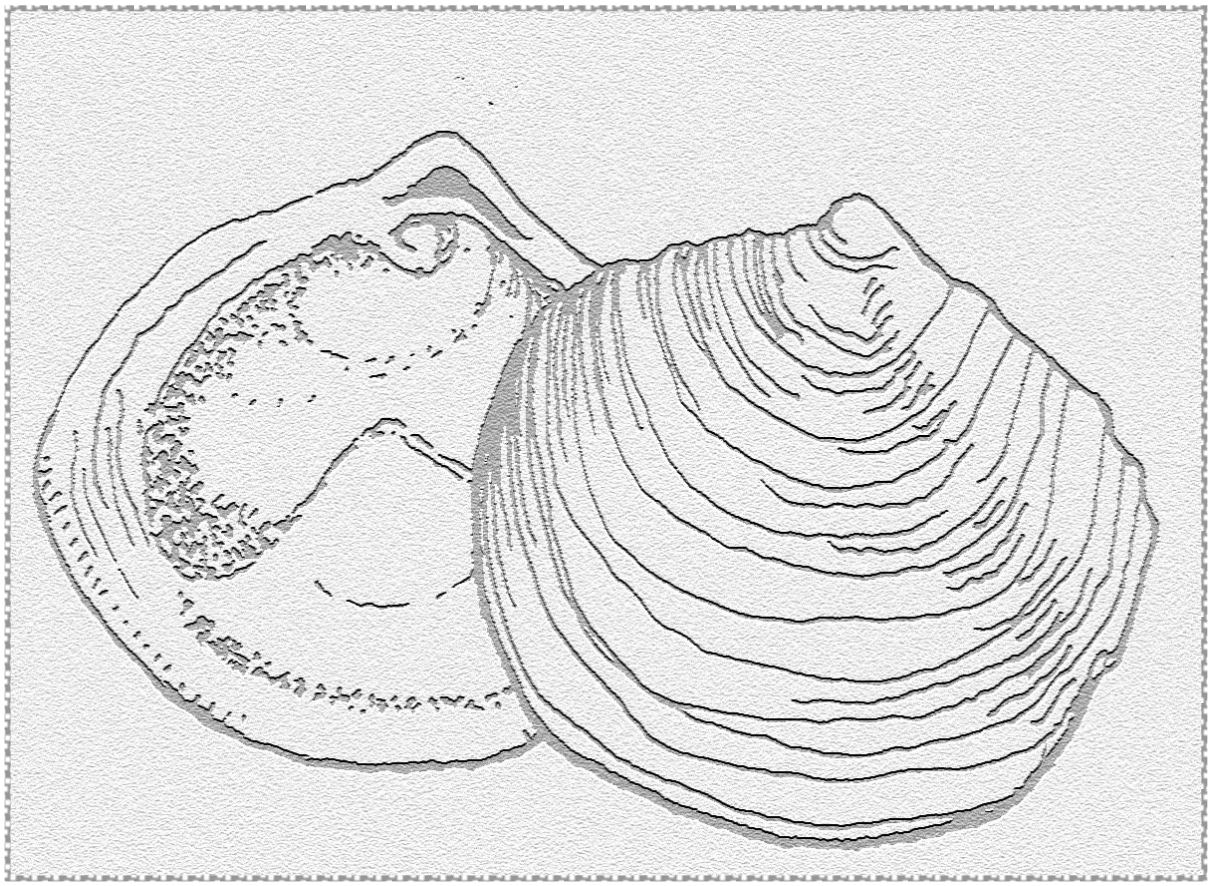
- **Student Journal**

EARTH'S SYSTEMS
5-ESS2-1.
Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

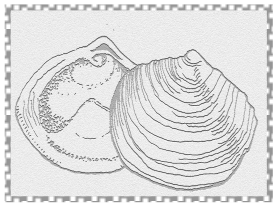
- **Building a Watershed**



# BACKGROUND INFORMATION

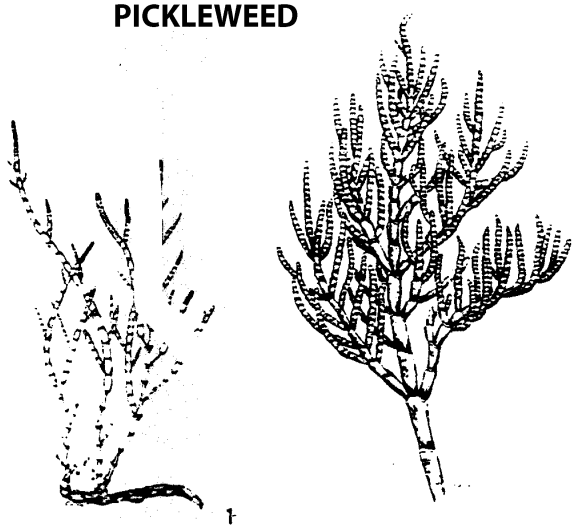


# BACKGROUND - FIELD GUIDES



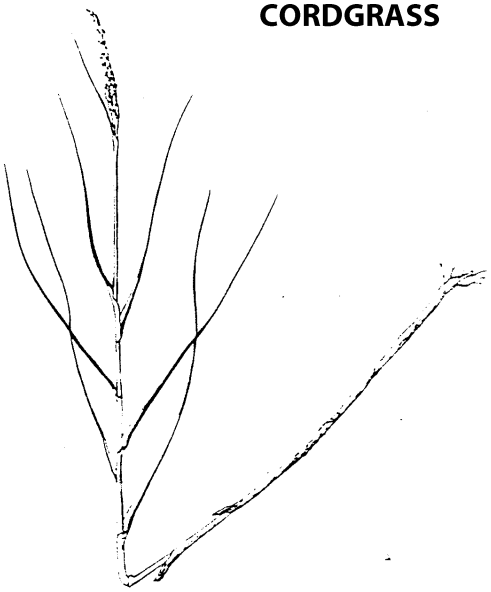
## PLANT GUIDE

**PICKLEWEED**

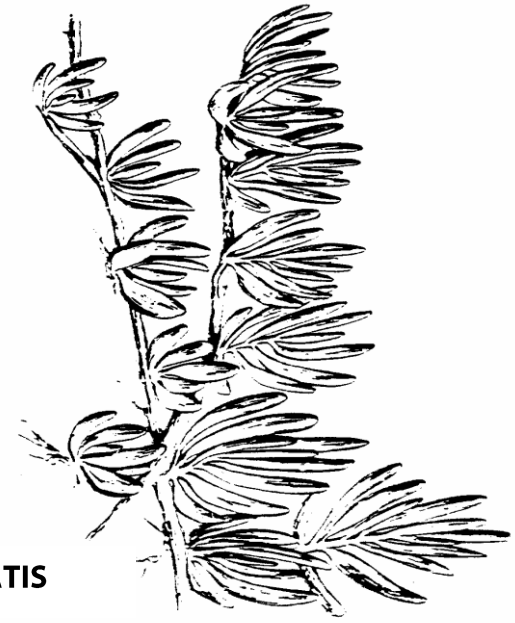


**GLASSWOR**
**–**

**CORDGRASS**

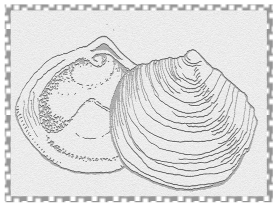


**JAUMEA**



**BATIS**

# BACKGROUND - FIELD GUIDES



## PLANT GUIDE

**CORDGRASS** Grass Family
Spartina foliosa

**HABITAT:** Grows in the low marsh where the roots are continually bathed in ocean water.

**APPEARANCE:** Look for a tall grass which is higher than the other plants in the salt marsh.

**REPRODUCTION:** All grasses are wind pollinated. Look for straw colored spikes of densely packed flowers. Male flowers will have pollen and the female flowers will show graceful waving stigmas to catch the pollen.

**ADAPTATION TO SALT:** All the salt marsh grasses are **salt excreters** using special pores to push out droplets of salty water. Look on the grass blades for salt crystals. See sea lavender.

**ECOLOGICAL RELATIONSHIPS:** Home for the endangered Light-footed Clapper Rail. A spider lives its whole life inside the blades. Important food for grazing animals.

**PICKLEWEED** Goosefoot Family
3 kinds, 2 examples
**Pickleweed** Salicornia pacifica [1]
**Glasswort** Arthrocnemum subterminale [2]

**HABITAT:** Found throughout the salt marsh.
**APPEARANCE:** Stems look like a chain of small pickles.
**REPRODUCTION:** The flowers of all pickleweeds are pollinated by the wind. The small flowers are hard to see because they have no colorful petals
**ADAPTATION TO SALT:** Pickleweeds are some of the many marsh plants that use salt **storage** (they are **accumulators**). Also called **succulents**, these plants are swollen with the stored salty water. When the salt concentration becomes too high the cells will die.
**ECOLOGICAL RELATIONSHIPS:** Frequently the most common plants in the marsh, they provide shelter and food for invertebrates. Belding's Savannah Sparrows build their nests in the glasswort.

**BATIS or SALTWORT** Saltwort Family
Batis maritima

**HABITAT:** Most frequently found in the low marsh. It grows with cordgrass and pickleweed.

**APPEARANCE:** Look for bunches of succulent leaves attached to creeping stems. The leaves retain their yellow-green color all year.

**REPRODUCTION:** This plant is pollinated by the wind like its neighbor pickleweed. The fruits look like a small bumpy potato.

**ADAPTATION TO SALT:** This plant is a succulent; it stores and dilutes salt within special cells. The leaves drop off when the cells are too full of salt. See pickleweed.

**ECOLOGICAL RELATIONSHIPS:** In late summer thousands of the bright green fruits can be found with other debris left at the high tide line. This plant finds new places to grow by floating with the tide.

**JAUMEA** Sunflower Family
Jaumea carnosa

**HABITAT:** Found growing in the middle marsh where fewer high tides reach out but where the salt collects in the summer.

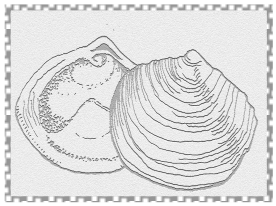
**APPEARANCE:** Jaumea has smaller-than-a-dime yellow sunflowers. The leaves are flat and succulent.

**REPRODUCTION:** The flowers are insect pollinated. The plants bloom in the summer.

**ADAPTATION TO SALT:** The swollen leaves show it is succulent. See pickleweed and batis.

**ECOLOGICAL RELATIONSHIPS:** One of the few plants in the salt marsh which provides nectar and pollen for insects.

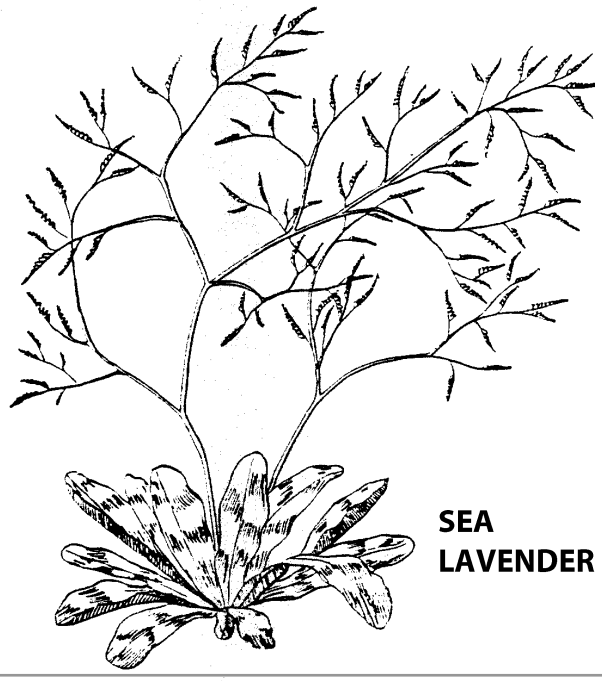
# BACKGROUND - FIELD GUIDES



## PLANT GUIDE

**SEA-BLITE**

**ALKALI HEATH**

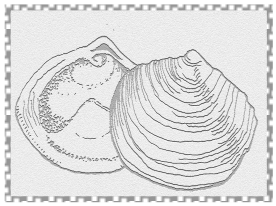


**SEA LAVENDER**

**SHOREGRASS**

**SALT GRASS**

# BACKGROUND - FIELD GUIDES



## PLANT GUIDE

**ALKALI HEATH** Frankenia Family
Frankenia salina

**HABITAT:** Found in the high marsh. Also found inland in wet salty areas.

**APPEARANCE:** A small shrubby plant with small pink flowers. The leaves are small and flat. Sometimes the edges are rolled under which gives the leaves a needle shape.

**REPRODUCTION:** The pink flowers are insect pollinated. The plant blooms in the summer.

**ADAPTATION TO SALT:** Alkali heath excretes or pumps out salt through glands on the leaf. Look for salt crystals. See sea lavender.

**ECOLOGICAL RELATIONSHIPS:** Produces nectar for insects; provides shade and a place to hide for invertebrates.

**SUAEDA or SEA-BLITE** Goosefoot Family
Suaeda esteroa

**HABITAT:** Found in the high marsh. Grows with glasswort and shoregrass, as wells as other common high marsh plants.

**APPEARANCE:** Look for a shrubby bush with dense, blue-green, succulent leaves. Small flowers tucked into leaf axils. Usually they are taller than surrounding plants. See batis.

**REPRODUCTION:** Wind pollinated. See batis and pickleweed.

**ADAPTATION TO SALT:** The many succulent leaves store salt. When there is too much salt in the leaves they turn red and fall off. See pickleweed.

**ECOLOGICAL RELATIONSHIPS:** One of the nine species of plants which make up the thick growth in the upper marsh. Birds, mammals (mice, shrews), and invertebrates use this habitat for cover, nesting grazing, and hunting.

**SALT GRASS** Grass Family
Distichlis spicata
**SHOREGRASS**
Distichlis littoralis
**HABITAT:**
Salt grass grows over a wide area -- from the middle salt marsh to many wet, salty places inland.
Shoregrass will be found in the high marsh, where the highest concentrations of salt can be found in the summer months.
**APPEARANCE:**
Salt grass has a single row of leaves on opposite sides of the main stem.
Shoregrass has short tufts of leaves marching up the stem. Put your hands on shoregrass and feel the prickle from the sharp leaf tips.
**ADAPTATION TO SALT:** All the salt marsh grasses are **salt excreters.** Look for salt crystals on the leaves.
**ECOLOGICAL RELATIONSHIPS:** Both grasses produce seeds for birds and mammals. The endangered butterfly, the wandering skipper, lays eggs on salt grass leaves.

**SEA LAVENDER or MARSH ROSEMARY** Leadwort Family
Limonium californicum

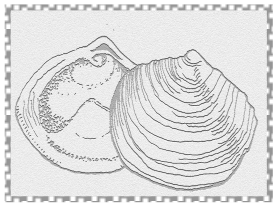
**HABITAT:** Found in middle and high marsh. Frequently seen with glasswort and shoregrass.

**APPEARANCE:** Look for a tall branching flowering stalk above a base of many long leaves. The small flowers are blue and white. Blooms in late summer.

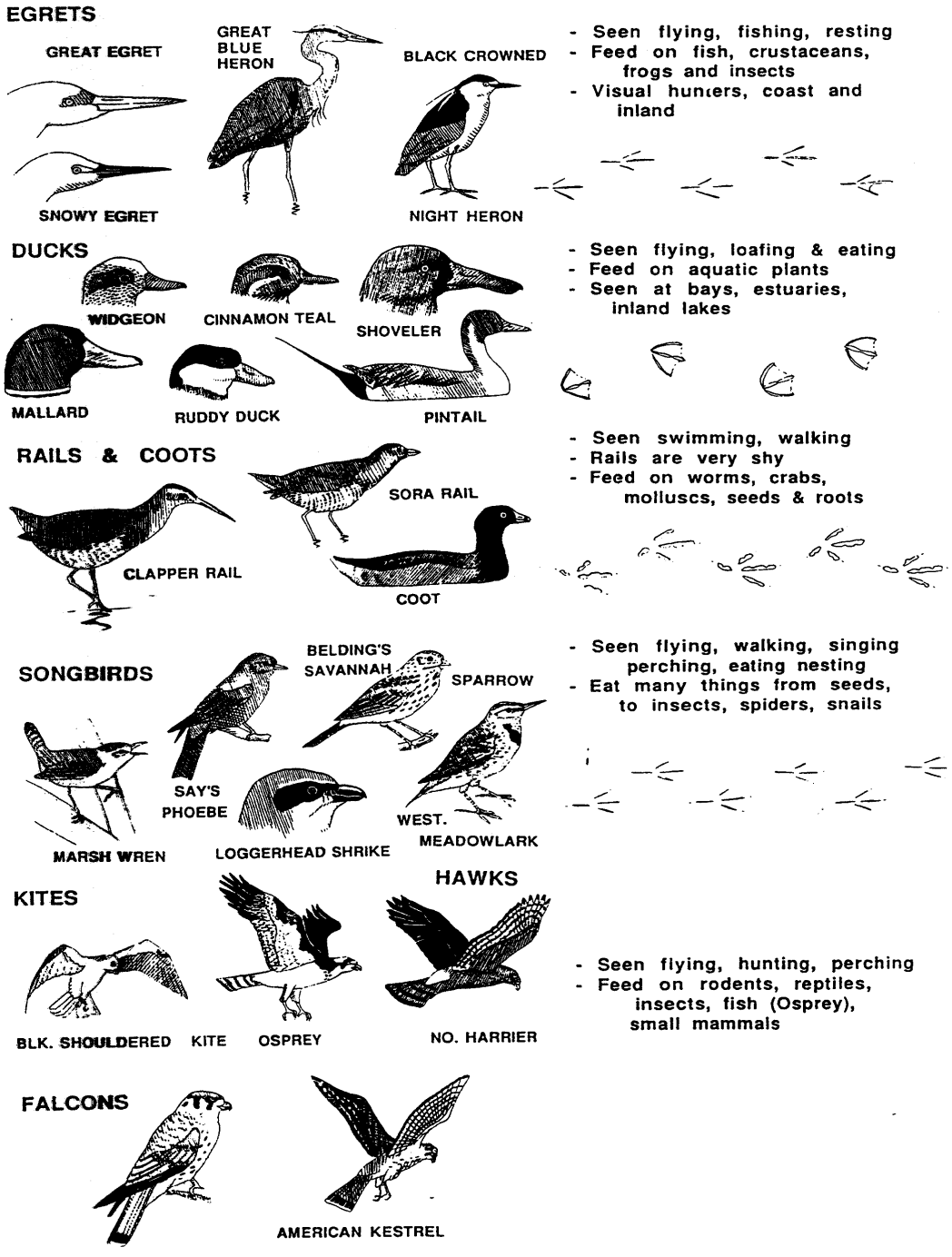
**ADAPTATION TO SALT:** This is one of the **salt excreters** - look for crystals of salt on the leaf surface. Salty water is pumped out of the leaf through special pores, the sun evaporates the water and salt crystals remain behind.

**ECOLOGICAL RELATIONSHIPS:** Flowers are a late summer nectar source for certain insects. On the flower stem, spiders build webs and capture prey.

# BACKGROUND - FIELD GUIDES



## BIRD GUIDE



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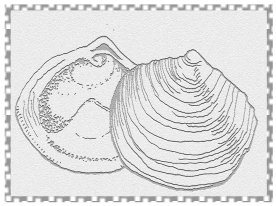
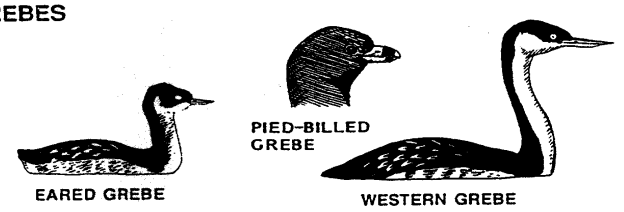


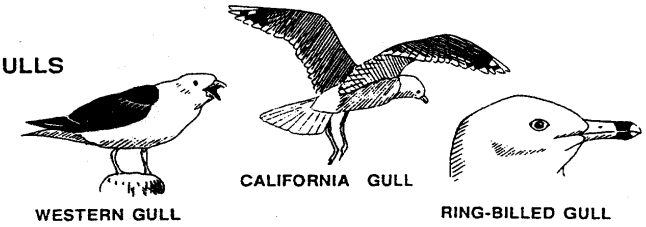
## BIRD GUIDE

### GREBES



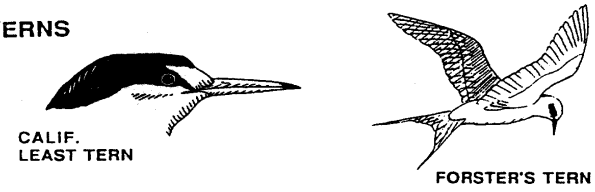

- Seen on water, poor walkers
- Seacoast & inland lakes
- Feed on fish, invertebrates, crustaceans
- Migratory

### GULLS



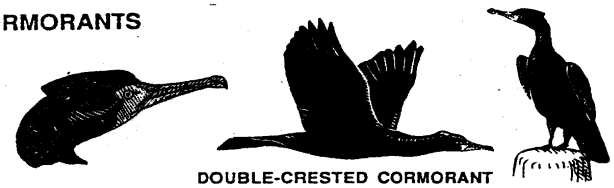

- Seen flying, resting on land and in water
- Eat almost anything
- Some species found on coast and on inland lakes

### TERNS



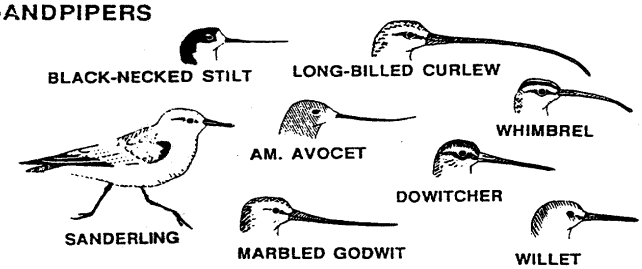

- Aerial acrobats, roost on sand bars
- Eat fish
- Migratory
- L. Tern is an endangered species

### CORMORANTS



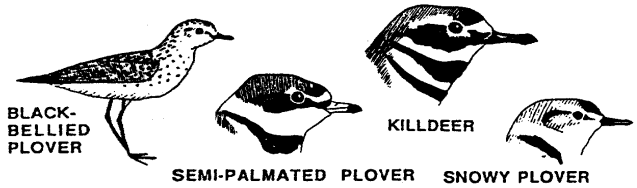

- Seen flying, swimming and resting on pilings, wires
- Poor walkers
- Eat fish
- Resident along west coast

### SANDPIPERS

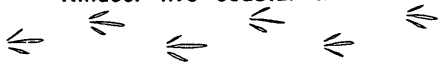



- Seen flying, walking, feeding and resting
- Probe mud with sensitive bills for crustaceans, worms
- Long distance migrants
- Mostly seen in flocks when feeding and resting

### PLOVERS




- Seen flying, walking, feeding and resting
- Visual hunters after insects
- Long distance migrants
- Tend to feed singly but rest in flocks
- Killdeer live coastal & inland



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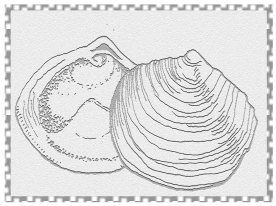

## VISITING THE TIJUANA ESTUARY

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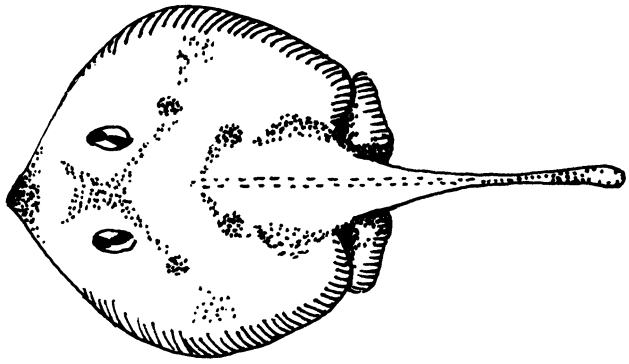
### Estuary Explorers School Field Trips

"Tijuana Estuary Explorers" is an in-class and field trip program, targeted at 3rd - 5th grade that meets state standards and incorporates reading, writing and science into four comprehensive activities about the Tijuana Estuary and its watershed.

Using a personalized field journal, students will read the field notes written by two characters, Pablo and Silvia Hernandez, as they explore the watershed and estuary that the students too will soon visit. Along with their journal notes, students will find pages to start their own journal, using the questions and activities provided.

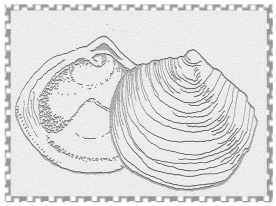
At the end of the field trip, teachers and students will be given *Take Action* magnets to go along with worksheets in the back of this guide to assist them in working to conserve wetland habitats.

**A mandatory four-hour teacher training is required for all teachers who wish to participate in this program.** The training will guide teachers through the student journal, which encompasses the in-class and field portion of the program. Trainings are held 3 - 4 times a year. Please call for more information and dates of upcoming trainings (619) 575-3613 ext. 305 or 306.



**Types of tours available:** Guided
**Length of visit:** Approximately 2 ½ hours
**Languages available:** English and Spanish
**Group size:** Maximum 40 students
**Adult-to-student ratio required:** 1: 10

# BACKGROUND



## VISITING THE TIJUANA ESTUARY

### Reservation procedure

Reservations may be made by phone (619) 575-3613 ext. 305 or 306, or e-mail (marya.ahmad@parks.ca.gov) on a first-come, first-served basis. A two-week advance notice is required.

### Visit days

The best days to schedule a visit are Monday through Friday. Mornings are encouraged.

### Special Visitors

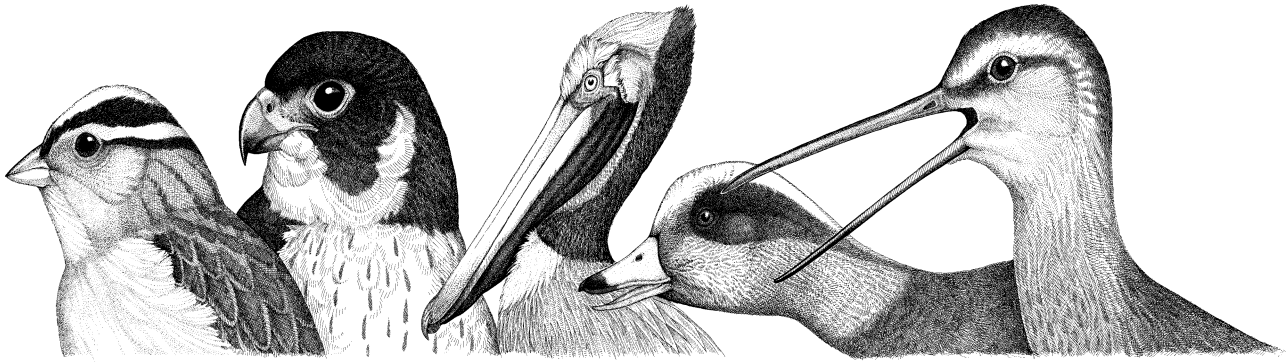
Special Ed. classes, home school classes and students with physical disabilities are welcome! We have programs for all levels and ages. Please let us know of any special needs when reserving your field trip.

### Typical Lesson Rotations

Divide children into three groups. Review field manners. Each group will then rotate through three activities that will include going birding, salt marsh plant activity, plankton catch, or building a watershed.

### Weather Advisory

Field trips are conducted rain or shine. However, for safety reasons, the plankton catch activity will be substituted for another activity if your field trip happens within 3 days (sometimes longer) following a rain event.



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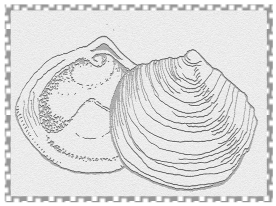


## PREPARING FOR THE FIELD TRIP

### Facility Logistics

1. The bus should drop off the students at the Visitor Center on Caspian Way. The parking lot is large enough for the bus to turn around once dropping the students at the front sidewalk.

2. The bathroom and water fountains are located in the brick building in front of the Visitor Center.

3. Backpacks may be kept in the Visitor Center while students are on the trails.

4. Lunch sites include the back patio (shaded amphitheater), picnic tables (no shade), and the Sports Park. The Sports Park is a grassy area with restroom facilities and a playground that is only one-half block from the Visitor Center, an easy walk. **Please call the Sports Park at (619) 934-9137, if you are planning to use their facility.**

### Student Preparation

1. All students **MUST** read the Estuary Explorers journal prior to the field trip and complete the pre-lessons in their journals.

2. Make sure all students bring necessary items – walking shoes, hats, sunscreen, pencils, nametags and **journal**. Students must have appropriate shoes on to participate in the trail activities.

3. Read and discuss the Field Manners on page iii of the Explorers Journal with the students twice before arriving at the Visitor Center.

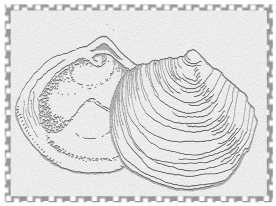
4. Upon arrival, have students use the restrooms and/or drink water and then proceed to the classroom.

5. To help things run more smoothly, please have the students divided into three (3) groups before arriving. Different color nametags or group names are very helpful.

### Teacher Aide and Chaperone Preparation

1. Alert aides and parents that they will be needed to help involve students in discussion, help students complete their work, stay focused, and possibly with discipline. Also, advise the parents and aides that this visit is for the students and they should not answer the questions asked by the guide.

# BACKGROUND



## PREPARING FOR THE FIELD TRIP

There are special manners that your students will need when visiting a reserve where wildlife lives. Please review these manners with your students on **page iii** of the Estuary Explorers Field Journal.

### FIELD MANNERS

**There are special manners that you need when visiting a reserve where wildlife lives:**

**1. Can you hear the birds and their song?** Remember to use a quiet voice.

**2. What can you see?** Walk with a purpose, looking for clues of animals and other live things. Remember, running is not allowed in the estuary.

**3. Stay on the trails…for the wildlife.** Trails were made to protect wildlife and nesting sites.

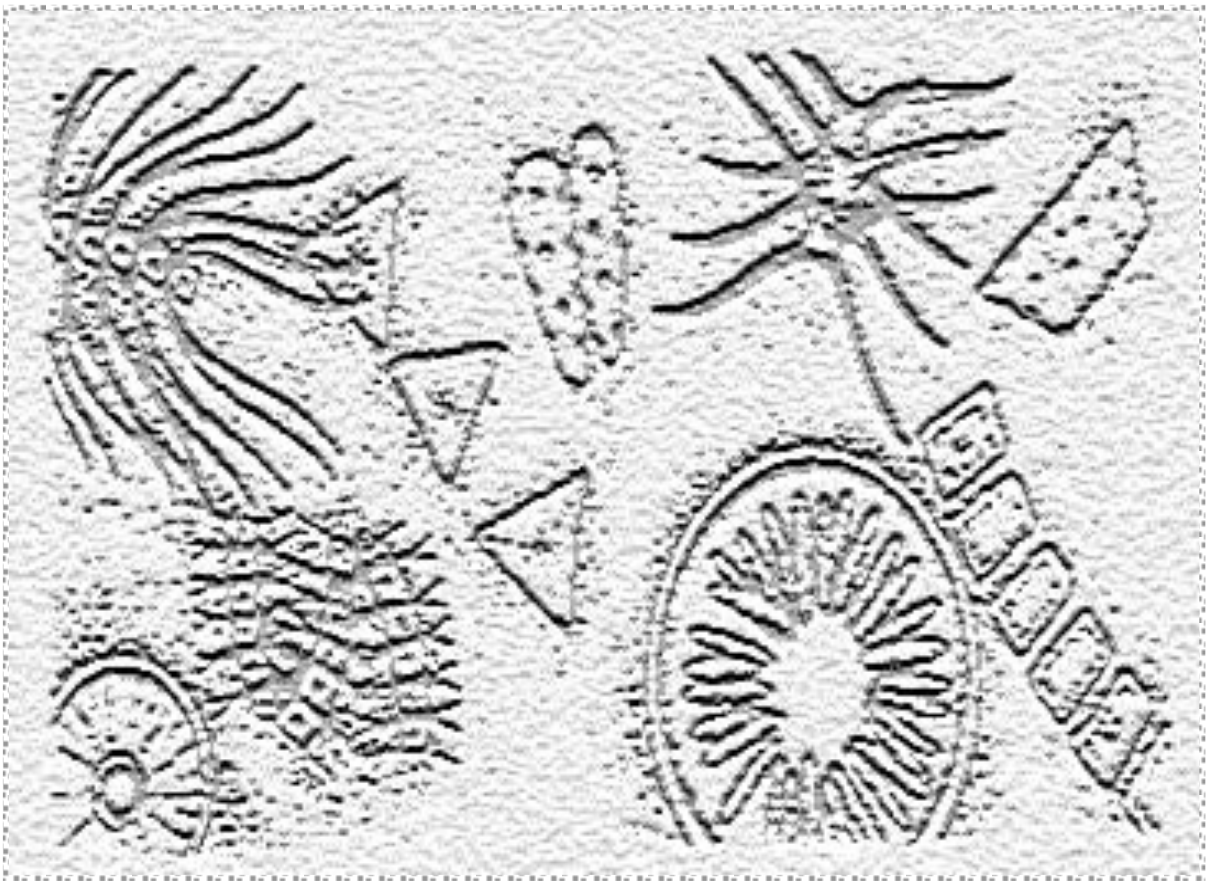
**4. Every animal has a safety zone, the place where the animal feels safe and protected.** Leave a safety zone of at least twelve inches around any animal you find.

**5. Please leave plants, flowers, feathers, shells, nest, bones, etc. in the reserve.** If everyone from your class picked a flower, more than 30 food sources for butterflies and other insects would be removed!

**6. No eating or drinking on the trails.** As a field biologist, it is important that your hands are free to touch, feel, and write about your new discoveries.

**iii**

# PRE-LESSONS



# PRE-LESSONS

## VOCABULARY BINGO

**Overview**

Students will learn the definitions of vocabulary words pertaining to the Tijuana Estuary Explorers program.

**Materials**

- Copy of vocabulary list and definitions
- *Vocabulary Bingo* game board
- Bingo markers - approximately ten per student *(not included)*

**Procedure**

**1.** Provide each student with a vocabulary list. Practice the pronunciation of each word as a class.

**2.** Review the definitions of the words. If preferred, provide students with the vocabulary words and direct them to research the definitions themselves in a dictionary.

**3.** Once the students are familiar with the vocabulary words and their meanings, play *Vocabulary Bingo*. Write the vocabulary words on the board or make sure each child has a list of the words. Direct students to neatly write one vocabulary word in each square of the blank bingo page. It does not matter which words they use or in which squares the words are placed. Each word may be used only once. Give each student markers (beans, plastic disks, squares of paper, etc.) to use when they have a match.

**4.** When the students are ready, read a definition. The students look at their bingo boards and, if they have the word that matches the definition, a marker is put on the word to indicate a match. The first student to fill one row yells "bingo" and wins the game. Bingo can be played several times. Encourage students to exchange boards with each other when a new game begins.

# PRE-LESSONS

## VOCABULARY BINGO

### ACADEMIC VOCABULARY LIST

**ACCUMULATOR** - a salt marsh plant that stores salt

**ADAPTATION** - a physical characteristic or behavior of an organism that helps them survive over time

**AQUATIC** - pertaining to water

**BRACKISH** - containing a moderate amount of salt

**BAY** - an inlet of the sea

**BEACH** - the shore of a body of water that is covered with sand, gravel or rocks

**CHAPARRAL** - a shrubland plant community found primarily in California, that is shaped by a Mediterranean climate (mild, wet winters and hot dry summers) and wildlife; dominant plants include chamise, ceanothus (wild lilac), and manzanita

**COASTAL SAGE SCRUB** - a low scrubland plant community (waist-high bushes) found in coastal California and northern Baja California, it is named after the California sagebrush plant; other dominant plants include California buckwheat, bush sunflower, and black sage

**CRUSTACEAN** - ocean animals with outer coverings that are shed periodically as the animal grows, like crabs, shrimp and lobsters

**DECOMPOSE** - to break down into more basic elements (decay)

**DECOMPOSER** - an organism (such as bacteria) that breaks down dead plants and animals into more basic elements, releasing nutrients

**DIVERSITY** - the variation of life forms within a given ecosystem

**ECOSYSYEM** - a system made up of a community of living things and the physical environment with which they interact

**ENDANGERED** - a species in danger of extinction

**EROSION** - is the process of breaking down land and soil caused by wind, water, removal of plants and human land use

**ESTUARY** - a semi-enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea where the river meets the sea or where freshwater meets salt water

**EXCRETER** - a salt marsh plant that pushes salt out

**EXTINCT** - a species that no longer exists

**FOOD CHAIN** - a sequence of organisms in which each member of the chain feeds on the member below it

**FRESHWATER** - refers to bodies of water that have no salt in them (or very little amounts), like a lake or stream; it is necessary for the survival of most terrestrial organisms

# PRE-LESSONS

## VOCABULARY BINGO

### ACADEMIC VOCABULARY LIST continued

**HABITAT** - the arrangement of food, water, shelter and space suitable to an organism's needs

**HERBIVORE** - an animal that feeds only on plants

**ICHTHYOPLANKTON** - are the eggs and larvae of fish found mainly in the upper 200 meters of the ocean

**LARVAE** - juvenile forms of many invertebrates and fishes

**MIGRATION** - the act of moving (usually seasonally) from one place to another for feeding or breeding

**MUDFLATS** - muddy areas of a wetland that are exposed at low tide, providing foraging for shorebirds

**NATIVE** - a plant or animal belonging to a locality, not brought to the locality by humans

**NUTRIENTS** - any substance that provides energy for growth (such as food, vitamin, minerals)

**OXYGEN** - a gas that animals breathe to stay alive

**PHYTOPLANKTON** - small, usually microscopic, plants that drift in the water

**PLANKTON** - small, usually microscopic, plants and animals that drift in the water

**PREDATOR** - an animal that hunts, catches and eats other animals

**RIPARIAN** - a plant community that lives along and within a freshwater system such as a river or stream

**SALINITY** - amount of dissolved salts in the water

**SALT MARSH** - an area of soft, wet lands with low growing vegetation (plants)

**SALTWATER** - refers to bodies of water with salt in them, such an ocean, sea, or gulf

**SHOREBIRD** - wading birds that frequent shores of oceans, rivers and marshes

**SLENDER** - small and narrow in shape, thin

**STOMATA** - an opening on the leaf of a plant to allow gases to pass through

**TIDE** - the alternate rising and falling of the ocean caused by the gravitational attraction of the moon and sun

**WATERSHED** - a region that drains into a creek, river, ocean or other body of water

**WAXY** - smooth and tends to repel water

**ZOOPLANKTON** - small animals that drift in the water

## PRE-LESSONS

# VOCABULARY BINGO

## BINGO GAME BOARD

# PRE-LESSONS

## HOW TO TEACH THE JOURNAL

**TEACHER'S NOTES**

**Discussion Questions**

Did you enjoy keeping a journal?

Why or why not?

Why might a field biologist keep a journal?

How would the journal of a field biologist be useful in the future?

**Further expand** on students' answers to the above discussion questions using the *Your Journal for Estuary Explorers* to guide you (page iv of Student Journal).

**Overview**

Students will read the fictional journal of Pablo and Silvia Hernandez and conduct research to answer *Did You Know* questions.

**Materials**

- One copy of Estuary Explorers Journal per student
- Pencils to write responses
- Research materials (i.e. internet access)

**Procedure**

**1.** Teach the vocabulary pre-lesson before reading the journals. Vocabulary words are used throughout the journal.

**2.** Introduce the concept of journals to students. Ask if they have ever kept a journal. (Use **Teacher's Notes** for discussion question ideas and review page iv of the Student Journal).

**3.** Read the journal entries as a class, further expanding on information provided in the text and answering questions. Note: Consider reading one journal entry each day over the course of a week. At the end of each journal entry, ask students to visualize what they read and answer the sections after the *Did You Know* questions at the end of each reading.

**4.** Use the **Teacher's Notes** to help guide student responses and evaluate student responses. Remind students NOT to complete the Field Trip Activity section in their journals because that will be completed when they visit the Tijuana Estuary.

# PRE-LESSONS

## HOW TO TEACH THE JOURNAL

**TEACHER'S NOTES**

**Expanding on Concept of a Journal**

1. Explain that it is very important that field scientists keep notes or a journal. It would be impossible to remember everything seen in the field and then to record it when returning to base camp.

2. Explain that scientists write down what they see, take samples for further research, make drawings of things that can not be brought back as samples, and record questions needing further research.

### Your Journal for the Estuary Explorers

*Why might a field biologist keep a journal? How would the journal of a field biologist be useful in the future? Why should you keep a journal?*

Naturalists, biologists, and botanists keep a journal. They record their observations of plants, animals, the weather, and their environment when out in nature.

Field notes in a journal always include the date, time, weather conditions, and location. Notes should also include sketches, drawings, or photos. Sometimes people include poetry and paintings to explain what they see.

Your journal will be a way for you to write down and draw what you learn before and during your adventure to the Tijuana Estuary. Your field notes and the data you collect should be shared with others so they too can learn about the wildlife of the Tijuana Estuary.

Follow these simple steps when writing in your journal:

- Note the time, date, location and weather.
- Draw or sketch what you see and then describe it.
- Look and watch quietly.
- Look closely and carefully.
- Look down, around, and up.
- Write down what you smell.
- Write down what something feels like.
- Use as many of your senses as you can when you are outside.
- Enjoy nature and explore!

**iv**

# PRE-LESSONS

## INTRODUCTORY READING

## DAY ONE – Adventures of Pablo and Silvia Hernandez

**Overview**

Students will read the fictional journal of Pablo and Silvia Hernandez and conduct research to answer questions in the *Did You Know* section.

**Materials**

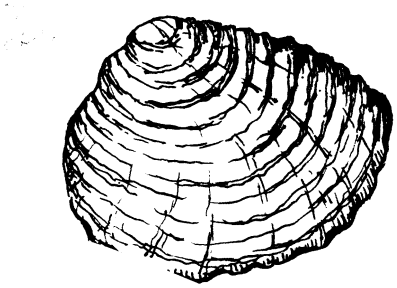
- One copy of Estuary Explorers journal per student
- Pencils to write responses
- Research materials (i.e. internet access)

**Procedure**

**1.** Begin the readings on day one with the introductory reading *Adventures of Pablo and Silvia Hernandez* on page 1 and 2 of the student journal.

**2.** After reading the journal entry as a class recall vocabulary used in the journal entry.

**3**. Review with students what is a watershed and what watershed they live in to prepare for their field trip to the Reserve.



# PRE-LESSONS

## INTRODUCTORY READING

### TEACHER'S NOTES

**Watershed**

We all live in a watershed.

A watershed is a region that drains into a creek, river, ocean or other body of water

*Introductory Reading*

**Adventures of Pablo and Silvia Hernandez**

*Throughout your student journal you will read the field notes written by Pablo and Silvia Hernandez as they explored the watershed and estuary that you too will soon visit. Along with their journal notes you will find pages for you to start your own journal, using the questions and activities provided.*

The Hernandez family lives in San Diego, California. They are a small family – Mr. and Mrs. Hernandez and their two children, Pablo and Silvia. Pablo and Silvia are ten-year old fraternal twins. Pablo is three minutes older than Silvia, and makes sure to remind her of this on a regular basis.

Pablo and Silvia like to play outside. They are part of an ecology club at school that goes on adventures all over San Diego County exploring wild places!

At their last club meeting it was announced that they could enter to win an adventure exploring their local watershed. Through this adventure they would learn what it is like to be a field biologist. The entry form asked, "Have you ever wanted to learn how water is made? What a least tern looks like or what invisible animals live in water? How a pickle turns red?"

Pablo and Silvia raised their eyebrows and looked at each other, shrugging their shoulders. Pablo said, "It might be kind of fun." Silvia said, "What in the world is a watershed?" Pablo and Silvia decided to sign up and apply.

Two weeks later, a letter arrived for Pablo and Silvia, inviting them to be a part of the watershed adventure known as the **Estuary Explorers**.

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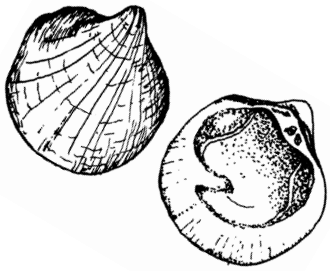
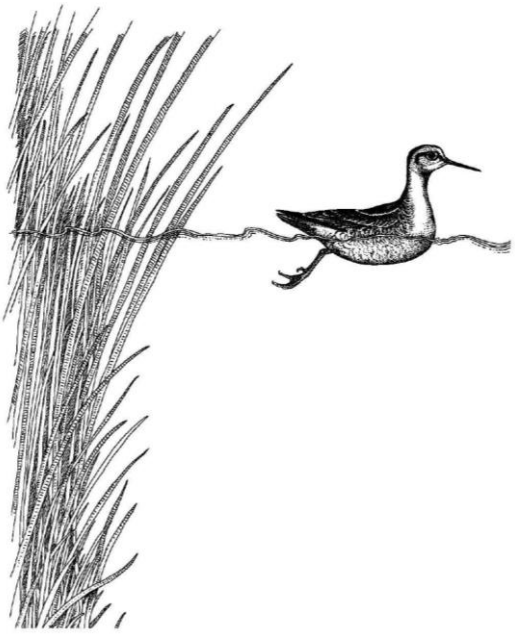


Only six students were invited for this exploration! Dr. Pelly, a field biologist, would be arriving at their home at 5:00 a.m. for the next five weekends ready to take them on their adventure and discovery through their watershed.



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# PRE-LESSONS

## JOURNAL READING #1

## DAY TWO – Where does water live?

**Overview**

Students will read the fictional journal of Pablo and Silvia Hernandez and conduct research to answer questions in the *Did You Know* section.

**Materials**

- One copy of Estuary Explorers journal per student
- Pencils to write responses
- Research materials (i.e. internet access)

**WORDS TO REVIEW**

Dam
Freshwater
Habitats
Pollutants
Run-off
Watershed

**Procedure**

**1.** On day two, read W*here does your water live?* on pages 3 - 5 of the student journal.

**2.** After reading the journal entry as a class recall vocabulary used in the journal entry.

**3.** Provide students with research tools to answer **Your Watershed Notes** and provide them with a minimum of 30 minutes to write their responses in their Journals.

**4.** Use the **Teacher's Notes** to assist in reviewing student responses in their journals.

# PRE-LESSONS

## JOURNAL READING #1

*Journal Reading #1*

SILVIA'S FIELD NOTES
**Where does your water live?**
**5:00 a.m., On our doorstep**
**Location: Chula Vista, CA**

We sat on our doorstep at 5 a.m. We were so excited to be a part of the **Estuary Explorers** that we could hardly sleep the night before. Suddenly, a fire-red jeep appeared coming up the street. In the back seat of the car, sat Theresa, Francisco, and a few other students from our ecology club. After we said hello to everyone we jumped into the back seat of the large jeep that amazingly sat all six of us! Dr. Pelly announced, "Our first stop — the Tijuana River Watershed."

We drove for a long time. I saw a sign that said Border Crossing. We began to drive up some mountains. Finally, we stopped at a river and Dr. Pelly said we were at our first exploration site. I wondered, "Where are we and why are we here?"

We stood beside the river and I could see a lot of people, animals and cars moving around the river below. Dr. Pelly said we were at the beginning of our watershed in the Juárez mountains of Baja California. "A **watershed**," Dr. Pelly explained, "is where our water is naturally stored. It starts at the mountains where the snow melts, becoming water, and enters a river or

3

stream. The river or stream, sometimes called a waterway, flows downhill. Often a few streams or rivers will join at certain points along the watershed creating one waterway. The water continues to flow through different habitats and towns, finding its way to the coast and ocean. Along the way, water may be added from rain or run-off from the land. The watershed starts as freshwater at the top of the mountains and eventually mixes with the saltwater of the ocean when it reaches the coast."

"Everyone lives in a watershed and needs the watershed to survive," said Dr. Pelly. "We use fresh water for drinking, watering our plants and crops, and we also use resources in our watershed for recreation like swimming. Our watershed is also VERY important for many different types of wildlife. It provides a home, food and water for many animals and plants that you will be learning about as an **Estuary Explorer**."

Dr. Pelly asked us if we knew that three-fourths of our watershed is in Mexico. The Tijuana River watershed has two main river branches, one coming from Mexico in the south and one river branch coming from the United States in the northern part of the watershed. Each of these branches are made up of many different rivers and creeks that come together to make the watershed. The water finally ends up in the Tijuana Estuary along the coast.

Along the way, different things affect the health of the watershed. For example, water from storm

4

# PRE-LESSONS

## JOURNAL READING #1

**TEACHER'S NOTES**

**YOUR WATERSHED NOTES**

The earth has a limited amount of water. That water keeps going around and around and around and around and… in what we call the "Water Cycle."

This cycle is made up of a few main parts:

* evaporation
* condensation
* precipitation
* collection

drains on our streets flows right into the watershed. This means we need to be very careful about what is on our streets because, along with the water, pollutants can also flow into the watershed making it unsafe for humans or animals to drink the water.

In the distance I could see a huge wall of concrete dividing the river. It caused the river to look like a lake. I asked Dr. Pelly what the concrete was for and if it was part of the watershed.

"Three dams are found along the Tijuana River watershed that you live in," said Dr. Pelly. "Dams change the way the water flows in a watershed. This changes the homes of many animals and the lives of people along the watershed. For example, if you are a farmer who usually gets water from a river or a stream, a dam may limit how much water you receive because it holds the water back, or it may help you to get more water depending where you are along the river. What will happen to the farmers' crops if they do not get enough water?" Of course, we all answered that the crops would die. I thought to myself, "I wonder why they build dams?"

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5

**Did you know** that the water that you drink today is the same water that was here when dinosaurs lived?

YOUR WATERSHED NOTES

*(Answer the following questions in the space provided. Share your journal notes with your class and family.)*

Why is the water that you drink today the same water that was on earth billions of years ago?

6

# PRE-LESSONS

## JOURNAL READING #1

**TEACHER'S NOTES**

**YOUR WATERSHED NOTES**

What watershed do you live in?

*This is a good activity for students to take home. Some useful websites include:*

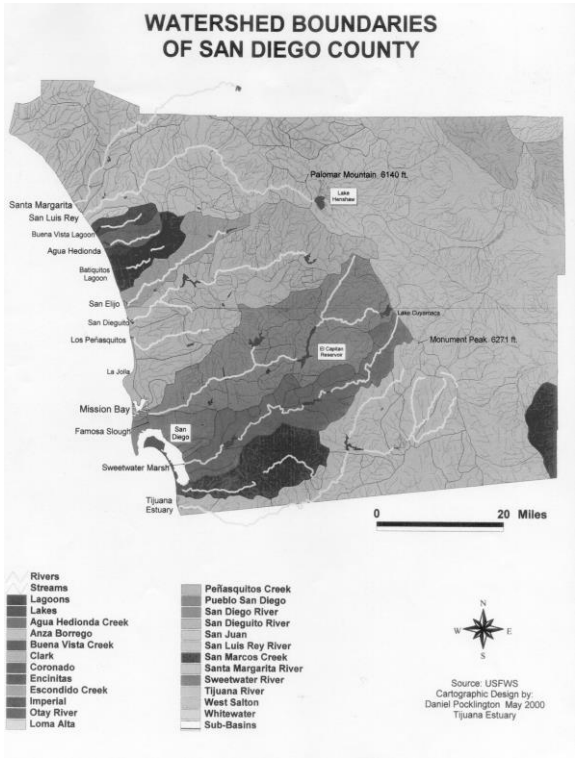
*www.projectcleanwater.org*

*www.sdcounty.ca.gov*

*www.sdbay.sdsu.edu/education/pueblo.php*

Which watershed do you live in? Draw your watershed.

_____




7

# PRE-LESSONS

## JOURNAL READING #2

## DAY THREE – Invisible Water Creatures

**Overview**

Students will read the fictional journal of Pablo and Silvia Hernandez and conduct research to answer questions in the *Did You Know* section.

**Materials**

- One copy of Estuary Explorers journal per student
- Pencils to write responses
- Research materials (i.e. internet access)

**WORDS TO REVIEW**

Adaptation
Brackish
Freshwater
Ichthyoplankton
Larvae
Plankton
Phytoplankton
Saltwater
Zooplankton

**Procedure**

**1.** On day three, read *Invisible Water Creatures* on pages 9 and 10 of the student journal.

**2.** After reading the journal entry as a class recall vocabulary used in the journal entry.

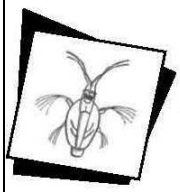
**3.** Provide students with research tools to complete **Your Plankton Notes** and provide them with a minimum of 30 minutes to write their responses in their Journals.

**4.** Use the **Teacher's Notes** to assist in reviewing student responses in their journals.

# PRE-LESSONS

## JOURNAL READING #2

*Journal Reading #2*



**PABLO'S FIELD NOTES**
**Invisible Water Animals**
**6:00 a.m, at the Tijuana Estuary**
**Location: Imperial Beach, CA**

We stood on a muddy trail just a few miles from the ocean. Dr. Pelly called this place an estuary. Francisco asked what that meant. I am glad he did because I had no idea. We were surrounded by what I thought were many rivers or streams. Alongside the water this funny-looking grass was the only thing growing. There were many birds picking at the mud with their beaks and you could feel the ocean breeze. There was a ripple in the water coming upstream.

After having us guess what an estuary was, **FINALLY** Dr. Pelly told us that an **estuary** is where **freshwater** and **saltwater** meet. In an estuary there is a daily ocean **tide** that moves in and out. The combination of the fresh and saltwater is called **brackish** water. Alongside the estuary different types of wildlife (both animals and plants) live and adapt to the salt in the water.

Dr. Pelly took out this huge pole from the jeep that had a net at the end of it and a small hand-held microscope. "Have you ever caught plankton?" asked Dr. Pelly. "What is plankton?" I wondered. "Maybe it's a fish."

9

Dr. Pelly explained that plankton is one of the most important food sources for marine mammals. **Plankton** are *drifting* organisms that we can usually only see under a microscope. But there are also some plankton that are as large as a jellyfish!

Here are some cool facts Dr. Pelly told us that I thought a field biologist would write down:

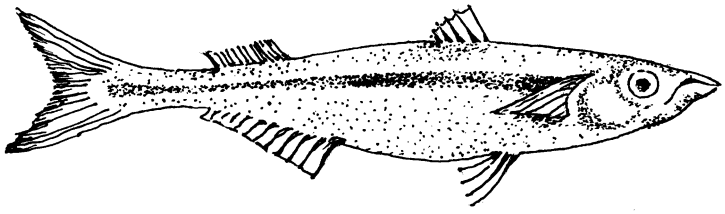
**Phytoplankton** are small drifting plant-like organisms in the estuary, and important food for many animals. They also make oxygen in the water for aquatic life to breathe!

**Zooplankton** are animals that can also drift, but they have the ability to move small distances on their own. They can be eggs, larvae, juveniles, or adults of other animals such as fish that live in the estuary.

**Ichthyoplankton** are the **larvae** (babies) of fish. Ichthy means fish.

Dr. Pelly explained that many fish species come to the estuary from the ocean to lay their eggs. It is a safe and important fish-hatching area. Over 28 different types of ichthyoplankton have been found by field biologists in the Tijuana Estuary. Without the estuary, these fish would not survive and the many animals that depend on them for food would also suffer.

10



# PRE-LESSONS

## JOURNAL READING #2

**TEACHER'S NOTES**

**YOUR PLANKTON NOTES**

**Fish Species**

For a guide of local fish species visit the Tijuana Estuary's Education webpage, look under *High School Curriculum*.

*www.trnerr.org*

When is a fish an ichthyoplankton during its lifecycle?

*A fish is an ichthyoplankton during its larval stage that usually occurs in a river or estuary habitat depending on the species.*

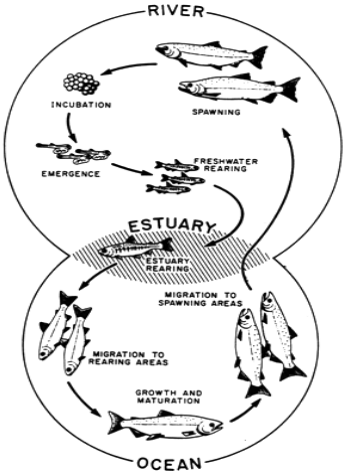
*www.enchantedlearning.com*

**Did you know** that a blue whale, the largest mammal, eats 4 tons or 40 million krill, a type of zooplankton, a day?

**YOUR PLANKTON NOTES**

*(Answer the following questions in the space provided. Share your journal notes with your class and family.)*

**Research the life-cycle of a fish and draw it below.**




**Salmon Life Cycle**

**When is a fish an ichthyoplankton during its life-cycle?**

_____

_____

11

# PRE-LESSONS

# JOURNAL READING #3

## DAY FOUR – Going Birding

**Overview**

Students will read the fictional journal of Pablo and Silvia Hernandez and conduct research to answer questions in the *Did You Know* section.

**Materials**

- One copy of Estuary Explorers journal per student
- Pencils to write responses
- Research materials (i.e. internet access)

**WORDS TO REVIEW**

Brackish
Coastal Sage Scrub
Migrates
Mud Flats
Riparian
Salt Marsh
Sand Dunes

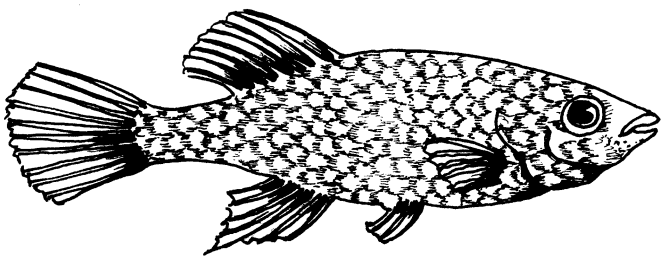
**Procedure**

**1.** On day four, read *Going Birding* on pages 14 - 16 of the student journal.

**2.** After reading the journal entry as a class, recall vocabulary used in the journal entry.

**3.** Provide students with research tools to complete **Your Bird Notes** and provide them with a minimum of 30 minutes to write their responses in their Journals.

**4.** Use the **Teacher's Notes** to assist in reviewing student responses in their journals.



# PRE-LESSONS

## JOURNAL READING #3



**SILVIA'S FIELD NOTES**
**Going birding**
**5:00 a.m., Tijuana Estuary**
**Location: Imperial Beach, CA**

We started our day at what Dr. Pelly called the channels, the different waterways that make up the **salt marsh** habitat of the estuary. The sun was just starting to rise behind us and the birds were waking up chirping. Dr. Pelly did say we would have to get up before the birds if we wanted to watch them. We were just in time!

Dr. Pelly named the habitats of the estuary — coastal dunes, brackish ponds, **mudflats**, salt marsh, **riparian**, and **coastal sage scrub**. Today we would be visiting each of these areas and learning what bird species live in each habitat.

Dr. Pelly said that each bird has a unique beak. A bird's beak acts like a utensil helping it to pick up, catch, or eat its food.

Our activity today would be similar to a scavenger hunt. Each of us would find one bird and describe its beak, feet and behaviors to the group. We'd see who could guess the right bird from our description.

We took a short walk to a habitat area that Dr. Pelly called the uplands or coastal sage scrub. Soaring above us was some type of large bird. Dr. Pelly said it was a bird of prey. While we looked for it in our field



guides, Dr. Pelly explained that it had a white underside and gray top feathers. As it soared it tilted from side to side.

What kind of bird could this be? It almost looked like an owl but it was daylight and owls fly at night. Could it be a northern harrier? I was right! Dr. Pelly said it was a male northern harrier gliding in search of small mammals for its breakfast. Cool!

We walked further east along the channels to the riparian habitat where willow and cottonwood trees stood. Dr. Pelly said that these types of trees could only grow in freshwater habitats. We sat quietly on the ground below a small cottonwood tree listening to a bird singing "*cheedle-cheedle chew.*" We could not see where the sound was coming from. I spotted it with my binoculars and quietly whispered my clues to the group.

"It is a small sparrow-like bird that is eating insects from the ground. It has gray top feathers and a whitish underside. Around its eye there is a light, white circle. It looks like it is gathering grass and leaves to make a nest." Pablo got the answer — the least bell's vireo, an **endangered** bird species of Southern California.

Dr. Pelly said we only had time for one more habitat — the sand dunes. The sand dunes were along the shoreline and are an endangered habitat of Southern California. Dr. Pelly said when a habitat is endangered much of the wildlife that depends on it also becomes



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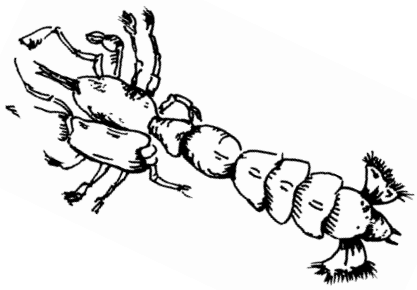


# PRE-LESSONS

## JOURNAL READING #3

**TEACHER'S NOTES**

**YOUR BIRD NOTES**

What percentage of bird species at the Tijuana Estuary are migratory birds?

**Math Equation**
*320 migratory birds ÷ 370 total bird species = N*

**Answer**
*N = .8649*
*= 86% of bird species are migratory birds at the Tijuana Estuary*

Write about one of the birds that migrate to the Reserve (see list in Journal).

**Native Bird Resources**

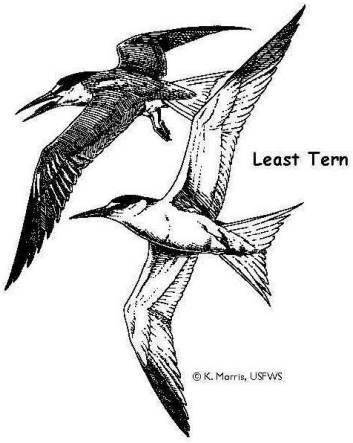
*http://nationalzoo.si.edu/migratory-birds*

*http://www.fws.gov/birds*

*http://www.allaboutbirds.org/guide*

endangered because they survive on the food, water, shelter, and space of the habitat.

We observed the sand dunes from a little wooden deck. It was Theresa's turn to play. She described a small little bird with black on top of its head, a white forehead, and a yellow bill. She thought it might be sitting on some eggs. The bird called out "*kip, kip, kip.*" Francisco figured this one out! It was the endangered least tern. The field guide said it lives here during the spring and summer during the nesting season. This means the least tern **migrates**. As we started to leave, we saw another least tern dive into the ocean catching fish.




16

**Did you know** there are more than 370 species of birds that make their home at the Tijuana Estuary? 320 of those species are **migratory** birds.

YOUR BIRD NOTES
*(Answer the following questions in the space provided. Share your journal notes with your class and family.)*

What percentage of the bird species at the Tijuana Estuary are migratory birds?

17

# PRE-LESSONS

## JOURNAL READING #3

**Write about one of the birds that migrates to the Tijuana Estuary:**
(*Choose from the list below*)

California least tern
Snowy egret
Great blue heron
Ruddy duck
Northern shoveler
Osprey
Willet
Marbled Godwit
American avocet
Western grebe

18

# PRE-LESSONS

## JOURNAL READING #4

## DAY FIVE – Plants of the Estuary

**Overview**

Students will read the fictional journal of Pablo and Silvia Hernandez and conduct research to answer questions in the *Did You Know* section.

**Materials**

- One copy of Estuary Explorers journal per student
- Pencils to write responses
- Research materials (i.e. internet access)

**WORDS TO REVIEW**

Accumulator
Excreter
Pollinator
Salt Marsh

**Procedure**

**1.** On day five, read *Plants of the Estuary* on pages 21 and 22 of the student journal.

**2.** After reading the journal entry as a class recall vocabulary used in the journal entry.

**3.** Provide students with research tools to complete **Your Plant Notes** and provide them with a minimum of 30 minutes to write their responses in their Journals.

**4.** Use the **Teacher's Notes** to assist in reviewing student responses in their journals.

# PRE-LESSONS

## JOURNAL READING #4

**TEACHER'S NOTES**

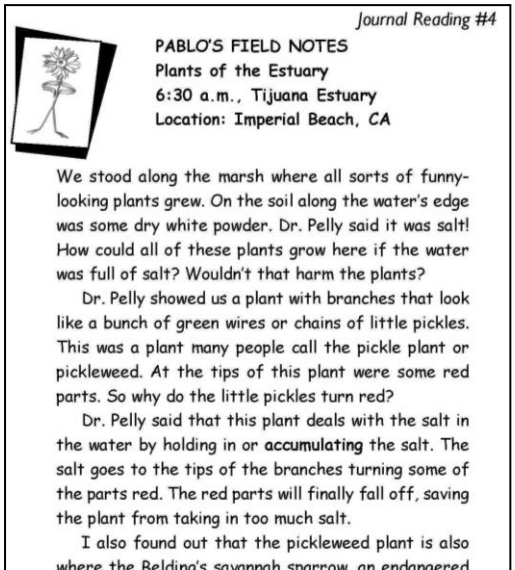
**YOUR PLANT NOTES**

What do the ground-nesting bees do for the salt marsh bird's beak plant to help it survive?

*Ground nesting bees are pollinators for the salt marsh bird's beak plant as well as many other estuary plants. Pollinators are essential for the survival of the plant because they allow the plant to reproduce or make seeds to grow new plants of the same kind.*

Why is this important for a plant?

*Pollinators are vectors (i.e. a bee) that moves pollen from the male anthers of a flower to the female stigma of a flower to accomplish fertilization or syngamy of the female gamete in the ovule of the flower by the male gamete from the pollen grain.*



*Journal Reading #4*

PABLO'S FIELD NOTES
Plants of the Estuary
6:30 a.m., Tijuana Estuary
Location: Imperial Beach, CA

We stood along the marsh where all sorts of funny-looking plants grew. On the soil along the water's edge was some dry white powder. Dr. Pelly said it was salt! How could all of these plants grow here if the water was full of salt? Wouldn't that harm the plants?

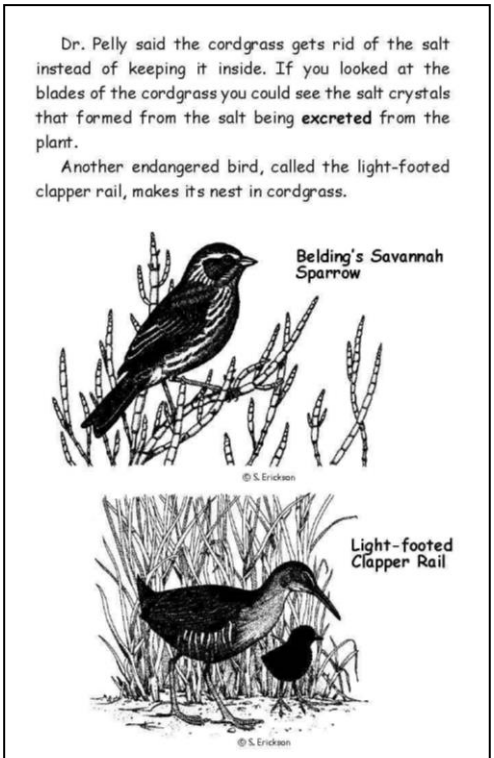
Dr. Pelly showed us a plant with branches that look like a bunch of green wires or chains of little pickles. This was a plant many people call the pickle plant or pickleweed. At the tips of this plant were some red parts. So why do the little pickles turn red?

Dr. Pelly said that this plant deals with the salt in the water by holding in or **accumulating** the salt. The salt goes to the tips of the branches turning some of the parts red. The red parts will finally fall off, saving the plant from taking in too much salt.

I also found out that the pickleweed plant is also where the Belding's savannah sparrow, an endangered bird of the marsh, makes its nest. This little sparrow only lives in marsh habitats of California!

After the pickle plant, we took a look at another plant called cordgrass. This plant lives in the same areas as the pickleweed, so why doesn't it have red tips?

21



Dr. Pelly said the cordgrass gets rid of the salt instead of keeping it inside. If you looked at the blades of the cordgrass you could see the salt crystals that formed from the salt being **excreted** from the plant.

Another endangered bird, called the light-footed clapper rail, makes its nest in cordgrass.

Belding's Savannah Sparrow

© S. Erickson

Light-footed Clapper Rail

© S. Erickson

22

**Did you know** salt marsh bird's beak is a plant that only lives with the help of ground nesting bees? Without these kinds of bees this marsh plant would not survive.

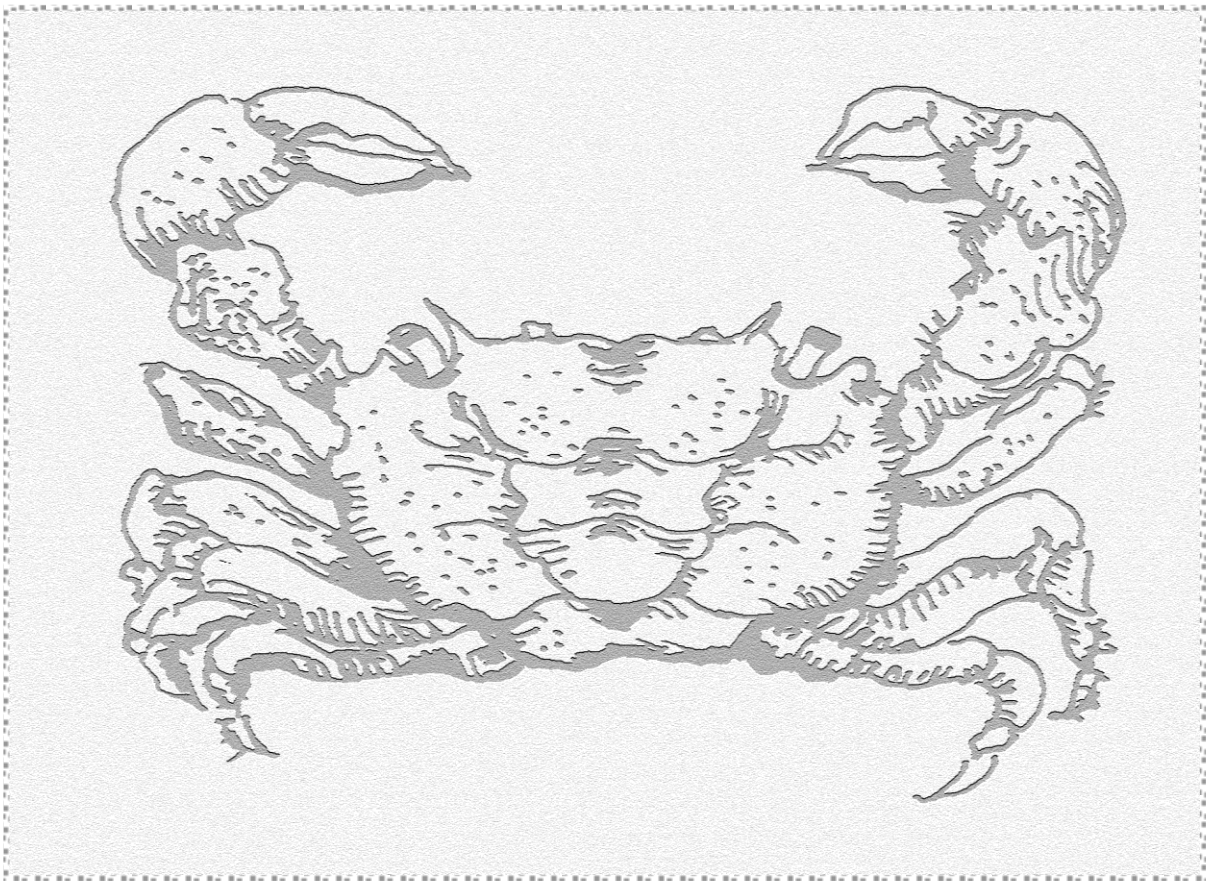
YOUR PLANT NOTES

What do the ground-nesting bees do for the salt marsh bird's beak to help it survive?

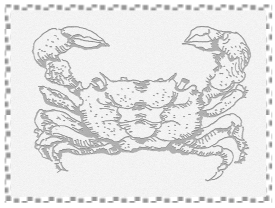
Why is this important for a plant?

23

# FIELD LESSONS



# FIELD LESSONS



## BACKPACK SUPPLIES

For the following lessons, **EXCEPT** *Building a Watershed*, all materials can be found in the Estuary Explorers Backpacks.

Before going in the field, check that all the materials you need are in the backpacks. Each activity contains a materials list. Below is a list of all items that should be in your field pack.

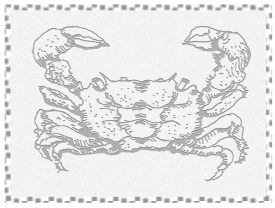
### BACKPACKS CHECKLIST


**Plankton Backpack:**
- Plankton pole
- Plankton signs (2)
- Plastic tub for water sample
- Discovery scopes
- Droppers
- Plastic containers (4) for grabbing sample

**Bird Backpacks (2):**
- *What to Look For* bird sign
- Binoculars (9)
- *Local Birds of San Diego County* laminated guides
- *National Geographic* bird book

**Plant Backpack:**
- Bingo cards
- Bingo card pieces
- Hand lenses in plastic tub
- Salt marsh plant sign

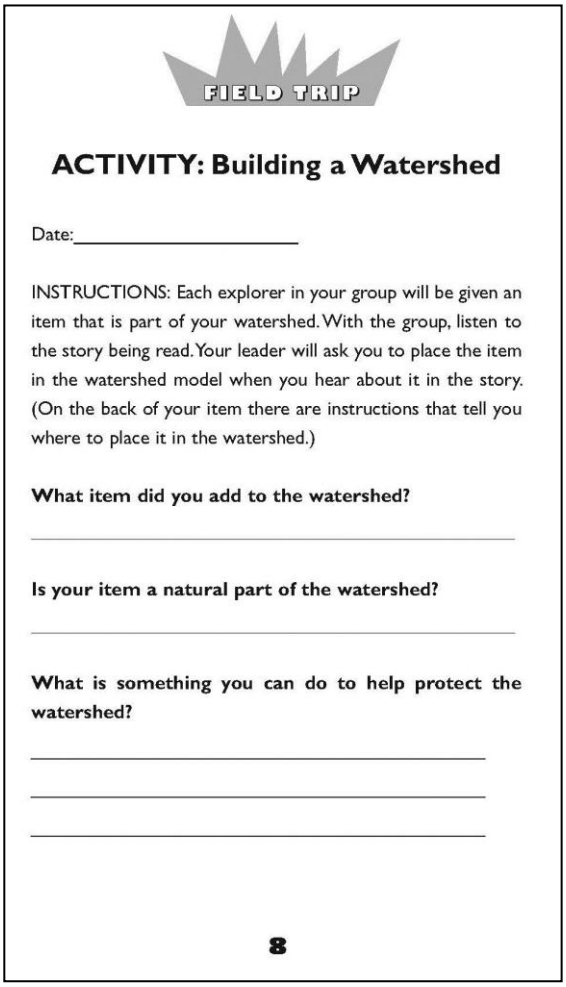
# FIELD LESSONS



## BUILDING A WATERSHED

### Overview

Students will learn components of a watershed through an interactive activity.



FIELD TRIP

**ACTIVITY: Building a Watershed**

Date:_____

INSTRUCTIONS: Each explorer in your group will be given an item that is part of your watershed. With the group, listen to the story being read. Your leader will ask you to place the item in the watershed model when you hear about it in the story. (On the back of your item there are instructions that tell you where to place it in the watershed.)

**What item did you add to the watershed?**

_____

**Is your item a natural part of the watershed?**

_____

**What is something you can do to help protect the watershed?**

_____

_____

_____

8

### Materials

- Watershed poster
- Watershed Story (one copy per instructor, pages 48 - 49)
- Watershed Story game pieces
- Watershed Discussion Topics (pages 50 – 51)
- Estuary Explorer journal

### Procedure

**1.** Provide each explorer with a game piece that is a part of your watershed.

**2. Ask each student** to place their item in the watershed model when they hear the bolded words on their piece.

**3.** Tell students that at the bottom of their item there are instructions that tell them where to place the item in the watershed poster.

**4.** At the end of the story, each student will be asked to answer the following questions on page 8:

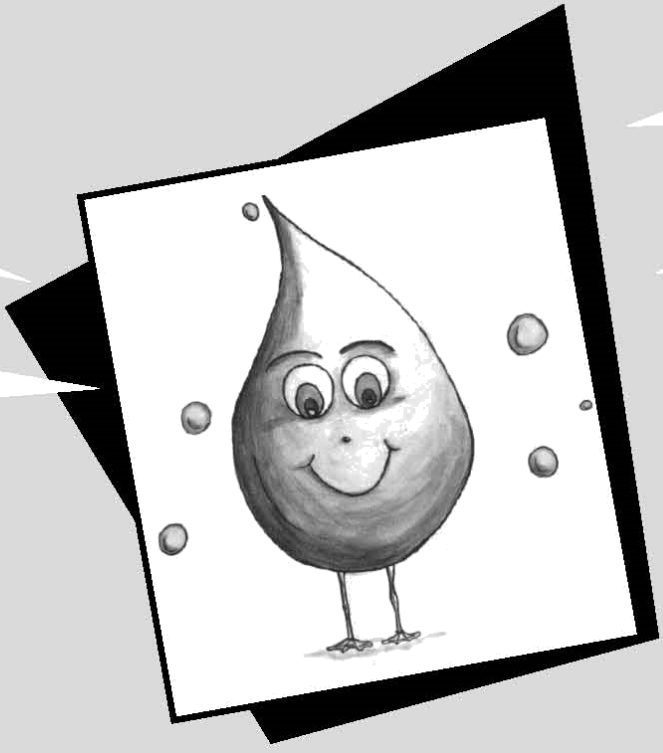
- What item will you be putting in the watershed?
- Is your item a natural part of the watershed? Explain.
- What role does your item have in the watershed? Explain.

**5.** With the class read the *Watershed Story* provided *I am a drop of water...*

**6.** Go over discussion topics with students to check for comprehension and to help students answer their questions. If time allows, you can lengthen your discussion after students have answered their questions.

**7.** Ask students to complete the *Building a Watershed Field Trip* page in their journals on page 8.

# WATERSHED STORY



## I am a drop of water...

A watershed is my home. It starts at the mountains where the snow melts, becoming water, and enters a river or stream. The river or stream, sometimes called a waterway, flows downhill. Often a few streams or rivers will join at points along the watershed creating one waterway. The water continues to flow through different habitats and towns, finding its way to the coast and ocean. Along the way, water may be added from rain or run-off the land. The watershed starts as freshwater at the top of the mountains and eventually mixes with the saltwater of the ocean when it reaches the coast.

**I am a drop of water** that has been here since the beginning of time. Millions of other drops of water, mountains, rivers, creeks and the ocean that form my watershed keep me company.

I have watched this landscape change. Once there were roaming dinosaurs and dense forest for miles. Today there are over **4 million people** living in and around my home — the Tijuana River watershed.

As I travel the creeks of southeastern San Diego County, Tecate, and Tijuana I see many different habitats that are home to a diversity of animals and plants. Year after year, I make my way to the ocean through **forests**, alongside the **chaparral and coastal sage scrub**, through the riparian corridors and **wetlands**, and back again to the ocean.

The plants of these habitats are critical to my survival. They help hold the soil in place along the watershed. The plants help to filter out pollutants that have become a big problem for all of us in the watershed. Without the plants, the rivers I travel in would fill up with soil and pollutants.

Along the way I have watched **animals** come and go. Many decades ago, I remember a large bird with enormous wings and a bald red head that would soar along my watershed. I have heard humans call it a **condor**. Its shadow once was seen casting down over the rivers and streams as it soared along the wind currents. I have not seen these birds for quite some time.

As I fall from the sky with the other droplets of **rain**, **hail**, **or snow**, I can see below the many changes made by humans to the watershed and the land. Unfortunately, humans do not always see how the changes they make will affect the future of the watershed and their freshwater. Only 2.8% of the water on this earth is freshwater that is recycled over and over through many watersheds. The natural soils, rocks, sands, and plants have worked together over time to purify water by filtering out the minerals and salts as the water passes through the watershed. When humans change or remove these natural filters, the little freshwater we have becomes threatened along with all the things that depend on it to survive.

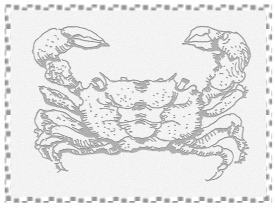
During the last century, I have watched people damage and pollute the watershed, often not knowing it!

All the storm drains on the streets empty into my home. Leftover **paint**, **engine oil**, and **chemicals** washed into the storm drains lead into the watershed, polluting the water, harming and killing animals, and making it **unsafe to swim**. Many times a year, beaches in San Diego are closed down because of polluted water that comes from our watersheds.

I have also seen humans develop new areas along the watershed, forgetting the importance of the natural filters and plants that keep the soil from **eroding** and keep our water free of salts and minerals. When areas are built in this way, it becomes harder and harder for me to stay clean and pure, as freshwater should be.

I am a little drop of water that with **your help** can continue to be an important part of your watershed.

# FIELD LESSONS

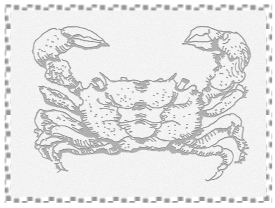


## BUILDING A WATERSHED

**Discussion Topics**

1. **Where does the watershed begin?**
   - *Answer: It starts as fresh water at the top of the mountains.*
2. **How and where does water flow through a watershed?**
   - *Answer: HOW? It starts at the mountains where snow melts, becoming water, enters a river or stream that makes its way all the way to the ocean as it flows downhill with gravity.*
   - *Answer: WHERE? It starts in the mountains and flows downhill through forests, alongside the chaparral and coastal sage scrub, through the riparian corridors and wetlands and back again to the ocean.*
3. **Why has the drop of water been around since the beginning of time?**
   - *Answer: water cycle discussion (evaporation, condensation, precipitation)*
4. **What are some of the habitats found within the Tijuana River Watershed?**
   - *Answer: forests, chaparral, coastal sage scrub, riparian, wetlands, ocean, dunes*
   *What is a habitat? (See vocabulary list on pages 25 - 26)*
5. **Why are plants important for the watershed?**
   - *Answer: They help hold the soil in place*
   - *Answer: They help to filter out pollutants*
6. **Who remembers the item that we took out of the watershed?**
   - *Answer: The condor*
   ***Why did we take out the condor?***
   - *Answer: To symbolize it is an endangered species. In the story it says, "Its shadow once was seen casting down over the rivers and streams as it soared along the wind currents. I have not seen these birds for quite some time."*
   - *Answer: In 1983, there were only 25 remaining California Condors in the wild. In 1987, the remaining 8 condors were captured and taken to the San Diego Zoo (Wild Animal Park) and the Los Angeles Zoo where they are being captive bred.*
   - *Answer: In 1992, the first captive-bred condors were reintroduced into the wild. As of May 1, 2002, the total population of condors reached 197, and the free-flying population reached 68. For population number updates, see the California Condor Recovery Program website:*
   http://www.sandiegozooglobal.org/success_stories/condors
   http://cacondorconservation.org
   - *Answer: Reasons why condors are endangered – loss of habitat, poaching, and lead poisoning. California condors, who scavenge for carcasses left behind by hunters, unintentionally eat lead fragments from bullets. These fragments can lead to serious illness or even death for the condor. Lead works by attacking the nervous system. Some early effects of lead poisoning in condors are loss of balance and inability to fly. Later effects are generally a result of damage to nerves that control the digestive system. Loss of appetite and associated weight loss can occur rapidly. If not treated quickly, the damage to the nervous system is irreversible and leads to a slow and agonizing death.*
   - *Answer: What are some other threatened and endangered species at the Reserve? (See page 76 for a list of endangered and threatened birds at the Reserve)*

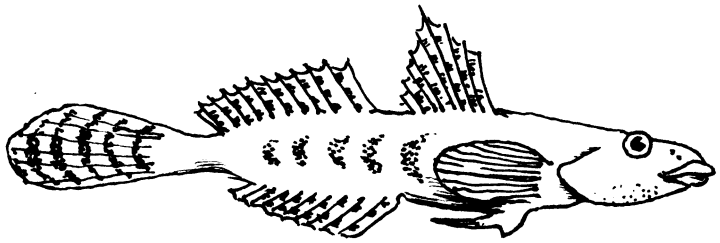
# FIELD LESSONS



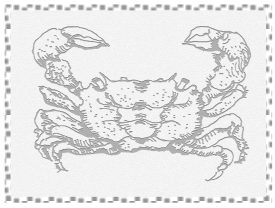
## BUILDING A WATERSHED

**Discussion Topics continued**

7. **How much of the water on earth is fresh water?**
   - *Answer: 2.8%*
8. **What are some ways that people damage the watershed?**
   - *Answer: Leftover paint, engine oil, chemicals, etc wash into the storm drains that lead into the watershed.*
   - *Answer: Building and development removes plants and trees, which lead to erosion and dirty freshwater (plants help to filter out pollutants and help keep soil in place). Erosion happens when there are no plants to hold the soil, then when it rains the soil washes away and into the watershed, the soil or sediment can fill in wetlands and dirty our limited supply of freshwater.*
9. **How can you help the watershed stay clean?**
   - *Answer: Have students brainstorm ideas such as:*
     ** Dispose of your trash properly. Recycle!*
     ** Keep motor oil, animal waste, fertilizers, pesticides, and even yard clippings out of the gutter.*
     ** Choose products that are earth-friendly and can be recycled.*
     ** Make good decisions about how you get from one place to another. Ride a bike or walk when you can.*
     ** Teach these smart habits to your friends and family.*
10. **How is a watershed like a large community?**
   - *Answer: It is geographical region, so instead of a map being divided up into counties or states, it could easily be divided into watersheds.*
   - *Answer: We all live in a watershed.*
   - *Answer: What someone does upstream in the watershed affects everything and everyone that lives downstream.*



# FIELD LESSONS



## PLANKTON CATCH

**TEACHER'S NOTES**

**Duration**
40 minutes

**Location**
Near Tidal Channel

**Zooplankton** are microscopic animals that drift in the water and eat other plankton.

**Phytoplankton** are microscopic primary producers (also called autotrophs). As the base of the oceanic food web, they use chlorophyll to convert energy (from sunlight), inorganic chemicals (like nitrogen), and dissolved carbon dioxide gas into carbohydrates.

### Overview

Students will work in the field to collect a water sample from a nearby channel and examine it for plankton.

### Objectives

Students will:

- Know how plankton fit into the food chain
- Understand the difference between zooplankton and phytoplankton
- Learn what are factors that could affect the abundance of plankton

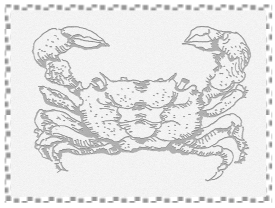
### Materials

- Plankton pole
- Plankton signs
- Plankton Backpack:
  - Plastic tub for water sample
  - Discovery scopes
  - Droppers
  - Plastic containers (4) for grabbing sample
- Estuary Explorer journal

### Background

*(From Wikipedia)*
**Plankton** are defined as any drifting organism that inhabits the water column of oceans, seas, and bodies of fresh water. They are widely considered to be some of the most important organisms on Earth, due to the food supply they provide to most aquatic life.
*(From Explorer Journal)*
Plankton are drifting plants or animals that we can usually only see under a microscope. But there are also some plankton that are as large as jellyfish! **Phytoplankton** are small drifting plants in the estuary, and important food for many animals. The also make oxygen in the water and for the air we breathe! **Zooplankton** are animals that also drift. They can be eggs, larvae, juveniles, or adults of other animals such as fish that live in the estuary. **Ichthyoplankton** are the larvae (babies) of fish. Ichthy means fish.

# FIELD LESSONS



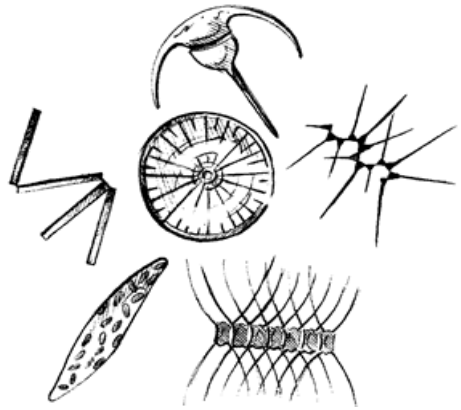
## PLANKTON CATCH

**Procedure**

**1. Before beginning:** When planning for this activity you want to be sure the tide is high enough get a water sample. This activity will NOT work if the tide is not high enough. To view how the Tijuana River is flowing visit *Southern California Coastal Ocean Observing System* website at: http://www.sccoos.ucsd.edu. In addition, if it has been raining, water quality can be an issue.

**2.** Take students to the 'the three benches' area where the plankton activity is usually done.

**3.** Have them sit and begin questioning them about plankton. You could start by asking them "What does a blue whale eat?" "How does it eat it?" Students may answer with 'plankton'. Then ask them if there is more than one type of plankton. Using the plankton signs, go over the different kinds of plankton and give examples of each (use sign for examples).



**Phytoplankton Examples**

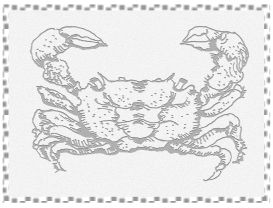
**4.** Explain to the students that today the group will collect a sample of water from the estuary and examine it for plankton. The students will record their observations.

**5.** Demonstrate how to use the discovery scopes and explain that you, the instructor, will be the one to get the sample of water since it requires going off trail. Explain to students that it is important to follow all of the field manners (like staying on trail) unless it is otherwise noted. Show the students how to use the droppers to fill their boxes with water after the sample has been taken.

**6.** While the students are assembling their discovery scopes, use the plankton pole with the largest bottle attached to take a sample from the channel. When doing so, explain to the children that it is important to reach out as far into the channel as possible and go halfway down in the water column if possible. Once collected, return the sample to the empty rectangular container and allow the students to start filling their boxes. You should collect about three samples just so there is enough water and diversity for observation.

**7.** Give the students several minutes to try to find plankton. Remind them that zooplankton move so if they see small movement, it is a zooplankton. Remind them to refer to the plankton signs too. Students may need help using their scopes.

# FIELD LESSONS



## PLANKTON CATCH

**8.** If a student finds plankton, and another doesn't, please have them share their samples.

**9.** Inform the students that the black page provided in their journal might help them to see the plankton better.

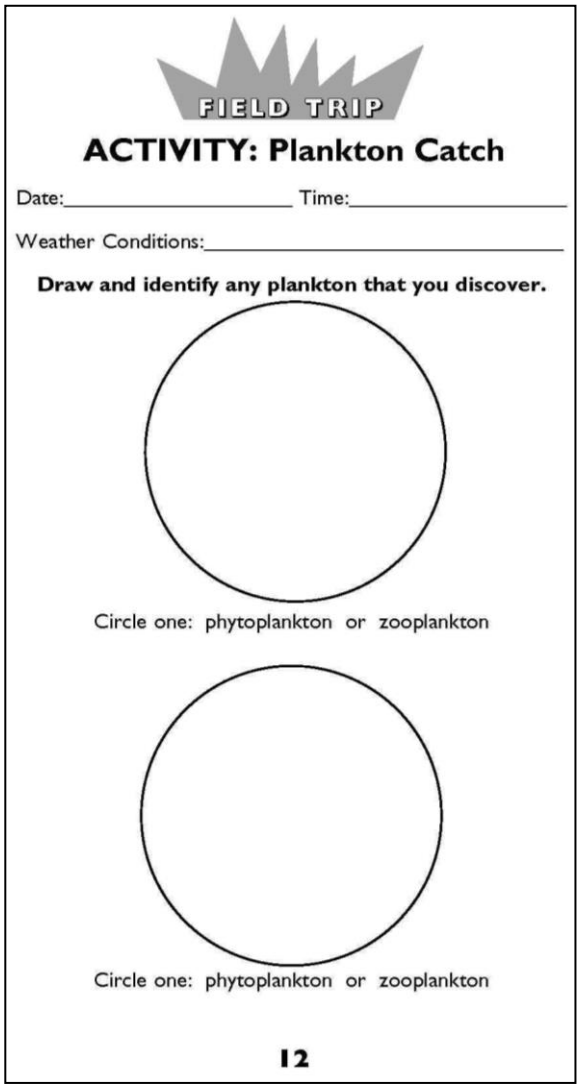
**10.** The students should draw any plankton they find in their Explorer Field Journal on page 12 and circle which kind of plankton it is.

**11. After Observations:** About ten minutes before concluding have all the students return their samples to the sample container. Tell them that you will be throwing the sample back into the channel and into the food chain. Once they are done, have them watch you return the sample by tossing it back into the channel.

**12.** Have them dismantle their discovery scopes and return everything back to its container. Pack up everything and return to the visitor center.

**13.** Make sure students wash their hands thoroughly before leaving.

**14.** When the students have left, make sure to wash all the plankton equipment.



FIELD TRIP

**ACTIVITY: Plankton Catch**

Date:_____ Time:_____

Weather Conditions:_____

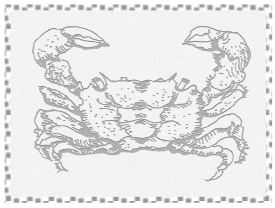
**Draw and identify any plankton that you discover.**

Circle one: phytoplankton or zooplankton

Circle one: phytoplankton or zooplankton

**12**

# FIELD LESSONS



## GOING BIRDING

**TEACHER'S NOTES**

**Duration**
40 minutes

**Location**
North McCoy Trail

**Endangered and Threatened Birds of the Reserve**

California least tern

Western snowy plover

Light-footed Ridgway's rail

Least Bell's vireo

Belding's savannah sparrow

### Overview

Students work with a partner to observe birds, they alternate using binoculars and recording in their journal.

### Objectives

Students will:

- learn how to identify birds by bird characteristics
- practice observing a bird and try to identify it with the help of a partner
- record their partner's observations in their own journal

### Materials

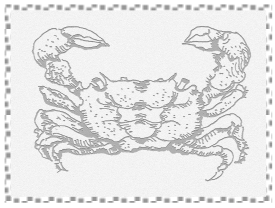
- *What to Look For* bird sign
- Bird backpacks (2):
  - Binoculars (9)
  - *Local Birds of San Diego County* laminated guides
  - *National Geographic* Bird Book
- Estuary Explorer journal

### Background

The *What to Look For* sign provides excellent background. For background about migration, watch *The Amazing Journey of the Migrating Shorebirds.*

More than 370 different species of birds have been sighted at the Tijuana Estuary, making this place a bird watcher's paradise. The best time of the year to go birding at the Tijuana Estuary is during the fall and winter (late September to early March). About 320 of the birds seen at the Tijuana Estuary are migratory birds. These birds fly along the Pacific Flyway, the migratory route that follows the coast of the Pacific Ocean. Many of the birds nest in the arctic in Alaska and Canada because of the large availability of food and long daylight hours, but when the temperature drops and days start to get colder, the birds must fly south to warmer climates. Some just stop at the Tijuana Estuary along the way while others decide to stay all winter long. Some of those that are just visiting

# FIELD LESSONS



## GOING BIRDING

the "hotel" and the "all-you-can-eat buffet" at the Tijuana Estuary are traveling all the way to the southern tip of South America. The California least tern, an endangered species, migrates north to the Tijuana Estuary to nest along its beach in the spring and summer.

Birds like other species are adapted to live and survive in the habitats where they are found. Many of these adaptations also allow us to more easily identify which bird we are seeing through a pair of binoculars. Characteristics such as beak, wings, and feet can tell you a lot about a bird's lifestyle while also helping you to identify it. Read the *What to Look For* sign for examples. A bird's overall shape, size, behavior, and markings may also help it to survive in its surroundings, but these things are essential details that one must pay attention to if they want to successfully and hopefully easily identify a bird. After all there are over 370 different birds at the Tijuana Estuary; something has to make them different; it is your job as a birdwatcher to find these differences that set each bird apart.

*The High School Teacher's Guide* also describes bird adaptations in the *Ecology Section*, page 10 or on our website at www.tijuanaestuary.org (Education section).

**Procedure**

**1. Before walking** out on the trail, discuss the background information with them using the illustrated sign.

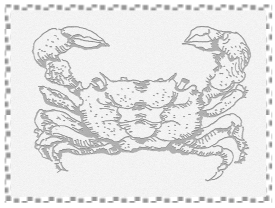
**2.** Ask the students if they remember from their journal reading, how many different birds have been seen at the Tijuana Estuary? *(370)*

**3.** Ask if they remember how many of these birds are migratory. *(320)* Elaborate on migration and flyways if appropriate or as time permits. In order to tell the difference between all these birds, bird watchers look for identifying characteristics of each bird they look at.

**4**. Point out the various bird body parts to the students using the front of the illustrated bird sign. Tell them that they will need to use descriptions such as size, shape, and color to describe the various body parts of each bird they see.

**5.** Have them practice by describing the bird in the poster, tell them to make sure to include things that stand out, i.e. the yellow tail bar, the black eye stripe or mask, the crested/mohawk crown of the bird, etc.

# FIELD LESSONS



## GOING BIRDING

**6.** Flip the sign over. Explain to the students that the shape of a bird helps them to survive in the place where they live and eat the prey items they feed on – these are adaptations. When they observe birds they should pay close attention to (use the examples on the sign):

- their **beak** (this gives you a clue as to what/how they eat),
- their **wings** (these can tell you how the bird flies or its pattern of flight which can then tell you where they live and how they hunt), and
- their **feet** (this gives you a clue as to where they live or spend most of their time, or in the case of raptors, feet or talons are used for grabbing prey animals).

**7.** Walk out to the marsh along the McCoy Trail.

**8.** Just before the students get to the North McCoy Trail bridge (where they will likely get distracted) go over the instructions for the activity.

**9.** Tell the students that they will work with a partner. Each student will describe one bird to each other using binoculars, but they will need to take turns.

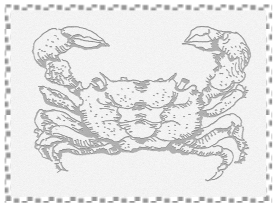
**10.** Have them open to the *Going Birding* page in their journal – pages 19 and 20.

**11.** Role play how it will look.

> *First Silvia will be the observer; she will get binoculars and find a bird to look at. When she finds a bird she should keep looking at it until her partner, Pablo, tells her to stop. Pablo is the first recorder and he will write down in his journal what Silvia tells him that she sees.*
>
> *When Silvia finds a bird, Pablo will start asking her the questions in the journal (have the students read along) – What is the bird doing? What does the beak look like? Etc.*
>
> *Using a field guide, together they will find the bird Silvia sees (but NOT until they reach that question). The final step is for Pablo to draw the bird Silvia saw using her descriptions and the picture in the field guide.*
>
> *IT IS NOW TIME TO SWITCH – now Silvia will be the recorder and write in her journal and Pablo will use the binoculars to observe a different bird than the one Silvia saw.*

**12.** Now that the students know what they will be doing, hand each partner a pair of binoculars and a field guide. It is time for them to go birding.

# FIELD LESSONS

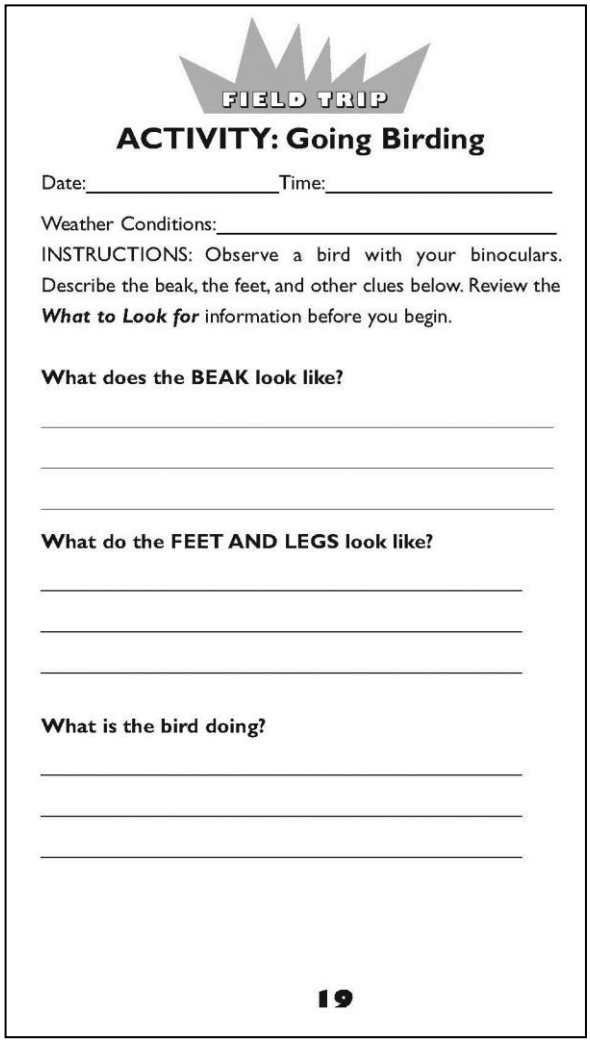


## GOING BIRDING

**13. After Observations:** Collect the binoculars and field guides from the students and place into backpack. Before they hand you the binoculars, instruct them to wrap the neck strap of the binoculars around the middle.

### Helpful Notes

Not all of the birds that are at the Tijuana Estuary will be on the local bird guide (remember there are 370), but most of the birds that the students will see will be on the backside of the guide, the side that says *Local Shore and Water Birds*.



FIELD TRIP

**ACTIVITY: Going Birding**

Date:_____Time:_____

Weather Conditions:_____

INSTRUCTIONS: Observe a bird with your binoculars. Describe the beak, the feet, and other clues below. Review the ***What to Look for*** information before you begin.

**What does the BEAK look like?**

_____

_____

_____

**What do the FEET AND LEGS look like?**

_____

_____

_____

**What is the bird doing?**

_____

_____

_____

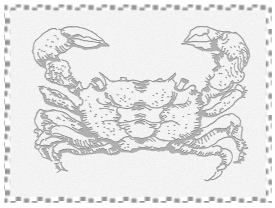
19

It is not important for the kids to find the exact bird they are looking at (but hopefully they will), the main purpose is for them to practice their observation and identification skills. One way for them to avoid finding one bird and deciding that must be it and not consider that it might actually be a different bird, is to have the students find 2 birds they think it could be. Then using the descriptions they wrote in the journal they can verify that the birds they have selected in the guide have those same features. For example, a whimbrel and a godwit look very similar, but if the student wrote down that the bird has a black, down-curved beak then it can't possibly be a godwit because these have an orange black tipped, slight up-curved beak.

Keep track of time. If the second partner hasn't had a chance to use the binoculars, at the halfway point have the students switch anyway.

Try to keep students in the same area along the trail; you normally don't have enough time to let the students walk past the first overlook. Make sure you allow enough time to walk back to the visitor center.

# FIELD LESSONS



## SALT MARSH PLANTS

**TEACHER'S NOTES**

**Duration**
40 minutes

**Location**
Outside next to Salt Marsh Plants

A **halophyte** (hal e fit) is a plant that grows in salty or alkaline soil.

An **excreter** releases or gets rid of salt.

An **accumulator** holds in salt.

**Marsh succulents** like **jaumea** and **pickleweed** store salt inside their tissues.

**Salt grass** excretes salt onto its leaves.

**Alkali heath** is another marsh plant that excretes salt.

**Cordgrass** excretes salt.

**Sea lavender** excretes salt.

### Overview

This activity uses a specially made bingo game to teach salt marsh plant adaptations. Students will choose one salt marsh plant to observe and record in their journal.

### Objectives

Students will:

- be able to distinguish how salt marsh plants adapt to a salty environment,
- know the difference between accumulator and excreter,
- describe the physical characteristics of both,
- learn 2 endangered bird species that are dependent on salt marsh plants.

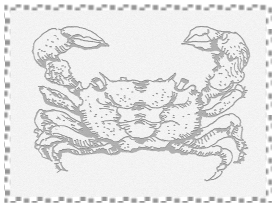
### Materials

- Salt marsh plant sign
- Plant Backpack:
  - Bingo cards
  - Bingo card pieces
  - Hand lenses in plastic tub
- Estuary Explorer journal

### Background

Salt marsh plants live in a very extreme environment. Salt marshes are places where salt water from the ocean fills up the marsh daily during the high tides. The plants that live here must deal with this daily influx of water and salt. They are unique in that they have special adaptations to living with high quantities of salt. **Refer to the salt marsh plant adaptations section in the exhibit hall** for a good overview *(text can also be viewed below)*. *The High School Teacher's Guide* also describes salt marsh plant adaptations in the *Ecology Section*, page 10 or on our website at www.tijuanaestuary.org (education section).

# FIELD LESSONS



## SALT MARSH PLANTS

### Salt Marsh Plants Exhibit

**PICKLEWEED STORES SALT**
Like many marsh plants that store salt, pickleweed is a succulent that dilutes salts internally. However, eventually salt levels become too high and the salt must be eliminated. Pickleweed does this by isolating and storing the salt in special cavities where it does no harm.

Notice how pickleweed's stem looks like a chain of small pickles. Each "pickle" is actually a pair of leaves fused together. These leaves contain special cavities where the salt is stored. In the fall, they turn red and drop off, carrying away the stored salt.

**HOW DO PLANTS SURVIVE IN SALT?**
By Getting Rid of It!

Just as the sun crystallizes salt on your skin after you swim in the ocean, it concentrates salt in the soils of the marsh after tides wash out. During the long dry season, some areas of the estuary becomes twice as salty as the sea.

Halophytes are adapted to survive in salty water and solids where other plants would die by their ability to either:

- Store salt in special cells where it does no harm, or
- Excrete, or push, salt out.

Halophytes do not need salty water to survive. In fact, most grow better with fresh water. Salty conditions stunt plant growth, resulting in shorter plants with sparse foliage.

Marsh succulents like *Jaumea carnosa* and *Batis maritima* , store salt inside their tissues.

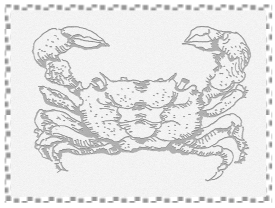
Salt grass excretes salt onto its leaves.

Alkali heath is another marsh plant that excretes salt.

Cordgrass excretes salt.

**SEA LAVENDER EXCRETES SALT**
Sea lavender grows in the middle and high marsh where its roots are bathed in salt water brought in by the tides. This halophyte excretes salt onto its leaves. It has special glands that push salty water out in a process similar to perspiration. Notice the tiny salt crystals on the plant's leaves. They are what remains after the sun evaporates the excreted saltwater.

# FIELD LESSONS



## SALT MARSH PLANTS

**Procedure**

**1.** Begin by quizzing students on the differences of wetlands, estuaries, and salt marshes.

**2.** Tell students that the area for today's activity is off trail in a sensitive habitat. Good field manners should be followed. Go over field manners if needed.

**3.** Take students to the area where there is access to salt marsh plants.

**4.** Tell them they are going to play bingo but in order to play they will need to know how salt marsh plants survive in salty water.

**5.** Discuss the background information with them using the illustrated sign.

**6.** Go over the two methods of adaptations: excreting and accumulating and the characteristics of each. Define words like *succulent*, *excrete*, *accumulate*, and *halophyte*. Once the students have a good understanding of the difference between the two methods, use the pictures from the bingo game to talk about the clapper rail and Belding's savannah sparrow that depend on these.

**7.** Before explaining the rules of the bingo game, pass out a hand lens to each student. Explain that the hand lens will allow them to see salt crystals on the excreters or any other detail.

**8.** Next explain the rules of the bingo game.

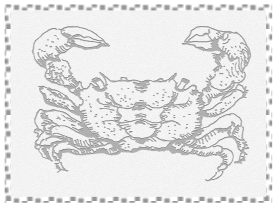
**9.** Each pair of students gets a bingo card (all the cards are the same). The cards have pictures of different wetland plants. Each plant is either an excreter or an accumulator.

**10.** There is one plant that is not an excreter or accumulator *(salt marsh bird's beak)*. This plant is located in the upper middle box on the bingo sheet.

**11.** Explain that this plant is endangered and therefore we are not allowed to be near it. This space on the card is a "freebie" for everyone. Open the pouch of bingo card pieces and pull out the one green piece. This piece goes on the salt marsh bird's beak space.

**12.** The other bingo card pieces are to block out the other squares on the card. Some pieces have a clapper rail and some have the Belding's savannah sparrow. Ridway's rail pieces go on excreter plants, they are marked "excreter." Savannah sparrows go on accumulator plants, they are marked "accumulator."

# FIELD LESSONS



## SALT MARSH PLANTS

**13.** Next explain that the way the bingo works is that each pair of students tries to find the plants on the bingo cards on their own in the salt marsh like a scavenger hunt. They will have to get three in a row and be able to share with the class where they found them. Make sure you define the boundaries of where they can go.

**14.** Once students think they have found a plant that is on their card, they must then decide if it is an excreter or accumulator.

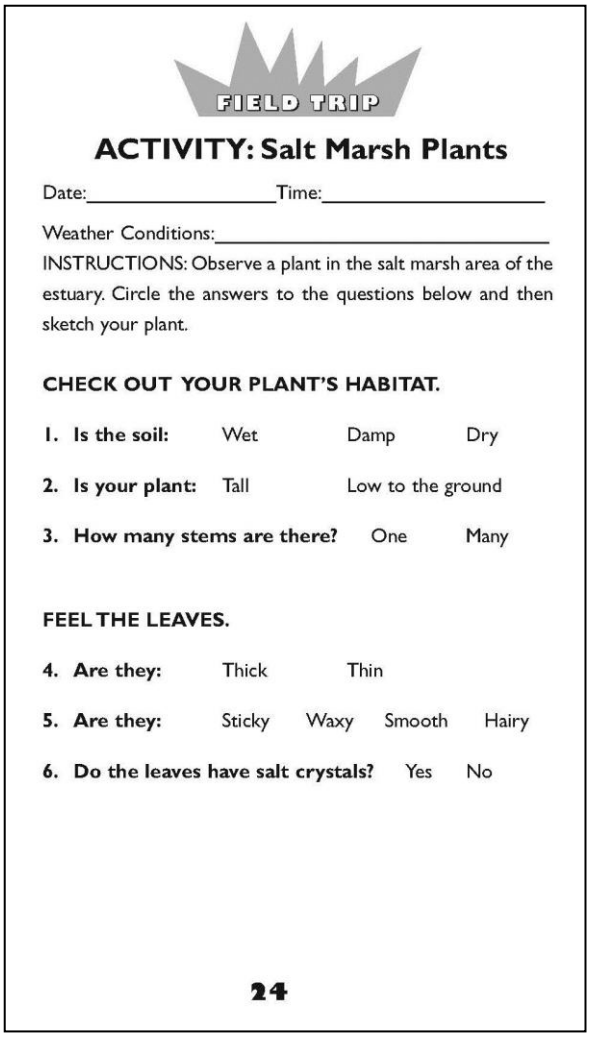
**15.** Then they place a Ridway's rail or savannah sparrow piece on the bingo card space.

**16.** The first student to get three in row in any direction shouts out "bingo."

**17.** Next test their knowledge. Have the winning students show the group where the plants they found are located. See if they were correct in calling it an excreter or accumulator. Have the other students follow along.

**18.** When the bingo is finished, collect the bingo pieces before the next activity.

**19.** After the plant bingo, have each student pick one plant to observe and take notes on in their field journal using the provided observation sheets on pages 24 – 26.



FIELD TRIP

**ACTIVITY: Salt Marsh Plants**

Date:_____Time:_____

Weather Conditions:_____

INSTRUCTIONS: Observe a plant in the salt marsh area of the estuary. Circle the answers to the questions below and then sketch your plant.

**CHECK OUT YOUR PLANT'S HABITAT.**

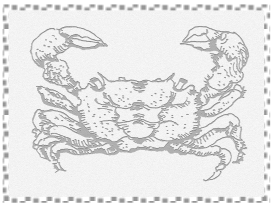
1. **Is the soil:** Wet Damp Dry
2. **Is your plant:** Tall Low to the ground
3. **How many stems are there?** One Many

**FEEL THE LEAVES.**

4. **Are they:** Thick Thin
5. **Are they:** Sticky Waxy Smooth Hairy
6. **Do the leaves have salt crystals?** Yes No

**24**

# SALT MARSH PLANTS



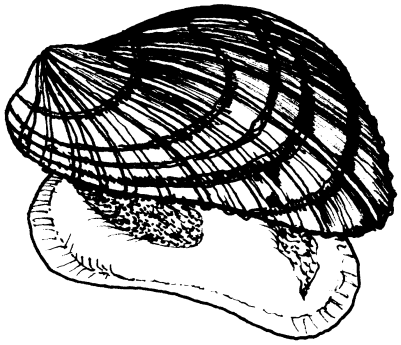
**LOOK AT THE PLANTS NEAR YOUR PLANT.**

7. How are the plants similiar?

8. How are the plants different?

9. How does your plant survive in the salt marsh?

25

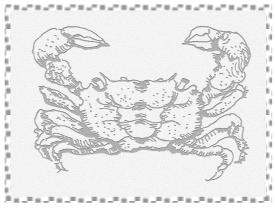


Draw your plant below.

The name of my plant is:

26

# FIELD LESSONS



## VISITOR CENTER SCAVENGER HUNT

***ALTERNATE LESSON***

**Overview**

Students will gain a better understanding of the natural environment of the Tijuana Estuary by searching for worksheet answers in the expository text of the visitor center exhibits.

**Materials**

- Student Visitor Center worksheet provided by Tijuana Estuary staff
- Pencils
- Clipboards

**Procedure**

**1.** Please explore the displays inside and directly in front of the Tijuana Estuary Visitor Center and answer the questions on this sheet. Thank you and good luck!

**2.** Remind students that answers can be found in the content of the exhibits. Questions begin with exhibit areas at the front of the Visitor Center and flow to the back of the Visitor Center in order.

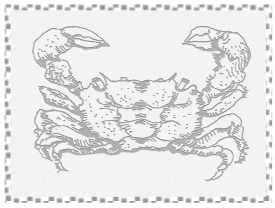
**Visitor Center Scavenger Hunt Worksheet**
*Teacher Answer Key*

**1.** How many miles is the 3,545-foot high mountain from the Estuary? (Hint: look out front)
**Answer:** It is the Otay Mountain and it is approximately 14 miles.

**2.** Why is there so much wildlife here at the Estuary?
**Answer:** (found on "Estuaries:" sign next to diorama.)
a. Tides bring in a fresh supply of nutrients twice every day.
b. Mudflats are full of food for birds and other wildlife.
c. Estuarine waters offer safe breeding and nursery grounds for fish and shellfish.

**3.** What adaptation do crabs have that allow them to survive on dry land?
**Answer:** They can store water in their gills. (Display boards on diorama)

# FIELD LESSONS



## VISITOR CENTER SCAVENGER HUNT

**4.** What are 4 reasons for species to become endangered?
**Answer:** (found on hanging display, by windows next to the earth)
a. Loss of habitat
b. Pollution
c. Predation
d. Human disturbance & vehicle use

**5.** What is the name of the one endangered plant found at the Tijuana Estuary?
**Answer:** Salt Marsh Bird's Beak

**6.** Can any bird drink salt water? If so, name one:
**Answer:** Yes, Belding's Savannah Sparrow

**7.** How fast can the tiger beetle run?
**Answer:** 2 feet per second (under "Olympic Dunes" question that is by the "Wildlife Abounds" polages)

**8.** When does the American wigeon visit the Estuary?
**Answer:** October through March (found on migratory waterfowl display next to large polage)

**9.** How many celestial objects (objects in the sky) are involved in creating tides?
**Answer:** 2 – earth and moon (Tides display)

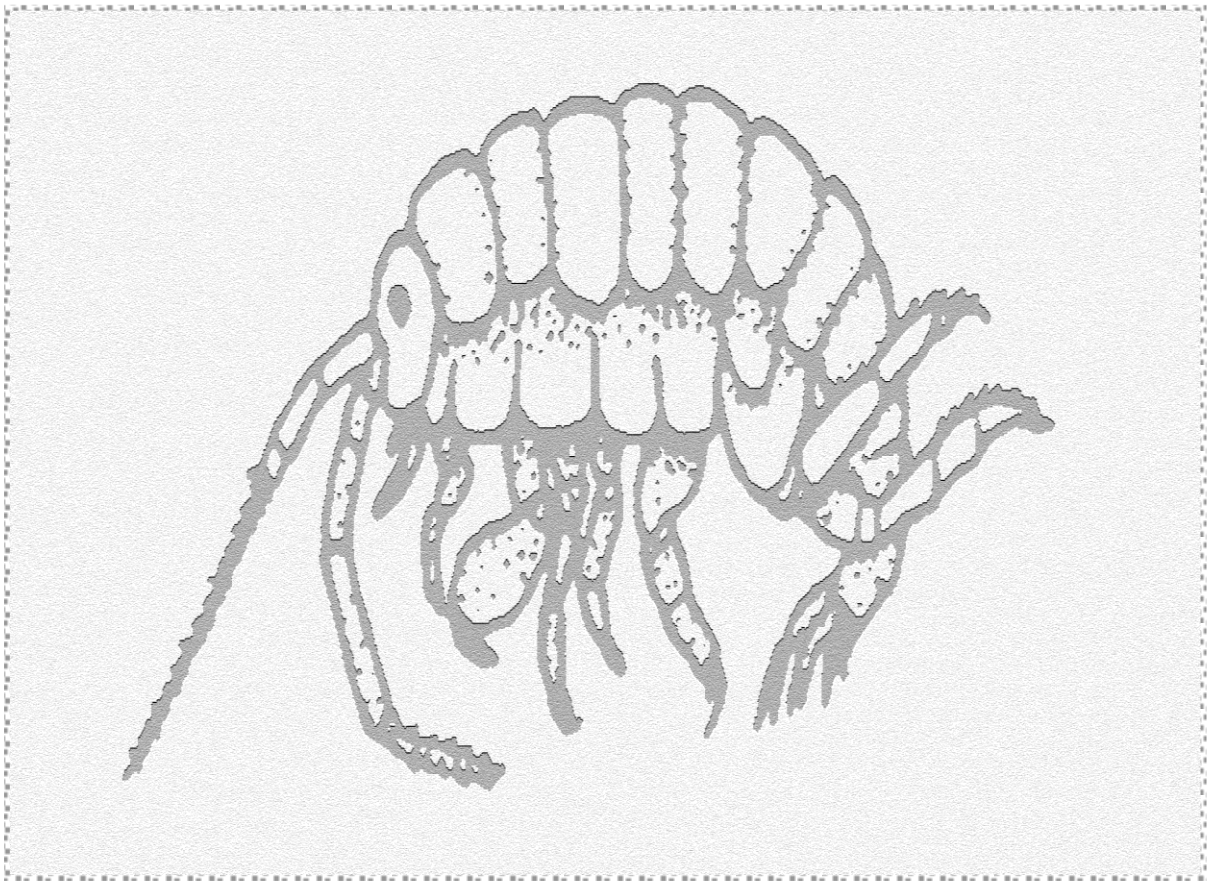
**10.** What type of water do you get when you mix fresh and salt water?
**Answer:** brackish (Habitats in a changing landscape)

**11.** What organisms break down plant materials and make them small enough for other organisms to eat?
**Answer:** Decomposers (on "The Estuary's Supermarket" – next to food chain)

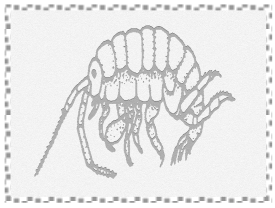
**12.** If you were a bird and wanted to eat the greatest variety of different foods, which bird would you choose to be?
**Answer:** Long-billed curlew (Food probing display)

**13.** What is a halophyte?
**Answer:** A plant that grows in salty or alkaline soil (Halophyte display back)

# FOLLOW UP ACTIVITIES



# FOLLOW UP ACTIVITIES



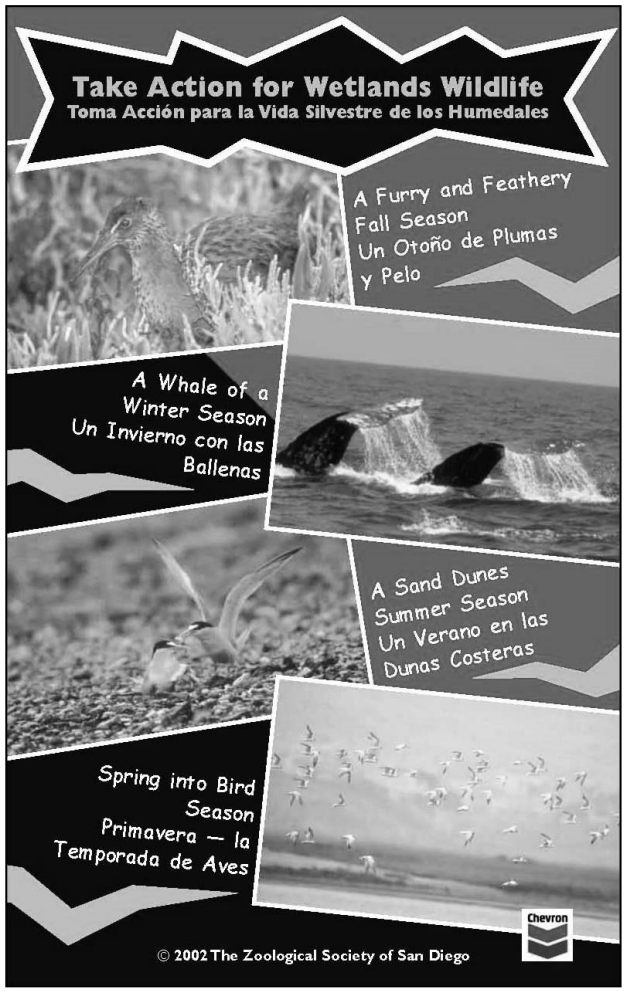
## TAKE ACTION MAGNETS

### Overview

Students will help save wetland plants and animals by their daily actions at school and at home.

### Materials

- Take Action magnets (one per student – given at end of Explorers field trip)
- Teacher's Guide: Take Action for Wetlands Wildlife worksheet
- Student's Guide: Take Action for Wetlands Wildlife worksheet (one per student – available in Spanish)




### Procedure

**1.** After completing the Estuary Explorers program provide each student with a *Take Action for Wetlands Wildlife* worksheet and magnet.

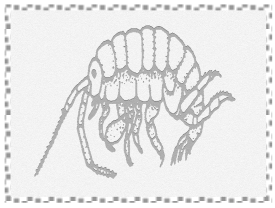
**2.** Each student should take home the magnet and student page to put on their refrigerator door.

**3.** Tell students that at home they should pick the season you are in (fall, winter, spring or summer) and focus on that season on the worksheet.

**4.** Do the *Action at School* with the students during that season and challenge them to do the *Action at Home* for a period of time such as one month.

**5.** Reward students for taking action for wildlife. If your class wants to do more, participate in one of the *Group Activities* highlighted on the worksheet such as a coastal clean up.

# FOLLOW UP ACTIVITIES



## TAKE ACTION MAGNETS

### TEACHER'S GUIDE
**Take Action for Wetlands Wildlife**

#### A FURRY AND FEATHERY FALL SEASON

Celebrate the tens of thousands of animals that depend on estuary and wetlands habitats as places to live, feed, and reproduce on **National Estuaries Day!** *(Check out these Web sites for more information and local events http://www.estuaries.org/national-estuaries-day.html , http://www.tijuanaestuary.org and www.estuaries.noaa.gov .)*

**Action at School:** *Design a postcard to send to a friend or family member.* Draw or write about an animal or plant that lives in the estuary habitat. Tell this person why you chose to share this animal with them and how they can help you to conserve or save it.

**Action at Home:** *Walk, ride a bicycle or carpool.* Reducing the use of gasoline in our cars will reduce the drilling of oil around the world. This helps conserve coastal habitats, like the Tijuana Estuary where more than 370 species of birds live!

**Group Activities:** *Help with a Coastal Cleanup during September.* Call 1-800-237-2583 for more information. *Support the US Fish and Wildlife Service during National Wildlife Refuge week.* Call 619-575-2704 for more information, or *http://www.fws.gov/kids.*

#### A WHALE OF A WINTER SEASON

Celebrate the planet's freshwater by spreading the word on how to conserve clean oceans for the 15,000 **visiting gray whales** during the winter months in San Diego and Baja California. *(Check out this Website for more information: www.worldwaterday.org.)*

**Action at School:** *Keep a plastic products journal.* Record ways that plastic is harmful to wildlife and how you can reduce using plastic. Have students create a journal to write down the types of plastic products they and others use during a week. Students need to collect the following information and answer the questions:

- What is plastic made from?
- How long does it take plastic to biodegrade?
- Record for the next five days what plastic products you use each day.
- Record for the next five days what plastic products you observe others using.
- What are ways that you and your family can cut down on the amount of plastic you use?
- What are some alternatives to plastic products?
- What are ways that plastic is harmful to wildlife?
- Will sponsoring beach cleanups solve the problem of plastic pollution? Why or why not?
- If you could pass a law in your community about plastic trash disposal, what would it say?

**Action at Home:** *Encourage your parents to purchase plain, unbleached toilet paper and paper towels.* Dyes used in colored paper products pollute water systems, and can be harmful to aquatic life such as migrating gray whales off the coast.

**Group Activities:** *Go to the Whale Watching Festival* at the Cabrillo National Monument during the third weekend of January (619-557-5450) or *visit the Birch Aquarium at Scripps for Whale Fest* (858-534-3474).

## SPRING INTO BIRD SEASON

Celebrate and support **International Migratory Bird Day**. Nearly 350 species of migratory birds travel between breeding grounds in North America and feeding grounds in South and Central America, Mexico, and the Caribbean.
*(For more information visit http://www.birdday.org.)*

**Action at School:** *Enjoy your local bird life.* With your class, observe the birds in your schoolyard and find out what birds are visiting your area. (Visit http://www.birdsource.org/gbbc/kids to learn how your students can help scientists do bird research.)

**Action at Home:** *Take care of your pets.* Cats kill hundreds of millions of wild songbirds each year—and they can't tell which are common and which are endangered! Cats live a lot longer if they're kept indoors, too. Dogs, allowed to run free, can frighten and injure wildlife. Keep your kitty inside, and use a leash when walking your dog. (For more information visit, the American Bird Conservancy Web site at www.abcbirds.org, click on their Cats Indoor Campaign.)

**Group Activities:** *Participate in International Migratory Bird Day* on the second Saturday in May. (For more information visit http://www.birdday.org, www.tijuanaestuary.org or call 619-575-3613.)

## A SAND DUNES SUMMER SEASON

Coastal dunes are home to migratory birds such as the **endangered California least tern** that lives along the coast of San Diego and Mexico during the summer months. Without the sand of these habitats, the least terns will lose their home.

**Action at School:** *"Adopt" an endangered animal or plant native to your area such as the least tern.* Learn more about the animal or plant and develop a public awareness campaign using posters, brochures, and other methods to teach your school and community about your "adopted" wildlife. *(For information, visit the US Fish and Wildlife Service endangered species Web site www.fws.gov .)*

**Action at Home:** *Recycle glass.* Glass is made from sand that also makes up coastal dunes habitats! We throw away enough glass each month in the United States to fill up a skyscraper. It takes one million years for glass to decompose, so recycling is very important.

**Group Activities:** Visit least terns and shorebirds at the Tijuana Estuary (619-575-3613) or the Chula Vista Nature Center (619-422-2481) and other wetlands in San Diego.

## Student's Guide

# TAKE ACTION FOR WETLANDS WILDLIFE

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## Guía para los estudiantes

# Toma Acción para la Vida Silvestre de los Humedales

### UN OTOÑO DE PLUMAS Y PELO

¡Este **Día Nacional de los Estuarios**, celebra los miles de animales que dependen de los habitats de los estuarios y humedales para vivir, comer y reproducir!

**Acción en la Escuela:** *Diseña una carta postal para mandarla a un amigo o un miembro de tu familia.* Dibuja o escribe sobre un animal o una planta que vive en el habitat estuarino. Dile a esta persona porqué escogiste este animal o esta planta para compartir con ellos, diles como ellos pueden ayudarte a conservarlo.

**Acción en la Casa:** *Camina, anda en bicicleta o "carpool."* Reduciendo el uso de gasolina en nuestros carros reduce la perforación para petróleo en el mundo. ¡Esto ayuda a conservar los habitats costeros, como el Estuario del Río Tijuana donde residen más de 370 aves!

### UN INVIERNO CON LAS BALLENAS

Celebra la agua dulce del planeta difundiendo la palabra sobre como conservar océanos limpios para las 15,000 **ballenas grises que nos visitan** en San Diego y Baja California durante los meses del invierno.

**Acción en la Escuela:** *Manten un diario de productos plásticos.* Anota maneras en que el plástico es dañoso para la vida silvestre y como puedes reducir tu uso del plástico.

**Acción en la Casa:** *Aconseja a tus padres a comprar papel del baño y toallitas sencillas y sin blanqueo.* Los tintes que se usan en productos de papeles de color contaminan a los sistemas de agua y pueden ser dañosos a la vida acuática como las ballenas grises que migran por la costa.

### PRIMAVERA — LA TEMPORADA DE AVES

Celebra y apoya el **Día Internacional de Aves Migratorias**. Casi 350 especies de aves migratorias viajan entre criaderos en Norteamérica y lugares de alimentación en Sudamérica, Centroamérica, México y el Caribe.

**Acción en la Escuela:** *Disfruta de tus aves locales.* Con tu clase, observa las aves en tu patio de recreo y investiga que aves estan visitando tu area.

**Acción en la Casa**: *Cuida tus mascotas.* Los gatos matan millones de aves cantoras silvestres cada año – ¡y no saben cuales son comúnes y cuales estan en peligro de extinción! También , los gatos viven más tiempo si los mantienen adentro. Perros, al correr sueltos, pueden asustar y lastimar a la vida silvestre. Manten tu gatito adentro de tu casa y usa una correa cuando caminas a tu perro.

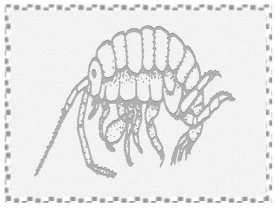
## UN VERANO EN LAS DUNAS COSTERAS

Las dunas costeras son hogares para aves migratorias como el **charrán mínimo, que está en peligro de extinción,** que vive por la costa de San Diego y México durante el verano. Sin la arena de estos habitats, los charranes mínimos perderan su hogar.

**Acción en la Escuela:** *"Adopta" un animal nativo o una planta nativa en tu area que está en peligro de extinción, como el charrán mínimo.* Aprende más sobre el animal o la planta y desarolla una campaña para educar al público usando posters, folletos y otros métodos para enseñarle a tu escuela y comunidad sobre tu vida silvestre "adoptada."

**Acción en la Casa:** *Recicla vidrio.* ¡El vidrio es hecho de arena, la cual también hace el habitat de las dunas costeras! Tiramos suficiente vidrio cada mes en los Estados Unidos para llenar un rascacielos.

# FOLLOW UP ACTIVITIES



## ENDANGERED SPECIES ACTIVITY

**Overview**

Students will learn about endangered and threatened species at the Tijuana Estuary Reserve and develop action steps to help these species.

**Materials**

- Estuary Explorer journal – page 27
- Research tools (i.e. internet, encyclopedias, library)
- Pencils

**Procedure**

**1.** Provide students with several research materials to research one of the species listed below.

**2.** Ask students to write down or be prepared to tell the class three things about the species and why they are threatened or endangered.

**3.** Students should then complete the page 27 of their Estuary Explorers journal listing six things they can do to help the animal or plant they just learned about.

**Endangered and Threatened Species at Tijuana Estuary (limited)**


Western Snowy Plover

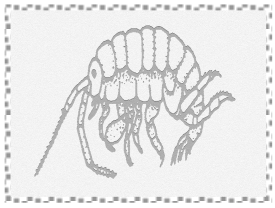

California Least Tern


Belding's Savannah Sparrow


Light-footed Ridway's Rail


Salt Marsh Bird's Beak

# FOLLOW UP ACTIVITIES



## ENDANGERED SPECIES ACTIVITY

*Follow Up Activity*

### Endangered means there is still time...

**Share the information you learned through the Estuary Explorers with someone else.**

**Make a list of things you can do at your school or home to save local wildlife:**

**1.** _____

**2.** _____

**3.** _____

**4.** _____

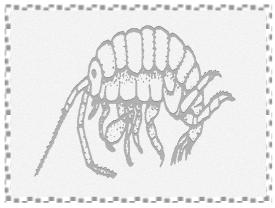
**5.** _____

**6.** _____

**You can be part of the solution by saving endangered wildlife!**

**27**

# FOLLOW UP ACTIVITIES



## TAKE ACTION RESOURCES

CALIFORNIA CONDOR

**https://institute.sandiegozoo.org/species/california-condor**
**https://www.wildlife.ca.gov/conservation/birds/california-condor**
To learn more about the California condor and its habitat visit this site.

COASTAL CLEAN UPS

**http://www.cleanupday.org**
Participate in a coastal clean up in your area.

CONSERVATION IN THE CLASSROOM

**http://www.teacherquicksource.com/environment/default.aspx**
Connects conservation concepts to classroom activities! This convenient resource will help you explore ways to educate children on the importance for caring for the environment to help make the earth a healthier place.

ECOLOGICAL FOOTPRINT

**http://files.earthday.net/bobbybigfoot**
You and your students can measure the impact your daily actions have on the planet.

ESTUARIES

**https://coast.noaa.gov/estuaries/**
Learn all about the habitat of estuaries and how to help them.

NATIVE BIRD RESOURCES

**http://www.enature.com**
**http://nationalzoo.si.edu/scbi/migratorybirds/**
**http://www.fws.gov/birds**
**http://www.allaboutbirds.org/guide/search**

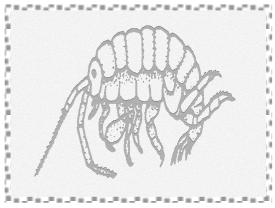
REDUCE, REUSE, RECYCLE!

**http://kids.niehs.nih.gov/recycle.htm**
This website explains what waste is and how you can help reduce waste. There are games, activities, and links to more resources.

REDUCING WASTE

**http://www.ciwmb.ca.gov/schools/Curriculum/CTL/TOC.htm**
Includes a full curriculum for K-6, *Closing the Loop*, designed to introduce students to integrated waste management through awareness, understanding, and action, and to encourage students to address today's solid waste problems.

# FOLLOW UP ACTIVITIES



## TAKE ACTION RESOURCES

SAN DIEGO NATIONAL WILDLIFE REFUGE COMPLEX
**http://www.fws.gov/sandiegorefuges/**
Learn about the Tijuana Slough National Wildlife Refuge and the other refuges in the county.

SAN DIEGO WATERSHED RESOURCES
**http://www.projectcleanwater.org**
**http://www.sdcounty.ca.gov**
**http://www.sdbay.sdsu.edu/education/pueblo.php**

SEAFOOD WATCH
**https://www.seafoodwatch.org/**
Your seafood choices can make a difference.

SOUTHERN CALIFORNIA COASTAL OCEAN OBSERVING SYSTEM
**http://www.sccoos.org**
Determine the Tijuana River flow and other useful tidal information.

STORM DRAIN POLLUTION
**http://www.sandiego.gov/thinkblue/**
Help keep trash and other items out of the storm drain.

TIJUANA RIVER NATIONAL ESTUARINE RESEARCH RESERVE
**http://www.trnerr.org**
Learn about the Tijuana Estuary and find other useful curriculum.

WASTE FREE LUNCH
**http://www.wastefreelunches.org**
Provides information for students, parents, and school staff on how to reduce lunch and snack waste.

WATER SAVING TIPS
**http://www.wateruseitwisely.com/**
Saving water can help people, wildlife, and watersheds.

WORLD WATER DAY
**http://www.worldwaterday.org**
Learn how to create an event around water resources or support one in your area.