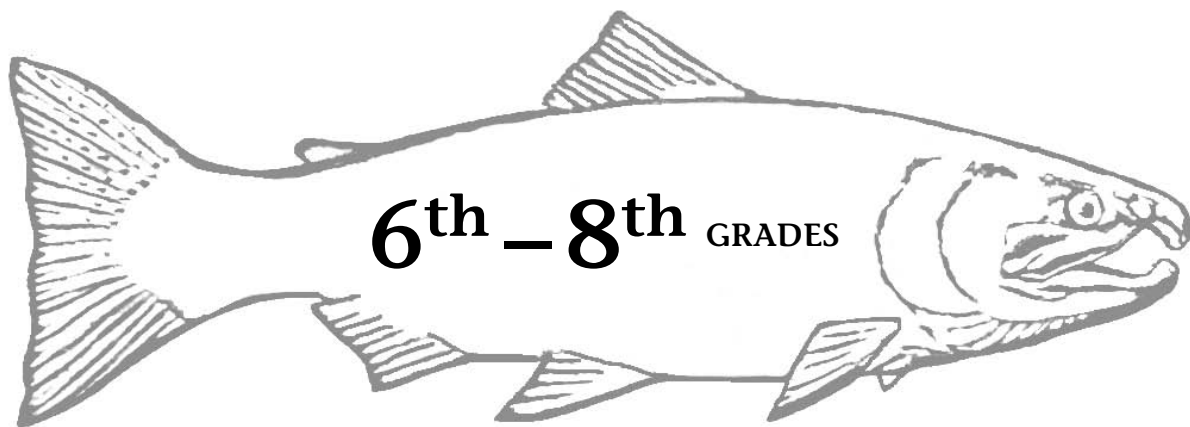


Creating
COASTAL STEWARDSHIP
through Science

Monitoring Creek Health

at Point Reyes National Seashore

2000 First Edition



Lynne Dominy
Christie Denzel Anastasia
Project Managers

This project was made possible by funding from:



Publishing Information

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The listing of a resource in this curriculum does not presume its endorsement by the National Park Service.

This guide may be obtained by participating in a teacher workshop at Point Reyes National Seashore or through a teacher in-service training at your school.

Teachers are encouraged to offer their feedback by filling out the enclosed evaluation form or contacting Point Reyes National Seashore directly.



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Preface

The intent of these guides is to provide middle school students with the opportunity to observe natural processes at Point Reyes National Seashore so they might take a greater interest in environmental stewardship and science. Teachers from fifteen area schools developed and field-tested seven “Creating Coastal Stewardship through Science” guides for classroom and field trip use. Each guide is carefully designed to facilitate a hands-on learning experience using science and the environment. Natural resources such as Pacific gray whales, northern elephant seals, tule elk, California quail, Douglas iris, and the San Andreas Fault are highlighted because they are easy to identify and to observe. All activities are linked to the California State Science Standards (2000) and the National Science Standards.

You may use this guide alone or in conjunction with other guides. We highly recommend that whenever you use a guide, you use the pre-visit activities to fully prepare the students for the field trip. These activities address student safety, wildlife observation techniques, equipment use, field journal development, and concepts that need to be taught prior to the park visit. Use of the post-visit activities is also critical to the learning process because they guide the students in making scientific deductions and in developing their environmental stewardship ethics.

Following this preface, you will find background information on the National Park Service and an overview of Point Reyes National Seashore. To provide your students with a better understanding of the place that they will be visiting, we recommend that you share this information with your students. For an in-depth overview of the National Park Service, visit our website at www.nps.gov.

Point Reyes National Seashore provides outstanding opportunities for learning about natural and cultural resources. There are also exceptional educational opportunities provided by Park partners such as the Point Reyes Bird Observatory, Audubon Canyon Ranch, and Point Reyes National Seashore Association. To learn more about the Park and our partners, visit our website at www.nps.gov/pore.



THE NATIONAL PARK SERVICE

The National Park Service cares for special places saved by the American people so that all may experience our heritage.

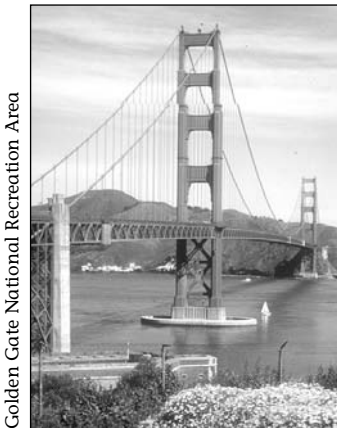
Experience Your America

On August 25, 1916, President Woodrow Wilson signed the act creating the National Park Service, a new federal bureau in the Department of the Interior responsible for protecting the 40 national parks and monuments then in existence and those yet to be established.



Olympic National Park

This “Organic Act” of 1916 states that “the Service thus established shall promote and regulate the use of Federal areas known as national parks, monuments and reservations . . . by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”



Golden Gate National Recreation Area

The National Park Service still strives to meet these original goals, while filling many other roles as well: guardian of our diverse cultural and recreational resources; environmental advocate; world leader in the parks and preservation community; and pioneer in the drive to protect America’s open space.

The National Park System of the United States comprises over 379 areas covering more than 83 million acres in 49 states, the District of Columbia, American Samoa, Guam, Puerto Rico, Saipan, and the Virgin Islands.



Mesa Verde National Park

Although not all parks are as well known as the Grand Canyon and Yellowstone, all are areas of such national significance that they have been included in the National Park Service—ancient ruins, battlefields, birthplaces, memorials, recreation areas, and countless other wonders. Point Reyes National Seashore is one of ten national seashores.



Grand Canyon National Park

The future of the National Park System lies in understanding and protecting its meanings, values, and resources. Each part of the system represents the United States and a part of our heritage. Preservation of individual sites and the entire system will ensure the essence of quality remains in our lives and the lives of all future generations.



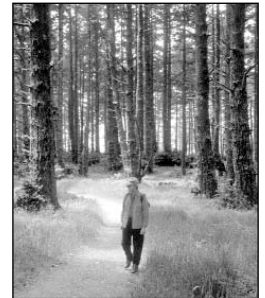
POINT REYES NATIONAL SEASHORE

Point Reyes National Seashore was established to preserve and protect the natural and cultural features and natural ecosystems along the diminishing undeveloped coastline of the western United States. Located just an hour's drive from a densely populated metropolitan area, the Seashore is a sanctuary for countless plant and animal species. With half of Point Reyes National Seashore designated as wilderness, it provides a sanctuary for the human spirit — for discovery, inspiration, solitude, and recreation — and a reminder of the human connection to the land.



Bruce Farnsworth

Point Reyes National Seashore comprises over 71,000 acres, including 32,000 acres of wilderness area. Estuaries, windswept beaches, coastal scrub, coastal grasslands, salt marshes, and coniferous forests create a haven of 80 miles of unspoiled and undeveloped coastline located just an hour's drive from an urban area populated by seven million people. Abundant recreational opportunities include 140 miles of hiking trails, backcountry campgrounds, and numerous beaches.



Sue Van Der Wähl

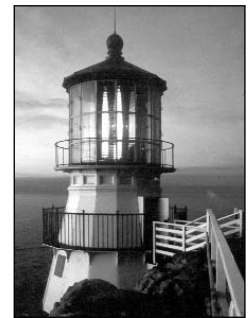
The San Andreas Fault separates the Point Reyes Peninsula from the rest of the North American continent. Granite bedrock found here and not found again until the Sierra Nevada range suggests the peninsula is geologically dynamic. According to geologists, the land that is now called Point Reyes has moved some 300 miles northwest over a period of 100 million years and is still moving.



Rich Stallcup

As wildland habitat is developed elsewhere in California, the relevance of Point Reyes as a protected area with a notably rich biological diversity increases. Over 45% of North American avian species and nearly 18% of California's plant species are found here. Point Reyes also contains some examples of the

world's major ecosystem types. For this reason and because Point Reyes is dedicated to the conservation of nature and scientific research, it was recognized in 1988 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Man and the Biosphere program and named as part of the Central California Coast Biosphere Reserve.



Bruce Farnsworth

The cultural history of Point Reyes spans many lives and ways of living with the land. The Coast Miwok people are the first known residents of this peninsula. Archeologists have identified over 100 village sites in the Seashore and cultural traditions are still celebrated in the Park annually. Overlapping the Coast Miwok were Mexican land grantees, lighthouse keepers, and lifesaving station crews. To this day, agricultural operations that were built near the turn of the twentieth century continue within the Seashore's pastoral zone.



NPS Collection



Educational Opportunities at POINT REYES NATIONAL SEASHORE

Point Reyes National Seashore provides an outdoor classroom and learning laboratory for the study of geological and ecological processes and changing land-use values in which a greater understanding of and caring for public lands can be fostered.

Ranger-led Curriculum-based Education Programs

Reservations for ranger-led programs are requested in writing and assigned on a first-come first-serve basis. Visit www.nps.gov/pore for the reservation form and calendar.

K-2

Students explore the natural resources of the seashore with Park Rangers in the Bear Valley area or in their classroom.



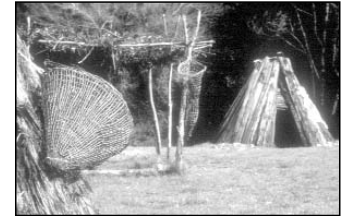
NPS Collection

3-4

Students immerse themselves in the Coast Miwok culture by completing a comprehensive curriculum and visiting the Coast Miwok cultural exhibit, Kule Loklo.



NPS Collection



NPS Collection

4

Students revisit the days of early lighthouse keepers while operating the original Point Reyes Lighthouse clockwork with Park Rangers.



NPS Collection

5

Students study the oceanic influences on the Point Reyes Peninsula by completing a classroom curriculum and viewing gray whales and elephant seals with Park Rangers.

6-8

Students participate in Ranger-led stewardship activities such as habitat restoration, water quality monitoring and beach cleanups.

Ranger-led Training Programs

9-12

Students become DOCENTS to assist middle school teachers with classroom teaching and use of scientific research tools on seashore field trips (service learning credits earned).



NPS Collection

Students become RESEARCH ASSISTANTS at the Pacific Coast Learning Center by participating in the inventorying and monitoring of seashore resources.

Teachers

Teacher workshops are offered throughout the year for existing park curricula and for field trip planning. Visit the Seashore's website at www.nps.gov/pore for a calendar of workshops.



NPS Collection

Classroom and Field Trip Curriculum

Based on the National and State Science and Social Science Standards

3-4



Teacher packets are available for field trips to the recreated Coast Miwok village, Kule Loklo, located near the Bear Valley Visitor Center.

The “Creating Coastal Stewardship through Science” middle school curricula are available to teachers who attend a one-day workshop at Point Reyes or a teacher in-service training.

6-8



Completion of the **Identifying Resident Birds** Curriculum, as a companion to a birdwatching field trip, will enable students to observe and identify different bird species, their habitats and their behaviors. A visit to Point Reyes Bird Observatory will also enable students to observe bird banding and netting and to understand the most common threats to bird survival.



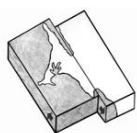
Completion of the **Monitoring Creek Health** Curriculum, as a companion to a Ranger-led creek program, will enable students to observe and understand the complexity and sensitivity of creek habitats and their role in protecting them.



Completion of the **Discovering Northern Elephant Seals** Curriculum, as a companion to an elephant seal viewing field trip, will enable students to observe and understand the amazing adaptations and behaviors of Northern elephant seals.



Completion of the **Defining Habitats** Curriculum, as a companion to a Park field trip, will enable students to observe and understand the complex land and ocean habitats of the Point Reyes Peninsula and their roles in habitat protection.



Completion of the **Uncovering the San Andreas Fault** Curriculum, as a companion to a geology field trip, will enable students to observe and understand the existence of the San Andreas Fault and the implications that it has for area residents.



Completion of the **Investigating Tule Elk** Curriculum, as a companion to an elk viewing field trip, will enable students to observe and understand their behaviors and the issues that surround their management.



Completion of the **Observing Pacific Gray Whales** Curriculum, as a companion to a whale watching field trip, will enable students to observe and understand gray whale adaptations and behaviors, and the factors that influence their survival.

Educational Facilities



The **Historic Lifeboat Station** is available to educational groups for overnight use. Nightly fees are charged. Group size must be under 25 (including chaperones). Reservations are made on a first-come first-serve basis by completing the boathouse form on our website at www.nps.gov/pore.



The **Clem Miller Environmental Education Center** is an overnight facility available by lottery to school groups visiting for multiple-night stays September through May. The facility is used for summer camps during the summer months. Fees are charged. For more information, contact Point Reyes National Seashore Association at (415) 663-1200.



The **Pacific Coast Learning Center** is a day-use facility located on Highway 1. This facility is used by researchers and students to study the natural and cultural resources of the Seashore.



The **Bear Valley Visitor Center** is a day-use facility that is open to school groups Monday through Friday 9 A.M. to 5 P.M. Exhibits on natural and cultural resources are found here. Books, brochures and other educational materials are available.



The **Ken Patrick Visitor Center** is located on Drakes Beach, approximately 30 minutes from the Bear Valley Visitor Center. This facility is open year-round on weekends and holidays from 10 A.M. until 5 P.M. Ranger-led elephant seal programs meet at this Visitor Center. Exhibits and a 150-gallon saltwater tank are located here. Books, brochures and other educational materials are available.



The **Lighthouse Visitor Center** is located on the outermost tip of the Peninsula, approximately 45 minutes from the Bear Valley Visitor Center. This facility is open Thursday through Monday 10 A.M. until 4:30 P.M. (closed Tuesdays and Wednesdays). Ranger-led whale programs and lighthouse tours meet at this Visitor Center. Exhibits on maritime history and whale biology are located here. Books, brochures and other educational materials are available.



The **Lighthouse** is located below the Lighthouse Visitor Center at the bottom of a 308-step staircase. The lens room is usually open from 2:30 P.M. until 4 P.M. Thursday through Monday or as weather and staffing permit. High winds always close the lens room. Space in the lens room is limited so reservations are required for groups. Call (415) 663-1534 to confirm existing weather conditions.

Group Camping/Overnight Opportunities

* This listing is provided for your convenience and does not constitute a recommendation or endorsement of any of these facilities.



All overnight camping in **Point Reyes National Seashore** requires a permit and advance reservations. Group sites are very limited and in high demand. Sky, Coast, and Wildcat Camps are all backcountry campgrounds that require hiking to access them. A fee is charged. For more information, visit the Seashore's website at www.nps.gov/pore.

The **Point Reyes Hostel** offers a dormitory-style group cabin with a fully equipped kitchen and showers. For additional information and reservations, call (415) 663-8811 during office hours. Office hours: 4:30 P.M. – 9:30 P.M. and 7:30 A.M. – 9:30 A.M.

Samuel P. Taylor State Park, located 6 miles east of the Seashore on Sir Francis Drake Boulevard offers campsites for groups. A fee is charged. Reservations are highly recommended. For more information, visit their reservations website at www.reserveamerica.com.

Olema Ranch Campground is located half a mile from Seashore headquarters on Highway 1. It is privately owned. Several large group sites are available. Fees are charged. For more information, call (415) 663-8001.

The **Marconi Center** is located 8 miles north of Seashore headquarters on Highway 1. This facility is operated by California State Parks. Lodging, conference rooms and catered meals are provided for a fee. For more information, call 1-800-970-6644 or visit their website at www.marconiconfctr.org.



National Park
FOUNDATION

Creating
**COASTAL
STEWARDSHIP**
through Science



Monitoring Creek Health

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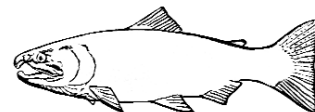
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Creating **COASTAL STEWARDSHIP** *through Science*



Monitoring Creek Health

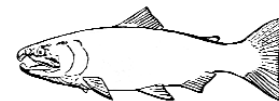
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Monitoring Creek Health



Teacher Preparation

POINT REYES NATIONAL SEASHORE protects a portion of the watershed necessary to ensure safe migration and spawning of coho salmon and steelhead trout. This protection is necessary as both species have been directly impacted by human activities and development. Healthy creeks are one step toward increasing and maintaining their population numbers. Their true hope for survival lies in changing human attitudes, behaviors, and priorities.

Completion of this unit, as a companion to your Park field trip, will enable your students to observe and understand creek habitats. Most importantly, your students will be prepared to take action in protecting their watersheds through a self-designed stewardship project.

Considerations

When: Year-round, but several days after a winter storm is the best time to make your visit.

Where: The best creek to visit in the Bear Valley Area is located near the Earthquake Trail. If you are staying at the Education Center, discuss the best location with the Clem Miller Director. Salmon viewing occurs at a separate location from monitoring.

How: This unit may be used independently of all other units. If you want to use an additional unit during your visit, we suggest the Defining Habitats unit. This will give students a more complete understanding of other resources at Point Reyes National Seashore and their relationship to creek ecology.

Creating
**COASTAL
STEWARDSHIP**
through Science





Weather: The chart below lists average climate expectations based on previous years data. The weather is subject to change quickly and can vary dramatically from different locations within the Seashore on the same day.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature (Fahrenheit)												
Normal Daily Maximum	53	55	55	57	60	62	64	64	65	62	58	54
Normal Daily Minimum	41	42	42	43	47	50	51	52	51	48	45	42
Extreme High	78	85	80	92	94	99	96	96	103	96	81	79
Extreme Low	21	26	29	32	32	39	39	42	39	32	29	18
Precipitation (inches)												
Normal	12.0	9.0	8.0	4.0	3.0	1.0	0.3	0.8	2.0	4.0	9.0	12.0
Maximum	20.0	16.0	15.0	11.5	8.0	4.0	2.5	6.0	7.0	13.0	18.0	19.0

Seasonal Events: Consult the chart below to assess which months may be best for a class visit to Point Reyes National Seashore.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Gray Whale Migration	✓		✓	✓								
Elephant Seal Breeding	✓	✓	✓									
Bird Migration			✓	✓	✓				✓	✓	✓	✓
Coho Spawning	✓											✓
Steelhead Trout Spawning		✓										✓
Tule Elk Rut Season							✓	✓	✓			
Peak Flower Blooms			✓	✓	✓							
Tidepooling	✓	✓	✓									
Geology	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ocean and Land Habitats	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Resident Birds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Chaperone Preparedness and Assistance

The success of your field trip will depend on your ability to actively prepare and involve your parent chaperones in the field trip activities. Without adult guidance, many of the students will not complete their field journals. It is essential that your field trip have as much structure as your classroom lessons. To accomplish this, we recommend that you assign each of your parents to a small group of students. Inform parents that they are responsible for assisting their students with the field observations and with the journal questions. Provide chaperones with their own copies of the student journals and encourage them to complete their journals with the students. Rangers will be utilizing chaperones to assist with creek assessment equipment.

Suggested Lesson Plan



Teacher Preparation

PRE-VISIT		Time needed: 7 hours
Activity #1	How Can We Learn More about Coho Salmon and Steel-head Trout? <i>Students use a newspaper and vocabulary list to complete questions and activities about both species of fish.</i>	1 hour
Activity #2	What Can We Learn about Water? <i>Students practice water testing in class.</i>	2 hours
Activity #3	Who Is in the Aquatic Food Pyramid and What Is Their Relationship to the Health of an Ecosystem? <i>Students research common aquatic insects and build food pyramids for the coho salmon and steelhead trout.</i>	2 hours
Activity #4	What Can We Expect on Our Field Trip to the Creeks of Point Reyes National Seashore? <i>Students prepare for field trip by reviewing expectations and creating field journals.</i>	1 hour
Activity #5	Safety and Stewardship Challenge <i>Proper behaviors around National Park resources are examined in a game format.</i>	1 hour
ON-SITE		Time needed: 2 hours
Field journal	How Healthy Is This Creek? <i>Students complete their field journals by performing various water quality tests and general observations.</i>	2 hours
POST-VISIT		Time needed: 3+ hours
Activity #1	What Can We Learn from Our Field Journals? <i>Students compile data from their field journals to draw conclusions between what they previously learned in class and what they experienced in the field.</i>	2 hours
Activity #2	How Can We Compare and Share Our Creek Monitoring Results? <i>Students add their creek data to the North Bay Riparian Station's website. Using results from other classes, students compare their creek data with other groups monitoring in the area.</i>	Time varies
Activity #3	What Is Your Role in Preserving Our Watershed? <i>Students investigate various professions and actions that promote a healthy watershed. This information is shared with the community.</i>	Time varies
Activity #4	How Can We Choose and Complete the Best Stewardship Project? <i>Students complete a project that will benefit salmon, trout and the environment.</i>	Time varies



Field Trip Logistics

Teacher Preparation

<i>Students need:</i>	<i>Teachers need:</i>	<i>Chaperones need:</i>
<input type="checkbox"/> rain gear	<input type="checkbox"/> rain gear	<input type="checkbox"/> rain gear
<input type="checkbox"/> warm, layered clothes	<input type="checkbox"/> warm, layered clothes	<input type="checkbox"/> warm, layered clothes
<input type="checkbox"/> gloves and hat	<input type="checkbox"/> gloves and hat	<input type="checkbox"/> gloves and hat
<input type="checkbox"/> sunscreen and sunglasses	<input type="checkbox"/> sunscreen and sunglasses	<input type="checkbox"/> sunscreen and sunglasses
<input type="checkbox"/> bag lunch with drink	<input type="checkbox"/> bag lunch with drink	<input type="checkbox"/> bag lunch with drink
<input type="checkbox"/> water	<input type="checkbox"/> water	<input type="checkbox"/> water
<input type="checkbox"/> waterproof boots or tennis shoes	<input type="checkbox"/> waterproof boots or tennis shoes	<input type="checkbox"/> waterproof boots or tennis shoes
<input type="checkbox"/> clipboard with field journal and pencil	<input type="checkbox"/> map with directions	<input type="checkbox"/> map with directions
<input type="checkbox"/> permission slip	<input type="checkbox"/> pencil sharpeners and extra pencils	
	<input type="checkbox"/> teacher backpack and field trip kits from Bear Valley Visitor Center	
	<input type="checkbox"/> first aid kit	
<i>Optional:</i>		
<input type="checkbox"/> small backpack	<input type="checkbox"/> small backpack	<input type="checkbox"/> small backpack
<input type="checkbox"/> binoculars	<input type="checkbox"/> binoculars	<input type="checkbox"/> binoculars
	<input type="checkbox"/> camcorder/camera	<input type="checkbox"/> camcorder/camera

Other Things to Remember:

- Some water quality tests require students to enter the creek. Rubber boots or shoes that can get wet are best. Closed-toe shoes are recommended.
- Bathrooms, drinking water, and the creek kits are available at the Bear Valley Visitor Center. This should be your first stop when visiting Point Reyes National Seashore.
- Have students bring bag lunches since you will be visiting during lunch time.
- If you have a student with accessibility concerns, please call the Park for suggestions.





Evaluation Process

We need your help! Since this guide was designed for your use, only your feedback will make it better. Following the unit overview is a preaddressed evaluation form. Please complete, fold in thirds, affix postage, and drop in the mailbox. In addition to the evaluation forms, we encourage other types of feedback. Please send any of the following items from your students:

1. Videotape or photos of Park field trip
2. Completed student journals
3. Any completed stewardship activities, including posters or newsletters
4. A class portfolio illustrating lesson activities
5. Any completed classroom projects or photographs of projects
6. Other items illustrating student feedback

Please indicate if these items need to be returned. We will use them to create a project library, highlight classroom efforts on our website and in Park publications, and complete evaluations of student outcomes.

Send to: National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Specialist
Point Reyes, CA 94956

Reservations

You must have a confirmed reservation for this field trip so a Park Ranger can assist your group. Please use the reservation form provided in this unit.

Creek Kit Contents

A Park Ranger will reserve creek kits for your confirmed class trip. The contents of each kit are listed below:

pH test:

- 1 box of pH indicator strips
- 2 water sample containers
- 1 stopwatch (for all tests)
- 7 enlarged pH charts

Dissolved Oxygen Test:

- 1 wastewater bottle
- dissolved oxygen tablets
- 7 glass test-tubes with black caps
- 7 Dissolved Oxygen instruction cards
- 1 test-tube drying rack

First Aid Kit:

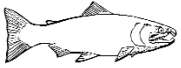
- topical antihistamine/analgesic
- basic supplies

Temperature/velocity Test:

- 2 thermometers
- dry sticks (to float in creek)
- 1 rope (12 feet)

Aquatic Insect Station:

- 1 ruler, aquatic insect collection pan
- ice-cube tray for insect sorting
- 4 paint brushes
- 7 plastic spoons
- 7 aquarium nets
- 2 basters
- 2 two-way magnifying viewers
- 1 water ecology book
- 7 laminated insect keys
- various ID guides (tracks, plants, birds)



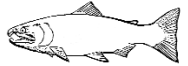
California Science Standard Links

Teacher Preparation

"Monitoring Creek Health" Unit										
	Pre-Visit					On-Site	Post-Visit			
	#1	#2	#3	#4	#5	Field Journal	#1	#2	#3	#4
Sixth Grade										
1										
2								a,b		
3										
4										
5	c,e		a,b, e			e		b		
6										
7	d	b		b,h		b,d,e,h	b,c, d,e		b,d	
Seventh Grade										
1										
2										
3										
4										
5	d									
6										
7	d,e	a	b	a,c		a,c,e	a,c	e	a,b, c,e	
Eighth Grade										
1						b	b			
2										
3										
4										
5		e								
6										
7										
8										
9				b			b		b	



Correlations to "A Child's Place in the Environment" California's State Approved Environmental Education Curriculum



Teacher Preparation

	"Monitoring Creek Health" Unit									
	PRE-VISIT					ON-SITE	POST-VISIT			
	#1	#2	#3	#4	#5	Field Journal	#1	#2	#3	#4
A Child's Place in the Environment: Grade 6 Lessons										
What Are Some Components of an Ecosystem?			✓							
What Role Does Diversity Play in an Ecosystem?			✓			✓			✓	✓
How Does the Sun's Energy Flow through an Ecosystem?			✓				✓			
What Interrelationships and Niches Can Be Identified in an Ecosystem?			✓							
What Cycles Exist in an Ecosystem and How Do They Sustain an Ecosystem?						✓				
What Examples of Ecological Principles Can Be Observed in an Ecosystem?						✓			✓	
What Are the Components and Relationships of Human Communities and How Do They Compare to Ecosystems?						✓			✓	✓
What Are Some Limiting Factors in Human Communities and in Ecosystems?		✓								✓
How Do Energy Sources Used in Human Communities Compare to Those Used in Ecosystems?										
How Can Organic Solid Waste in Human Communities Be Composted?								✓		
How is Land Used by Our Community and How Are Land-Use Decisions Made?										
How Can the Disposal of Solid Waste Affect the Quality of the Environment?								✓	✓	
How Does the Motor Vehicle Transportation System Affect the Environment?										
How Do Human Beings Affect Watersheds?	✓				✓	✓		✓		✓
What Human Actions Enhance, Protect, and Sustain the Quality of the Environment?					✓	✓		✓	✓	✓
What Have Communities Done to Become More Sustainable?										✓
What Projects Can Students Implement to Make Their Classroom and School or Community More Sustainable?	✓							✓	✓	✓



Acknowledgments

This unit was written by area teachers, Park Rangers, scientists, and area naturalists. Special thanks to the following people:

Point Reyes National Seashore: Coho Project/ Hydrology

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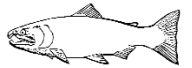
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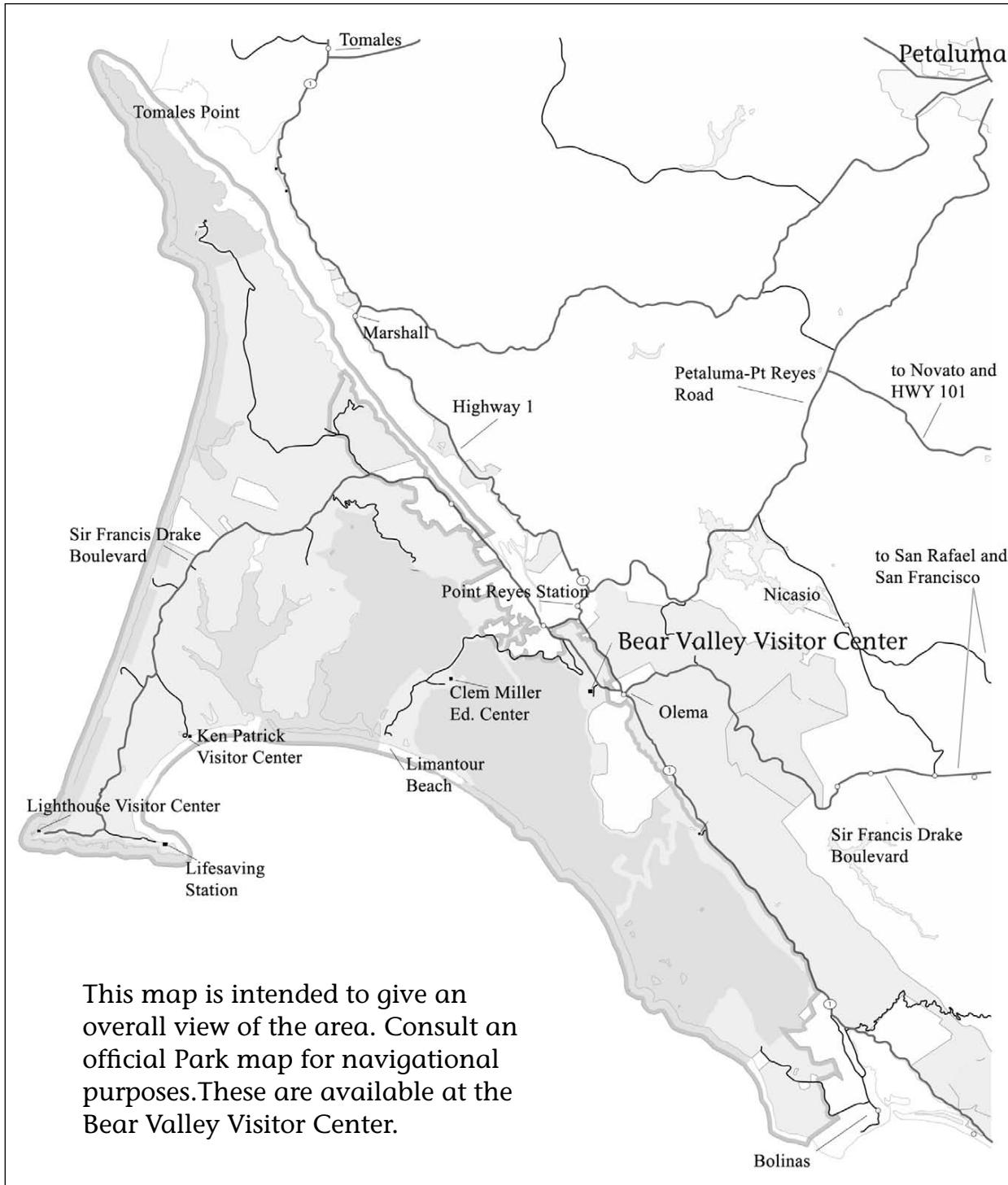
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Point Reyes National Seashore



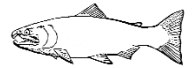
Attachment



Approximate Driving Times/Distances

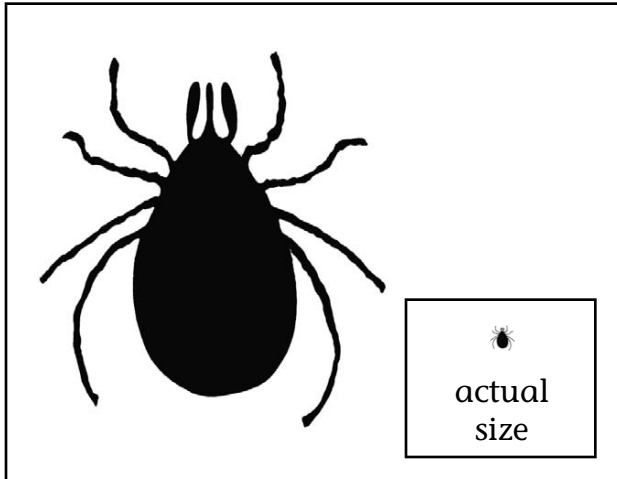
Petaluma to Bear Valley VC	40 min./19 miles
Novato to Bear Valley VC	40 min./19 miles
San Anselmo to Bear Valley VC	30 min./20 miles
Bear Valley VC to Limantour Beach	20 min./9 miles
Bear Valley VC to Tomales Point	30 min./19 miles
Bear Valley VC to Ken Patrick VC	30 min./15 miles
Bear Valley VC to Lighthouse VC	45 min./22 miles

Lyme Disease, Stinging Nettle, and Poison Oak



Attachment

Lyme disease is an illness caused by bacteria transmitted to people by tick bites. Not all ticks carry the disease. Field studies in Marin County show that 1–2% of the western black-legged ticks carry Lyme disease. Since there are several other species of ticks in Marin, the odds of a tick bite producing Lyme disease is less than 1 in 100. Even so, Lyme disease can be severe; it is important to understand the prevention and symptoms.



Symptoms:

arthritis and joint pain
lethargy
heart problems
pain/limping
fever
kidney problems
depression
bulls-eye rash (50% of victims)

Tick species in California include:

Western black-legged tick and Pacific coast tick (West Coast)
Lone star tick and American dog tick (throughout U.S.)

How to avoid tick bites:

- Wear light-colored, long-sleeved clothes so you can more easily see the ticks.
- Tuck shirt into pants and pants into socks to keep ticks away from your skin.
- Stay on trails.
- Apply an insect repellent, labeled for ticks, to shoes, socks, and pants.
- Check yourself completely after a hike. Closely check any skin irritation. Ticks anesthetize the skin before biting so you'll seldom feel the original bite.

What to do if bitten:

- Use tweezers to grasp tick at point of attachment, as close to skin as possible. Gently pull tick straight out.
- Save tick, notify your doctor.
- Don't panic—ticks need to be embedded for 24–48 hours to transmit bacteria. The ticks that transmit Lyme disease are usually in a developmental phase in which they are smaller than the head of a pin.

References:

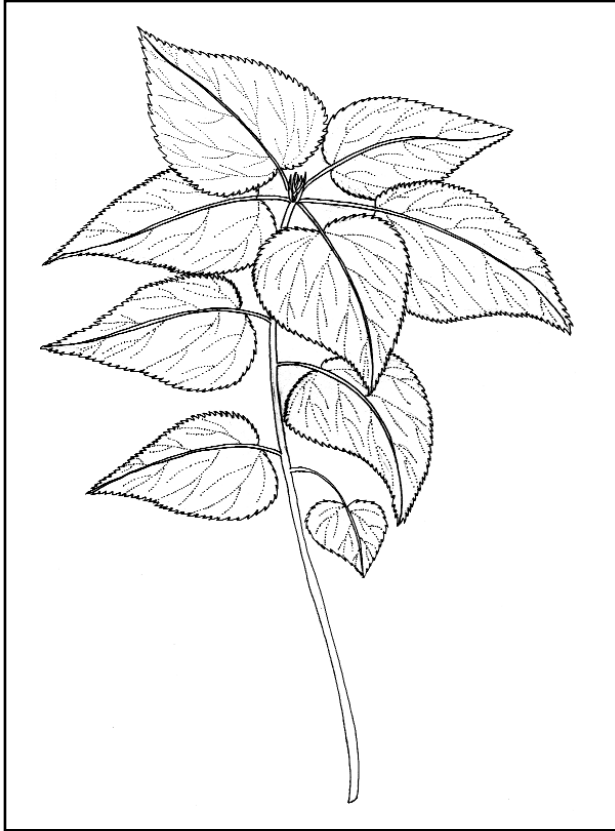
Ticks and Lyme Disease in the National Parks
Lyme Disease Foundation/www.lyme.org



Lyme Disease, Stinging Nettle, and Poison Oak

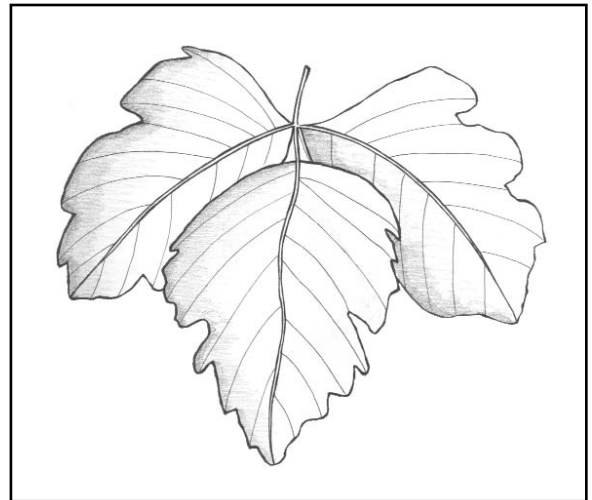
(continued)

Attachment



Stinging nettle is native to Europe, but grows at Point Reyes National Seashore. It can cause a painful rash that stings for up to twelve hours after brushing up against the plant. A topical analgesic (used to treat poison ivy or bug bites) can be applied to help alleviate the sting. Study the picture and have someone point out the plant in the Seashore to aid in its identification.

Poison oak usually causes an itchy rash if you are sensitive to it. You can get a rash by touching the plant, its leaves or roots. You can also contract poison oak by petting your dog (if the oils are on its coat) or by touching clothing that has touched poison oak. Rashes may occur several days after the initial contact with the plant. Severe rashes may affect the lungs. If you have difficulty breathing, call 9-1-1 or go to the nearest emergency room immediately. Preventive topical ointments are available to help avoid reactions to poison oak. Learn to recognize the compound leaves with a shiny appearance.



Creating Coastal Stewardship through Science



Reservation Form

If you are planning a trip to Point Reyes National Seashore to use this curriculum, please notify the Park to avoid conflicts with other groups and to be notified about any unusual closures. Mail this form at least two weeks in advance (fold in thirds and affix postage) or call (415) 663-8522 Extension 259 to leave a message.

Teacher Name: _____

School Name: _____

School Address: _____

City/State: _____ Zip Code: _____

School Phone: _____ School Fax: _____

Email Address: _____

Grade: _____ Class Size: _____

Home Phone: _____

Field Trip Options

Monitoring Creek Health

Observing Pacific Gray Whales

Discovering Northern Elephant Seals

Investigating Tule Elk

Uncovering the San Andreas Fault

Identifying Resident Birds

Defining Habitats

Field Trip Preferences

Field Trip Topic

Dates

Time

(list three in order of preference)

1. _____

2. _____

Comments

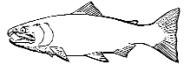
_____ Confirmation Letter

_____ Materials Sent

National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Program Coordinator
Point Reyes Station, California 94956



Creating Coastal Stewardship through Science



Evaluation Form

Please help us develop and improve our programs by taking a few minutes to complete this form. This evaluation form is preaddressed, but needs to be folded in thirds and provided with postage. If you prefer, email comments to:

PORE_Education@nps.gov

Name: _____ School Name: _____

School Address: _____

City/State/Zip Code: _____

School Phone: _____ School Fax: _____

Email Address: _____

Class Size/Grade: _____

Date of Visit: _____ Program/Location: _____

Getting Your Visit Set Up

Do you have any suggestions to make logistics easier? (maps, directions, reserving programs)

Curriculum Materials

Which lessons were the most effective?

Relevance of content to my students and curriculum:

Grade appropriateness?

Program Assessment

How does this program fit into California/National Standards and your personal education program?

Strengths/weaknesses of program?

Best part of experience?

What is the level of support at your school for this program?

What could the National Park Service do to improve your education program?

Overall, how would you respond if a colleague asked about this program?

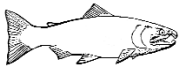
Highly recommended Recommended Recommended with some qualifications
Not recommended

National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Specialist
Point Reyes Station, California 94956



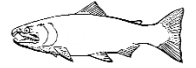


Acid	capable of reacting with and dissolving certain metals to form salts; having a sour taste; a substance capable of giving up a proton
Adaptation	adjustment or change in an organism to become suitable to a new situation
Alevin	the yolk-sac stage of salmonids
Alkaline	having a pH greater than seven
Anadromous	describes fishes that begin life in fresh water, then go to the ocean to live, and finally return to fresh water to spawn (derived from Greek = “running upward”)
Anoxic	absence of oxygen
Base	ability to react with acids to form salts; having a bitter taste; a slippery solution; capable of providing electrons
Benthic	bottom dwelling organisms found on stones, in mud, or vegetation
Carnivore	flesh eating mammals
Class	taxonomic category of plants and animals ranking above an order and below a phylum
Consumer	organism that eats other mammals
Creek ecology	relationship between organisms depending on or living around a creek
Dissolved oxygen	gaseous oxygen that is dissolved in water
Ecosystem	a community of interrelated life forms and non-living physical parts
Erosion	the wearing away of land by wind or water
Estuary	the mouth of a river where fresh and salt water mix
Family	taxonomic category below an order, above a genus (Kingdom/ Phylum/ Class/ Order/ Family/ Genus/ Species)
Food chain	an arrangement of the organisms of an ecological community according to the order of predation in which each member uses the next lower member as a food source



Vocabulary

Food web	the totality of interacting food chains in an ecological community where food energy passes among organisms as each consumes and is preyed on by others
Fry	a young, immature salmon or steelhead that has not smolted yet
Genus	taxonomic category ranking below a family and above a species
Habitat	the native environment of a plant or animal. The kind of place that is natural for the life and growth of a plant or animal
Herbivore	feeding on plants, plant-eating
Kingdom	broadest, most inclusive taxonomic category of organisms having certain basic characteristics (There are five kingdoms: Plantae, Animalia, Fungi, Monera, Protista)
Migrate	to physically move from one region to another depending on seasons; salmon hatch in fresh water, migrate to sea, and spawners migrate back again to fresh water
Omnivore	eating both animal and plant substances
Oncorhynchus	the genus name for the Pacific salmon (derived from Greek Oncho = hook, rhynchus = beak or snout)
Order	taxonomic category of plants and animals ranking above the family and below the class
Parr	a young salmon during the first one to two years of its life when it lives in fresh water
Parr Marks	dark round, or oval markings on the bodies of salmonid fry
pH	a measure of the “potential of hydrogen” of a solution based on a scale of 1–14 where pH 1 is the most acidic, pH 7 is neutral and pH 14 the most basic
Phylum	taxonomic category of plants and animals ranking above the class and below the kingdom
Producers	organism that contains chlorophyll to make food by photosynthesis

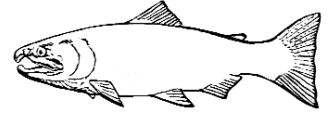


Vocabulary

Redd	a nest that a female salmon or steelhead digs with her tail in the gravel, and a place where her eggs are deposited
Resource manager	person who controls or directs research, monitoring, or actions toward natural or cultural resources
Riparian	a zone that links terrestrial and aquatic systems
Salmonid	of or belonging to the family Salmonidae, which includes salmon, trout, and whitefish
Scavenger	an animal that feeds on dead animal's flesh or other decaying organic matter
Smolt	a young salmonid adapting to life in the ocean environment
Spawn	to produce young or eggs, especially in large numbers
Species	taxonomic category ranking below a genus, consisting of organisms capable of interbreeding
Stewardship	choices and actions to protect our environment
Terrestrial	living or growing on land, not aquatic
Tributary	a smaller stream or river that flows into another larger stream or river
Watershed	the land that serves as a drainage for specific streams or rivers



Creating
**COASTAL
STEWARDSHIP**
through Science

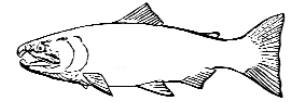


Monitoring Creek Health

Pre-Visit Activities

How Can We Learn More about the Coho Salmon and Steelhead Trout?	23
What Can We Learn About Water?	47
Who Is in the Aquatic Food Pyramid and What Is Their Relationship to the Health of an Ecosystem?	55
What Can We Expect on Our Field Trip to the Creeks of Point Reyes?	63
Safety and Stewardship Challenge	69

How Can We learn More about Coho Salmon and Steelhead Trout?



Pre-Visit Lesson Plan

Students use the *Plight of the Salmon* newspaper to complete several activity sheets as background information for their study of fish population issues, habitat requirements, life cycle, and stewardship projects.

Time required: 1-hour

Location: classroom/homework

Suggested group size: partner activity or individual homework

Subject(s): ecology, life science, social studies and language arts

Concept(s) covered: habitat requirements, life cycles, creek ecology, human impacts, and stewardship

Written by: Tricia Corsetti, Tomales Middle School
Christie Denzel Anastasia, National Park Service

Last updated: 07/01/00

Student Outcomes

At the end of this activity, the students will be able to:

- Complete reading comprehension activity sheets using the *Plight of the Salmon* newspaper.
- Understand the habitat requirements and environmental impact issues surrounding the coho salmon and steelhead trout.
- Understand the importance and role of the Coho and Steelhead Restoration Project of Point Reyes National Seashore.

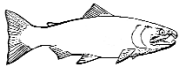
California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

- 6th grade: 5c- organisms can be categorized by functions;
5e- resources available and abiotic factors;
7d- communicate the steps and results from an investigation.
- 7th grade: 5d- reproduction;
7d- communicate the steps and results from an investigation.

Creating
COASTAL STEWARDSHIP
through Science





National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Use appropriate tools and techniques to gather, analyze, and interpret data, develop descriptions, explanations, predictions, and models using evidence, think critically and logically to make the relationships between evidence and explanations, use mathematics in all aspects of scientific inquiry.
- Content Standard C – Structure and function in living systems, reproduction and heredity, regulation and behavior, populations and ecosystems, diversity and adaptations of organisms.
- Content Standard F – Populations, resources, and environments, risks and benefits, science and technology in society.

Materials

To be photocopied from this guide:

- **Pre- and Post- Evaluation** activity sheet
- “*Plight of the Salmon*” newspaper located on pages 43–46
- **Vocabulary** sheets located in Teacher’s Preparation/Attachments
- **Finding the Fish Facts** activity sheet
- **Migration and Its Challenges** activity sheet
- **Salmonid Life Cycle** activity sheet

Vocabulary

Refer to vocabulary sheets located in Teacher’s Preparation/Attachments

Procedures

1. **Pre- and Post-evaluation**

Distribute Pre- and Post-evaluation activity sheets. Remind students this is not a graded test, but rather a measure of our success; each student will retake the same test after several lessons. (Note: You may choose to save these completed tests and redistribute in the first postvisit lesson. Students can change their answers based on what they have learned.)

2. **Distribute newspaper**

Each student will need a copy of the newspaper, *Plight of the Salmon*. Students can work in pairs or individually to complete activities.

3. **Reading Comprehension**

Read the *Plight of the Salmon* newspaper as a class and discuss the Coho and Steelhead Restoration Project.

4. **Activity sheets**

Give each student appropriate activity sheets, vocabulary list, and instructions for completion.

5. **Conclusions**

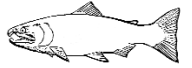
Review students’ answers and relate these concepts to lessons already covered earlier in the year.



Extension ideas

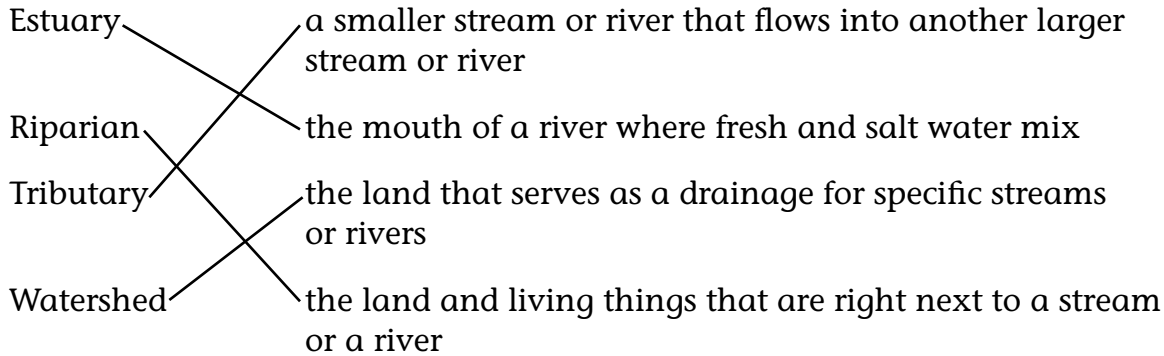
1. After learning about the Coho and Steelhead Restoration Project, students can begin to brainstorm similar stewardship projects in their local areas for stream protection. These ideas will be used in a follow-up stewardship lesson.
2. Students can create life-cycle mobiles of the salmon to better understand habitat requirements at all stages of life for anadromous fish.
3. Students can create life-sized drawings of the coho salmon and steelhead trout to illustrate the differences in size and appearance of each species.
4. Students can conduct an investigation of other threatened or endangered salmon species. Compare and contrast the challenges and behaviors that need to be addressed to conserve these species.
5. Attend a workshop with Trout Unlimited to receive certification for raising steelhead trout eggs in the classroom (see Resources: Workshops and Classes).

Pre- and Post-evaluation



Vocabulary Match-Up

Draw connecting lines between words and their definitions.



Species Challenges

Circle the factors below that have contributed to declines of coho salmon and steelhead trout in West Marin.

- | | | |
|---|---|---|
| <input checked="" type="checkbox"/> Development | Streamsides restoration | <input checked="" type="checkbox"/> Logging |
| <input type="checkbox"/> Conserving water use | Improved water quality | <input type="checkbox"/> Low reproductive rates |
| <input checked="" type="checkbox"/> Dam construction | Unevenly distributed fish sex ratios | |
| <input checked="" type="checkbox"/> Prolonged drought | Fencing off streams on agricultural lands | |

Environmental Quality

Place a check mark below next to safe tests of water quality:

- | | |
|---|---|
| <input checked="" type="checkbox"/> aquatic insect survey | <input type="checkbox"/> taste test |
| <input checked="" type="checkbox"/> pH | <input checked="" type="checkbox"/> habitat survey |
| <input checked="" type="checkbox"/> dissolved oxygen | <input checked="" type="checkbox"/> bacteria counts |

National Park System

Which part of the National Park System is closest to where you live?

Point Reyes National Seashore, Muir Woods National Monument, Golden Gate National Recreation Area

Life-cycle Information

True or False?

- F Coho salmon and steelhead trout can weigh over twenty pounds.
T Coho salmon can only live in salt water.
T Steelhead trout can only live in fresh water.

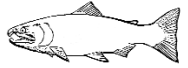
Stewardship

What can you do to increase coho salmon and steelhead trout population numbers? List your ideas on the back of this paper.

answers will vary

Plight of the Salmon Newspaper Activity

Finding the Fish Facts



Using the newspaper as the resource, answer the following questions about coho and steelhead.

1. What are three similarities and three differences between coho salmon and steelhead trout?

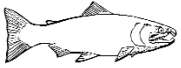
Similarities

anadromous
listed as threatened
can weigh over 20 pounds
same genus

Differences

coho lay eggs once, steelhead repeatedly
steelhead has further southern range
inside of mouths different colors
steelhead has longer freshwater residence

2. List two reasons these fish populations are declining in West Marin.
natural phenomena such as prolonged drought
development
3. What is the highest population count for these fish species in 1996–97?
Coho salmon: 549
Steelhead trout: 500
4. List five threats to salmon habitat.
 - a) *dam construction*
 - b) *logging and road construction*
 - c) *some agricultural practices*
 - d) *urbanization*
 - e) *large scale hatchery production that has diluted genetic integrity*
5. List five stewardship or conservation activities we can implement to remedy these threats.
 - a) *fence streams to prevent trampling*
 - b) *keep planned development away from streamsides*
 - c) *careful logging and constructing roads away from streams*
 - d) *stream restoration projects*
 - e) *collect data on population numbers*
6. What are four objectives of the Restoration Project?
Phrase the objectives as questions.
 - a) *What are the present stream conditions?*
 - b) *What were past stream conditions?*
 - c) *How can we implement a plan to restore and monitor habitat?*
 - d) *How can we inform the public and other resource managers?*



Plight of the Salmon Newspaper Activity
Finding the Fish Facts

(continued)

Teacher Master

7. Name at least three creeks of the Coho Salmon Restoration Project.
 - a) *Olema Creek*
 - b) *Lagunitas Creek*
 - c) *Pine Gulch Creek*
 - d) *Redwood Creek*
8. What is the federal status of the coho salmon and steelhead trout? What does that mean to the National Park Service?

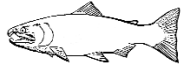
Populations of coho and steelhead were listed as threatened along the central California coast. This is a federal designation that the National Park Service must incorporate into its management goals.

Bonus

Indicate by name where coho salmon and steelhead trout are scientifically similar.

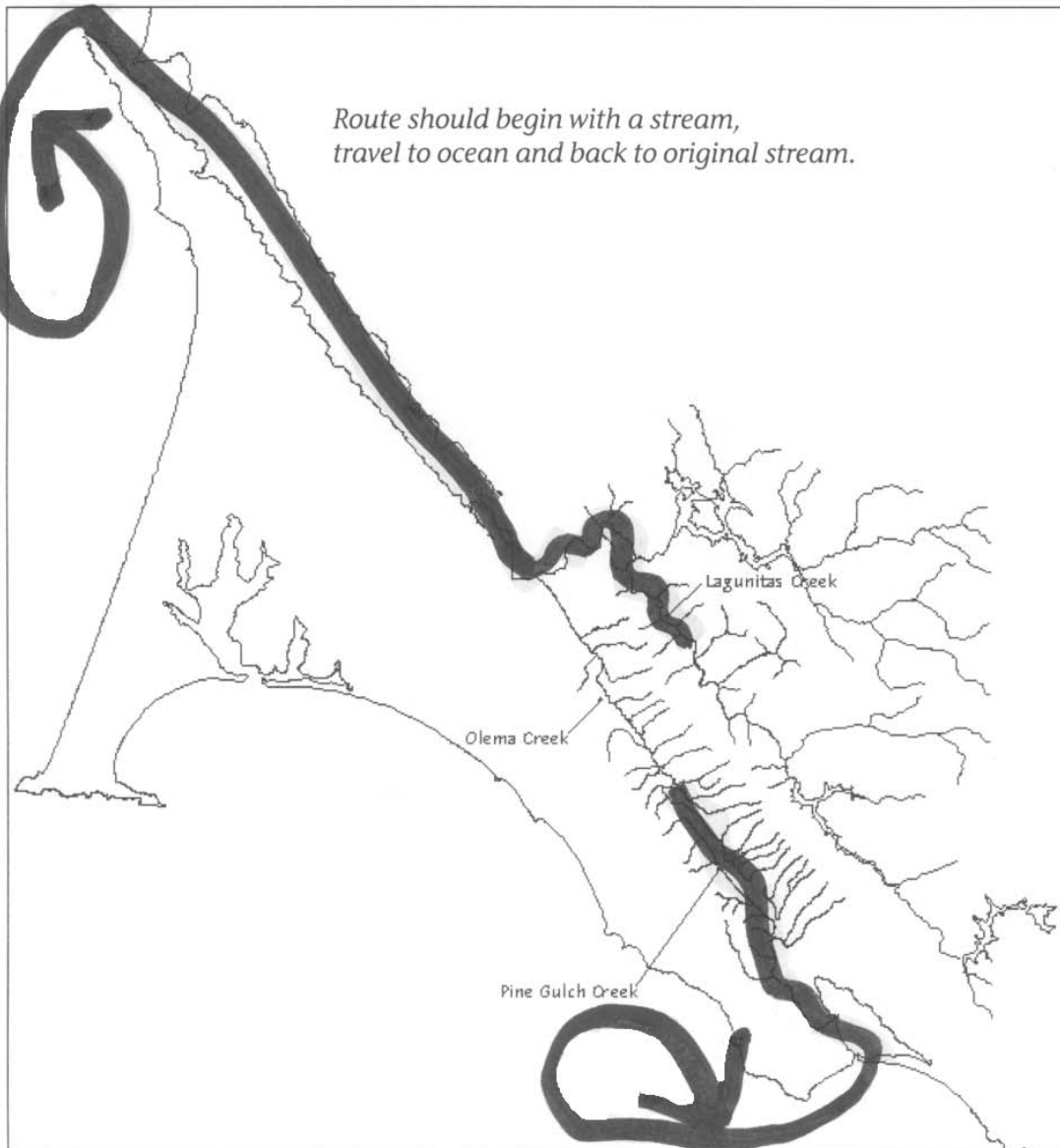
	Coho Salmon	Steelhead Trout
Kingdom	<i>Animalia</i>	<i>Animalia</i>
Phylum	<i>Chordata</i>	<i>Chordata</i>
Subphylum	<i>Vertebrata</i>	<i>Vertebrata</i>
Class	<i>Actinopterygii</i>	<i>Actinopterygii</i>
Order	<i>Salmoniformes</i>	<i>Salmoniformes</i>
Family	<i>Salmonidae</i>	<i>Salmonidae</i>
Genus	<i>Oncorhynchus</i>	<i>Oncorhynchus</i>
Species	<i>Kisutch</i>	<i>Mykiss</i>
Subspecies		<i>irideus</i>

Plight of the Salmon Newspaper Activity Migration and Its Challenges



1. Using the map below, draw a path of the coho salmon and steelhead trout migration routes.
2. List at least two threats along the migration route on the appropriate map locations.
3. Using a different color, label human interventions in the same way.

Human Interventions: Overfishing
Human Interventions: Overlogging
Threat: Dam in creek habitat
Threat: Oil Spill in marine habitat





Plight of the Salmon Newspaper Activity Salmonid Life Cycle

Teacher Master

- Using the *Plight of the Salmon* newspaper, gather the following information to create a life-cycle chart (choose either the coho salmon or the steelhead trout as an example to complete this activity).

ELEMENT OF LIFE CYCLE	FRESH OR SALT WATER	MONTH, SEASON, OR WEATHER CONDITIONS	TIME INVOLVED
<i>Ex: female digs series of shallow nests</i>	<i>fresh</i>	<i>winter</i>	<i>several weeks</i>
<i>eggs are deposited and fertilized simultaneously</i>			
<i>eggs are covered with gravel</i>			
<i>adults die; eggs hatch</i>			<i>incubation 4-6 weeks</i>
<i>alevins remain under gravel living off of leftover yolk</i>			
<i>young surface from gravel</i>		<i>spring</i>	
<i>life in stream</i>			<i>15-18 months</i>
<i>migrate to ocean (color, gills, kidneys change)</i>	<i>salt</i>	<i>following spring</i>	<i>live in ocean 4-18 months</i>
<i>return to home streams (males turn red, grow hooked jaws and long teeth, battle over females)</i>		<i>fall/winter (after rains begin)</i>	

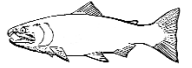
Using the information above, create a diagram to illustrate the life cycle, behaviors and changes of salmonids. Be creative; there are many ways to convey information.

Diagrams will vary.



Plight of the Salmon Newspaper Activity
Salmonid Life Cycle

(continued)



2. What are the benefits and disadvantages of being anadromous? Brainstorm as many ideas as you can think of before conducting additional research. Chances are your creative and logical ideas will be the same as you will find with further research.

BENEFITS

eggs are safer in fresh water
better food supply in ocean
decaying bodies of spawned-out fish
increase primary production of
algae and other aquatic plants
specialized niche helps alleviate
competition

DISADVANTAGES

extra energy expended for migration
extra risk involved in migration
must adapt to salt water
upstream travel difficult

3. Do the benefits outweigh the disadvantages?
Yes, that's why salmonids exist the way they do.



Pre- and Post-evaluation

Vocabulary Match-Up

Draw connecting lines between words and their definitions.

- | | |
|-----------|--|
| Estuary | a smaller stream or river that flows into another larger stream or river |
| Riparian | the mouth of a river where fresh and salt water mix |
| Tributary | the land that serves as a drainage for specific streams or rivers |
| Watershed | the land and living things that are right next to a stream or a river |

Species Challenges

Circle the factors below that have contributed to declines of coho salmon and steelhead trout in West Marin.

- | | | |
|----------------------|---|------------------------|
| Development | Streamside restoration | Logging |
| Conserving water use | Improved water quality | Low reproductive rates |
| Dam construction | Unevenly distributed fish sex ratios | |
| Prolonged drought | Fencing off streams on agricultural lands | |

Environmental Quality

Place a check mark below next to safe tests of water quality:

- | | |
|--|--|
| <input type="checkbox"/> aquatic insect survey | <input type="checkbox"/> taste test |
| <input type="checkbox"/> pH | <input type="checkbox"/> habitat survey |
| <input type="checkbox"/> dissolved oxygen | <input type="checkbox"/> bacteria counts |

National Park System

Which part of the National Park System is closest to where you live?

Life-cycle Information

True or False?

- T/F Coho salmon and steelhead trout can weigh over twenty pounds.
 T/F Coho salmon can only live in salt water.
 T/F Steelhead trout can only live in fresh water.

Stewardship

What can you do to increase coho salmon and steelhead trout population numbers? List your ideas on the back of this paper.





Plight of the Salmon Newspaper Activity
Finding the Fish Facts

Using the newspaper as the resource, answer the following questions about coho and steelhead.

1. What are three similarities and three differences between coho salmon and steelhead trout?

Similarities

Differences

2. List two reasons these fish populations are declining in West Marin.

3. What is the highest population count for these fish species in 1996 – 97?

Coho salmon: _____

Steelhead trout: _____

4. List five threats to salmon habitat.

a) _____
b) _____
c) _____
d) _____
e) _____

5. List five stewardship or conservation activities we can implement to remedy these threats.

a) _____
b) _____
c) _____
d) _____
e) _____

6. What are four objectives of the Restoration Project?

Phrase the objectives as questions.

a) _____
b) _____
c) _____
d) _____





Name _____ Date _____

Activity Sheet

Plight of the Salmon Newspaper Activity
Finding the Fish Facts

(continued)

7. Name at least three creeks of the Coho Salmon Restoration Project.
- a) _____
- b) _____
- c) _____
8. What is the federal status of the coho salmon and steelhead trout? What does that mean to the National Park Service?

Bonus

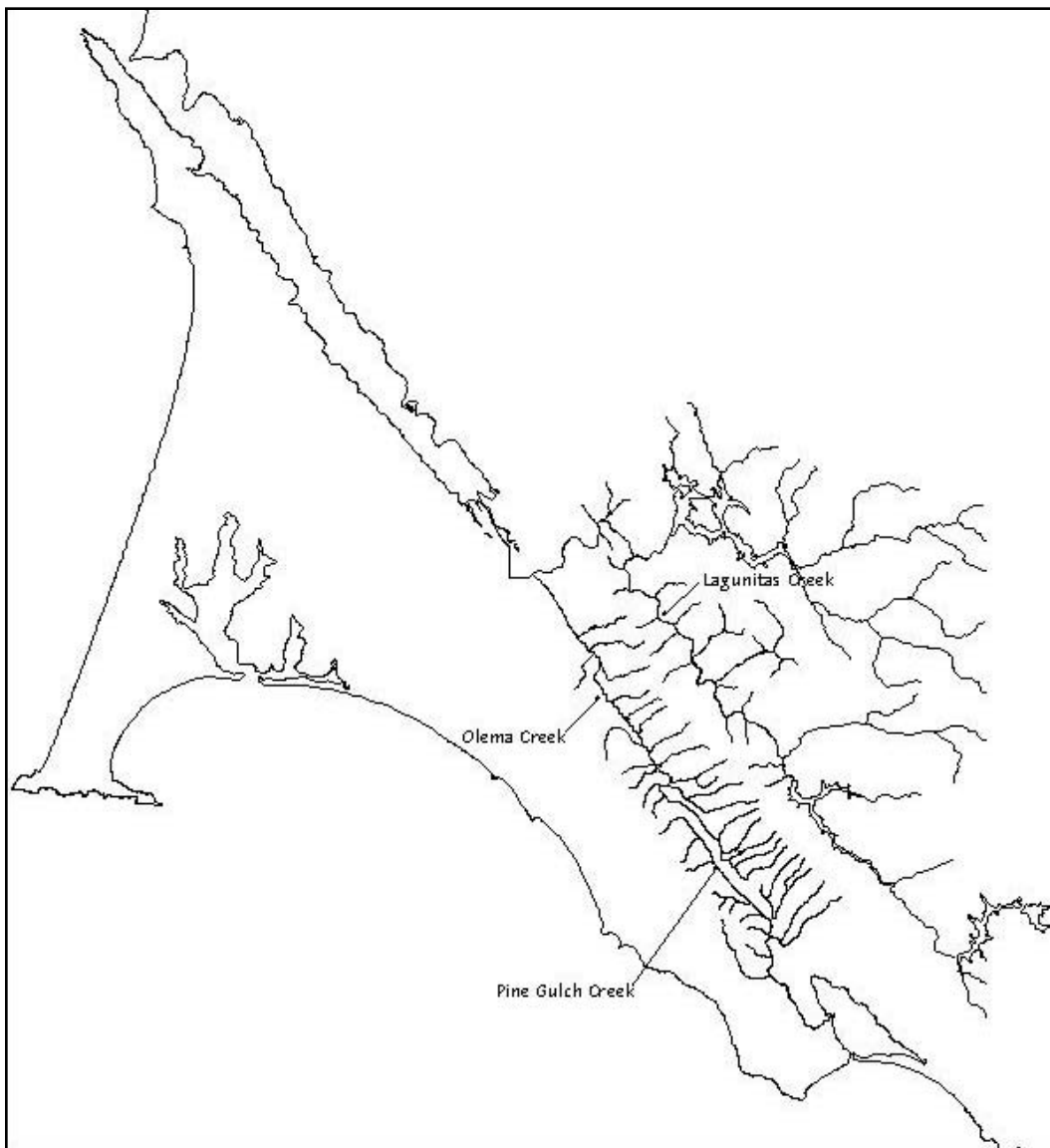
Indicate by name where coho salmon and steelhead trout are scientifically similar.

	<i>Coho Salmon</i>	<i>Steelhead Trout</i>
Kingdom	_____	_____
Phylum	_____	_____
Subphylum	_____	_____
Class	_____	_____
Order	_____	_____
Family	_____	_____
Genus	_____	_____
Species	_____	_____
Subspecies	_____	_____



Plight of the Salmon Newspaper Activity
Migration and Its Challenges

1. Using the map below, draw a path of the coho salmon and steelhead trout migration routes.
2. List at least two threats along the migration route on the appropriate map locations.
3. Using a different color, label human interventions in the same way.





Name _____ Date _____

Activity Sheet

Plight of the Salmon Newspaper Activity
Salmonid Life Cycle

- 1. Using the Plight of the Salmon newspaper, gather the following information to create a life-cycle chart (choose either the coho salmon or the steelhead trout as an example to complete this activity).

ELEMENT OF LIFE CYCLE	FRESH OR SALT WATER	MONTH, SEASON, OR WEATHER CONDITIONS	TIME INVOLVED
<i>Ex: female digs series of shallow nests</i>	<i>fresh</i>	<i>winter</i>	<i>several weeks</i>

Using the information above, create a diagram to illustrate the life cycle, behaviors and changes of salmonids. Be creative; there are many ways to convey information.





Plight of the Salmon Newspaper Activity
Salmonid Life Cycle

(continued)

2. What are the benefits and disadvantages of being anadromous? Brainstorm as many ideas as you can think of before conducting additional research. Chances are your creative and logical ideas will be the same as you will find with further research.

BENEFITS

DISADVANTAGES

3. Do the benefits outweigh the disadvantages?

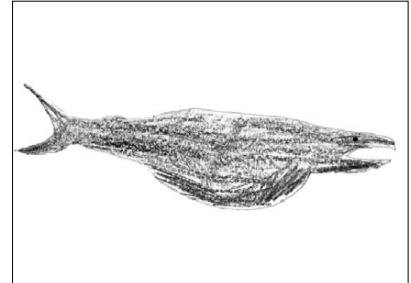


POINT REYES NATIONAL SEASHORE

GOLDEN GATE NATIONAL RECREATION AREA

MUIR WOODS NATIONAL MONUMENT

**Introduction
and
Overview**



"Female salmon grow big stomachs when they return to fresh water."
Drawing & caption by Akira Robinson, age 8.

The Plight of the Salmon

For thousands of years, coho (silver) salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) have migrated from the feeding grounds of the open ocean back to the streams of coastal California to spawn and die.

Shrinking Populations. During the past fifty years, however, the distribution and abundance of coho salmon and steelhead trout in California have declined dramatically.

A recent survey of 248 streams found that only half still contain coho. Steelhead trout could once be found in rivers as far south as the Mexican border, but their current range is only to Malibu Creek,

just north of Los Angeles. The most recent statewide estimate of spawning coho salmon is 31,000 fish per year — a startling 94 percent decline from about 515,000 since the 1940s. Although comparable statewide estimates are not available for steelhead, data from individual river systems indicate a similar trend.

Local Status. In 1996 and 1997, populations of coho and steelhead along the central California coast were listed as threatened under the Federal Endangered Species Act. When listing species with wide geographic distribution, the National Marine Fisheries Service evaluates populations in discrete Evolutionarily Significant Units (ESUs). Western Marin County lies within the heart of the central California coast ESU, where at least 50 percent of the streams no longer contain coho.

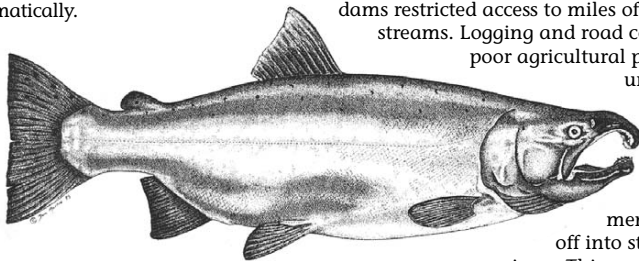
Locally, in Pine Gulch Creek, there have been no recorded observations of coho since the late 1970s. Olema, Redwood, and Lagunitas creeks now sustain relatively small coho populations. In Lagunitas Creek, with about 10 percent of natural

spawning population in the ESU, the highest count in recent years was 549 coho in 1996-97. Lagunitas Creek also presently supports roughly 500 adult steelhead, a decline from historical numbers.

Threatened Habitats. Decreases in coho and steelhead populations are related to past human activities and development. The construction of dams restricted access to miles of spawning streams. Logging and road construction, poor agricultural practices and urbanization all increased the amount of sediment that runs off into streams and rivers. This run-off chokes

the spawning gravels with fine silt and sand, suffocating eggs and trapping alevins (see Glossary, back page). Adult populations of fish have been reduced by commercial and recreational overharvest. Large scale hatchery production has diluted the genetic integrity of many wild populations, weakening their ability to survive in changing conditions. In addition, natural phenomena such as catastrophic floods, prolonged droughts, and variable ocean conditions have exacerbated the human causes of the decline.

Conservation. Fortunately, increased awareness has led to more beneficial practices. Land owners and land management agencies have instituted stream-friendly practices, including fencing streams to prevent trampling and sedimentation, keeping planned development away from areas alongside streams, logging carefully and constructing roads away from streams. These actions, along with community stream restoration projects, all contribute to a healthier stream environment and increase the survival rate of salmon and trout.



Spawning male coho salmon

Coho and Steelhead Restoration Project

what

A five-year project to restore and enhance coho and steelhead populations and their habitats.

why

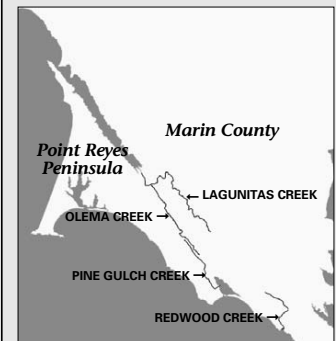
Coho and steelhead populations have declined drastically since the 1940s.

where

Four watersheds in federal parklands in Marin County, California

who

National Park Service scientists and staff, volunteers, school groups, cooperating land owners.



The Coho & Steelhead Restoration Project



DANIEL EVANS

Volunteers learn methods for assessing stream habitat and counting fish.

coho and steelhead populations and their habitat within three West Marin parks, Point Reyes National Seashore, Golden Gate National Recreation Area, and Muir Woods National Monument. The Coho and Steelhead Restoration Project is focusing on Pine Gulch, Redwood, Olema, and Lagunitas creeks and their watersheds. The project has the following six objectives:

- To learn what may influence the reproductive success of coho and steelhead by looking at present stream conditions.
- To investigate past stream conditions and how these have affected populations of salmon and steelhead.
- To assess current salmon and steelhead abundance and distribution.
- To develop and implement a plan for restoring and monitoring the fish and their habitat.
- To inform the public and other resource managers.
- To encourage community involvement through education and restoration of the watersheds.

Armed with hip waders and measuring sticks, National Park Service staff and volunteers brave streams swollen from the winter rains to survey for spawning coho and steelhead. They track spawners, carefully count carcasses, and take tissue samples for DNA study, providing valuable information to study the abundance and distribution of these fish. This is part of the work of the Coho and Steelhead Restoration Project.

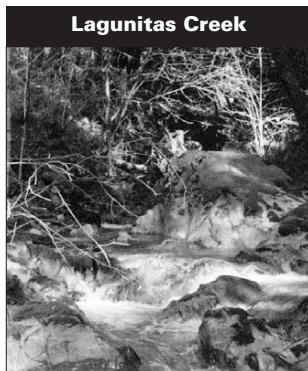
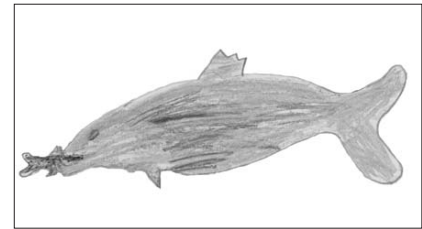
When coho salmon and steelhead trout were placed on the threatened species list, the National Park Service initiated a five-year project to identify, evaluate, restore, and enhance

The benefits of this program extend far beyond these salmonids. Healthy streams and riparian systems in West Marin will protect habitat for a myriad of other aquatic and land creatures such as river otters, California freshwater shrimp (an endangered species), California red-legged frogs (a threatened species) and migratory songbirds that nest in creekside bushes and shrubs.

The success of this ambitious program depends on the active participation of the public, local community conservation organizations, adjacent landowners, and public agencies. By working together, we will lay the groundwork for sustainable and healthy streams, riparian zones, and watersheds.

Salmon in the ocean eat small fish.

Drawing by Devon Lees and Okasako Schmucker, age 8.



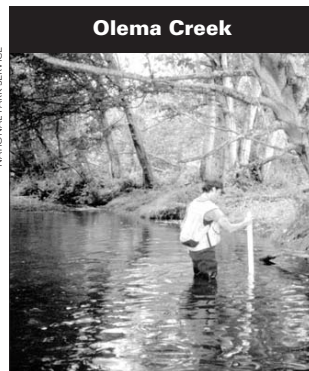
LANNY WAGGONER

Lagunitas Creek

- Mainstem length 13.9 mi
- Tributary length 24.2 mi
- Watershed area 45,300 acres
- Maximum elevation 2,044 ft

Flowing west from the hill country of western Marin County into Tomales Bay, one of the most pristine estuaries in the United States, Lagunitas Creek watershed contains several notable streams — Olema, Cheda, Devil's Gulch, and Lagunitas creeks — all of which have historically supported large runs of steelhead and coho. Lagunitas Creek now supports approximately 10 percent of the remaining wild coho salmon stock in central California.

Impoundments, land-use activities, water development and diversions have changed virtually all the streams within this watershed, eliminating more than one-quarter of the historic spawning and rearing habitat from the Lagunitas Creek watershed. The protection and enhancement of the remaining habitat is an issue of critical importance.



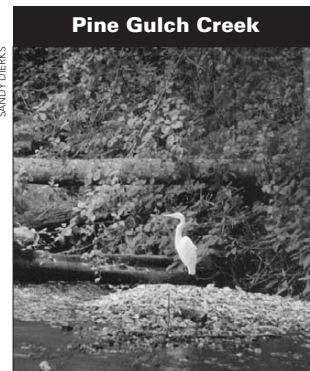
NATIONAL PARK SERVICE

Olema Creek

- Mainstem length 9.9 mi
- Tributary length 27.8 mi
- Watershed area 9,200 acres
- Maximum elevation 1,456 ft

An undammed tributary of Lagunitas Creek, Olema Creek flows northward through the Olema Valley between Inverness and Bolinas ridges to its confluence with Lagunitas Creek and ultimately into Tomales Bay.

The Olema Valley has a rich history of beef and dairy ranching. A portion of the watershed, protected from development, has been less affected by human activity, but past land-use activities have altered much of the lower reaches of the stream habitat within this watershed. Recent proactive land management programs have restored some of the habitat in order to increase numbers of juvenile coho salmon and steelhead trout. Adults returning upstream still face barriers, such as inadequate resting pools and altered flows caused by culverts on many of the tributaries to Olema Creek.



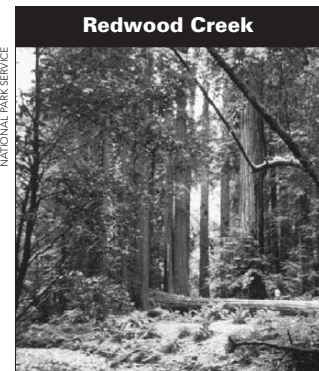
SANDY DIERKS

Pine Gulch Creek

- Mainstem length 7.6 mi
- Tributary length 16.2 mi
- Watershed area 4,900 acres
- Maximum elevation 1,566 ft

Pine Gulch Creek is the major source of freshwater flow into Bolinas Lagoon, a high-value estuarine preserve. Approximately 75 percent of this watershed lies within National Park Service lands, with the remainder in private ownership. Pine Gulch Creek formerly supported coho salmon, with the last recorded observation in 1979. Steelhead trout populations, on the other hand, are doing relatively well within the drainage.

This watershed has in the past been influenced by land-use activities, seasonal dams and diversions. The current low-impact agriculture operations and progressive water-use programs have significantly reduced the negative impacts of these types of operations on the watershed.



NATIONAL PARK SERVICE

Redwood Creek

- Mainstem length 5.9 mi
- Tributary length 14.2 mi
- Watershed area 5,610 acres
- Maximum elevation 2,575 ft

From its headwaters on Mt. Tamalpais, Redwood Creek flows through Muir Woods National Monument to Big Lagoon near Muir Beach. Since the Monument was established nearly 90 years ago, visitors from all over the world have marveled at the beauty of this old-growth redwood forest. Lucky winter visitors get an added bonus: the spectacle of spawning coho salmon in Redwood Creek! Redwood Creek is significant in that it may support a genetically intact wild coho salmon population. Once comprised of hundreds of coho, the run is now much smaller. Channelization of the stream in the 1930s, woody debris misguidedly "cleaned-up," lack of a defined trail, logging in a side canyon, intense dairy farming and other agriculture in the lower sections of the system all caused extensive erosion as well as loss of critical riparian vegetation.

NATALE COSENTINO

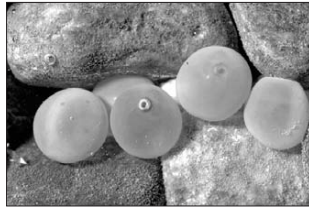


After two to three years in the ocean, they return to their home streams to spawn, guided by an amazingly keen sense of smell. Coho males turn brilliant red; they grow hooked jaws and long teeth and then battle over the privilege of fertilizing eggs. Females undergo a similar but less dramatic transformation.

POINT REYES BIRD OBSERVATORY



In order to live in salt water, the young fish, now known as smolts, adapt as they migrate. Their gills and kidneys change, and their color becomes silvery for better camouflage in the ocean.



JEFF FOOT

Once she has found the stream of her birth, the female digs a series of shallow nests and lays her eggs. The male fertilizes them and the female covers the eggs with gravel.

Each winter, after the rains begin, adult coho salmon and steelhead trout return from the ocean to the coastal streams of their birth to lay and fertilize their eggs. After hatching and maturing in the creek, the young fish swim out to sea, continuing the ancient cycle. Steelhead trout may repeat this journey several times. Salmon make the round-trip journey only once, dying in their native streams. Decaying, they provide nutrients for the next generation and the cycle begins again.

DAVID MANNING



Steelhead and coho fry spend one to three years in the streams, eating small prey or being eaten. Spots and oval parr marks help the young fish blend into the environment. Despite their natural camouflage, only one in ten survives to enter the ocean.

Life Cycle of Coho and Steelhead



JEFF FOOT

The eggs hatch in four to six weeks. After hatching, the alevins remain under the gravel for several weeks, living off the leftover yolk.



JEFF FOOT

When the yolk is depleted, the young surface from the gravel and are known as fry.

Among the many organisms that also rely upon healthy riparian habitat are the Pacific tree frog (right) and California newt (far left).



Fish Facts

Coho Salmon (silver salmon)

SCIENTIFIC NAME *Oncorhynchus kisutch*

RANGE North Pacific Basin from North Korea to Central California (San Lorenzo River in Santa Cruz).

IDENTIFICATION

JUVENILES: ● 2-15 months of age; 2-4 inches long.
● No spots on body, dorsal fin or tail.

ADULTS AT SPAWNING:

- 3 years old; 25 inches long; 10 pounds.
- Jacks (precocious males): 2 years old, 16 inches, 2-5 pounds.
- Bright red sides; hooked jaw ("kype") on males; scattered irregular spots; gums white at base of teeth, rest of mouth is black.

LIFE HISTORY

- Eggs deposited in winter, fry emerge in spring, smolts migrate the following spring.
- Freshwater residence 15-18 months.
- Saltwater residence 4-18 months.
- Adults enter fresh water in fall and winter.

World record: 31 pounds, caught in British Columbia in 1947.

California record: 22 pounds, caught in Lagunitas Creek in 1959.

Steelhead Trout (anadromous form of coastal rainbow trout)

SCIENTIFIC NAME *Oncorhynchus mykiss irideus*

RANGE Alaska to southern California (Malibu Creek)

IDENTIFICATION

JUVENILES: ● 2 months - 4 years old; 2-8 inches long.
● Dark spots on body, dorsal fin and tail.

ADULTS AT SPAWNING:

- 3-6 years, 12-40 inches, 5-20 pounds.
- Steelhead size at spawning is variable.
- Body color silver with red lateral stripe, many small scattered spots on back; gums and inside of mouth all white.

LIFE HISTORY

- Eggs deposited in winter or spring; smolts migrate in spring.
- Freshwater residence: 1-4 years, typically 2 years.
- Saltwater residence 2 months to 4 years, typically 2 years; can spawn several times.
- In contrast to coho, fish that return after spending only a few months at sea (called "half-pounders") are not sexually mature, can be either male or female, and return to the ocean.

California record: 27 pounds, caught in the Smith River in 1976.

More Facts Coho salmon and steelhead trout are two of the seven anadromous species in the genus *Oncorhynchus* that occur in the Pacific basin and spawn in North American streams. ● *O. clarki* — coastal cutthroat trout ● *O. gorbusha* — pink, humpback salmon ● *O. keta* — chum, dog salmon ● *O. kisutch* — coho, silver salmon ● *O. mykiss* — rainbow trout, steelhead trout ● *O. nerka* — sockeye, red, blueback salmon ● *O. tshawytscha* — king, chinook salmon.

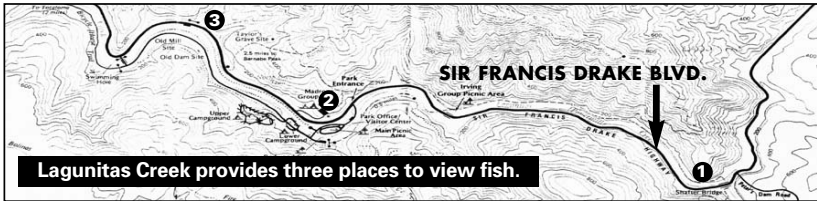


Third-graders at Bolinas School (who contributed crayon drawings to this publication) are learning about the natural history of coho and steelhead — raising steelhead in the classroom from eggs to fry and taking field trips to local creeks to watch spawning coho and study seasonal changes. Their studies are focused on Pine Gulch Creek, which flows beside the school.



Where to Find Spawning Coho Salmon & Steelhead Trout in West Marin

Winter rains bring new life to West Marin creeks. For thousands of years coho salmon and steelhead trout have returned from the vast ocean feeding grounds to the shaded streams of their birth. Look for salmon one to three days after a rainstorm. Traditionally, January is the best month to spot the spawning coho and steelhead. Listed below are some good sighting spots in western Marin County, California. Please use caution in these areas. Watch out for stinging nettle, poison oak and the swift currents.

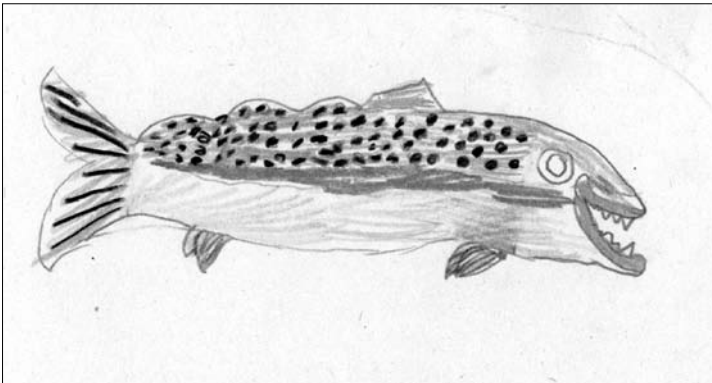


Lagunitas Creek: **1 Leo T. Cronin Fish Viewing Area, Shafter Bridge** On Sir Francis Drake Blvd. at the eastern boundary of Samuel P. Taylor State Park — 1/2 mile west of the town of Lagunitas. The Marin Municipal Water District opens a parking area next to the bridge to facilitate fish viewing from December through mid-February. For information call Marin Municipal Water District Sky Oaks Ranger Station, (415) 459-5267. **2 Samuel P. Taylor State Park** At the entrance station to the state park just off Sir Francis Drake Blvd., there is a short, steep access trail to the creek's edge where you may see the fish as they swim upstream. Samuel P. Taylor State Park, (415) 488-9897. **3 Devil's Gulch** A few miles west of the park entrance is the Devil's Gulch tributary of Lagunitas Creek. The trail begins on the north side of the road, across from a pullout on Sir Francis Drake Blvd. A flat walk takes you along the creek, providing several spots from which to view the fish. Samuel P. Taylor State Park, (415) 488-9897.

Olema Creek: Five Brooks Trailhead Off Highway One, approximately 3 miles south of the intersection of Highway One and Sir Francis Drake Blvd. Park at the trailhead and follow the driveway back towards Highway One. On the right side, follow the path to the creek's edge. Point Reyes National Seashore, (415) 663-1092.

Redwood Creek: Muir Woods Highway One to Frank Valley/Muir Woods Road will take you to the entrance of Muir Woods. Park in the lot provided, then proceed on foot, following the path through the entrance gates (\$2 entrance fee) and along Redwood Creek. Check the park schedule of ranger programs for an opportunity to learn more about the spawning salmon. Muir Woods National Monument, (415) 388-2595.

"The male salmon get fighting teeth when they return to the river."
Drawing & caption by Bryn Byer age 8.



A Coho Glossary

- ALEVIN:** yolk-sac fry stage of salmonids.
- ANADROMOUS:** *ana*=up, *dromous*=running (Greek): ascending rivers from the sea for breeding.
- ONCORHYNCHUS:** *oncho*=hook, *rhynchus*=beak, snout (Greek): the genus name of Pacific salmon and trout.
- PARR:** a young salmon during the first one to two years of its life when it lives in fresh water.
- PARR MARKS:** dark, round or oval markings on the bodies of salmonid fry.
- RIPARIAN:** *ripar*=bank of a stream (Latin); relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or tidewater.
- RUN:** to migrate, especially to move in a large group in order to spawn.
- SALMONID:** of or belonging to the family Salmonidae, which includes salmon, trout and whitefish.
- SPAWN:** to produce young or eggs, especially in large numbers — used in reference to an aquatic animal.
- WATERSHED:** an area or region bounded on the periphery by a summit or boundary line separating the drainage districts of two streams or coasts and draining ultimately to a particular watercourse or body of water.
- ENDANGERED SPECIES:** as defined by the Endangered Species Act of 1973, any species in danger of extinction throughout all or a significant portion of its range.
- THREATENED SPECIES:** as defined by the Endangered Species Act, any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

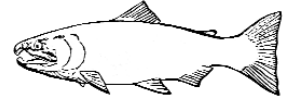
Published in 1998 by the National Park Service
 Project Staff: Ron Smith, David Manning, Brannon Ketcham, David Press
 Managing Editor: Carlin Finke
 Copy Editor: Nancy Adess
 Designer: Claire Peaslee
 Printed on recycled paper



For information about becoming involved in the Coho and Steelhead Restoration Project, call project coordinator Brannon Ketcham at (415) 663-8522 Extension 275.

What Can We Learn about Water?

Students practice performing water-quality tests in the classroom prior to their creek monitoring experience.



Time required: 2–hours

Location: classroom

Suggested group size: all students

Subject(s): chemistry, environmental science

Concept(s) covered: water quality monitoring and testing

Written by: Tricia Corsetti, Tomales Middle School

Last updated: 07/01/00

Student Outcomes

At the end of this activity, the students will be able to:

- Measure and monitor water samples in the classroom (pH, dissolved oxygen, and temperature).
- Draw conclusions about water samples and water analysis.

California Science Standard Links (grades 6–8)

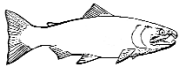
This activity is linked to the California Science Standards in the following areas:

- 6th grade: 7b- appropriate tools and technology to perform tests, collect data, and display data;
- 7th grade: 7a- appropriate tools and technology to perform tests, collect data, and display data;
- 8th grade: 5e- determine pH of a solution.

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Abilities necessary to do scientific inquiry.
- Content Standard B – Properties and changes of properties in matter.
- Content Standard E – Understanding about science and technology.



Materials

To be provided by the teacher:

- pH paper, small jars or cups, vinegar, milk, lemon juice, tap water, distilled water, soda pop, chalk, baking soda, aspirin, antacid tablets, safety goggles
- aquarium thermometers
- dissolved-oxygen test kit (if available), safety goggles, clear jars

To be photocopied by the teacher:

- **Water Data Analysis Information** field journal sheet
- **The pH Scale** field journal sheet

Vocabulary

acid, alkaline, anoxic, base, dissolved oxygen, pH

Procedures

1. Set up each water-test station as follows:

pH: Set up jars with some common substances (lemon juice, vinegar, rainwater, baking soda, and others...). Have available small cups for mixing and pH paper to perform test.

Temperature: Set up several jars with hot, warm, cold, and ice-cold water. Have a thermometer available. If possible, set up two jars with the same temperature under a light bulb, one with a shield for shade, and one without.

Dissolved oxygen: Set up a variety of liquid samples to be tested. You may choose samples from pH station or samples with dirt, soap, etc. Follow instructions on test kit.

2. Provide students with handouts

Each student should have a field journal sheet for **Water Data Analysis Information** and **The pH Scale**. These sheets will be incorporated into their journals and travel with them on their field trip.

3. Explain water tests

Stress that water testing will only give a “snapshot” of creek health. Explain each station and what each measures. Students may record what each station measures on the **Water Data Analysis Information** activity sheet. Divide students into small groups to practice performing the tests with teacher supervision.

4. pH test directions

Place pH paper halfway into the liquid for about 5 seconds, pull out, and notice the color the paper becomes. Dissolve the solid substances in distilled water and have students test them as well (chalk, aspirin, antacid pills). pH results will be recorded below pH scale on activity sheet in section marked “Common Liquids”. Students can draw lines from liquid to corresponding pH rating.



* A buffer is something that neutralizes acids and bases in solution. Chalk, baking soda and antacids act as buffers. Mix them with the lemon juice and vinegar and test the solutions again. Do not mix anything with ammonia!!! Some acid-base mixtures can produce dangerous reactions.

5. Temperature test directions

Have students practice using the thermometers to get accurate readings. Students should compare their results to assess general accuracy.

6. Dissolved-oxygen test directions

If you have access to a dissolved-oxygen test kit, the students will need to follow the directions carefully with your assistance. You will test a half-full container of water, then shake the container vigorously, and retest.

Water left uncovered in a refrigerator or ice chest for 24 hours will have 10–11 ppm (parts per million). Water left uncovered at room temperature for 24 hours will have 8 ppm, and boiled water will have 1–2 ppm because the dissolved gases have diffused.

7. Class discussion

Lead a class discussion about the procedures for accurate testing in the field and emphasize water safety procedures. Students may record additional information from this discussion on the **Water Data Analysis Information** field journal sheet.

pH:

What type of activities or events could impact pH?

Why do highly acidic or highly basic conditions kill fish? Salmon eggs will die if rain becomes slightly acidic. What would make the rain acidic?

Why might mayflies and caddisflies be able to tolerate more acidic water conditions than salmon eggs? Could natural conditions, such as the type of bedrock below the creek, affect the pH reading?

Temperature/ dissolved oxygen:

What is the relationship between dissolved oxygen and temperature?

Why does the shaken water sample have more dissolved oxygen?

What natural events could increase water temperatures?

What human interventions could increase water temperatures?

Is there a relationship between temperature and depth in the oceans? In creeks?

Does water temperature affect the rate of photosynthesis by aquatic plants?

Does water temperature influence the sensitivity of creek life to toxic wastes, parasites, and disease?

What conditions would increase or decrease dissolved oxygen?

Would rotting plants increase or decrease the dissolved oxygen?



General:

What are some of the limiting factors in an aquatic ecosystem? In a human community?

Extension ideas

1. Have students bring in several different water samples from the community and from around the schoolyard to test. Be sure to label each sample and record results.
2. Have students generate all the ways humans can impact water quality and the results of certain tests.
3. Investigate other parameters of water quality, including chlorine levels, nitrates, phosphates, conductivity, coliform content or level, and turbidity. What tests are used for measuring these parameters? What are the natural readings versus the danger readings for each of these? What are the possible sources and remedies?
4. Using a long sheet of paper, draw a river. Cut the paper into as many sections as you have students or teams. In addition, give each student a kind of land use. Have students illustrate their land use on their piece of "River Front Property." Then reconnect the river. Discuss how different land uses impact water quality and note that what happens upstream will effect the downstream.

Water Data Analysis Information

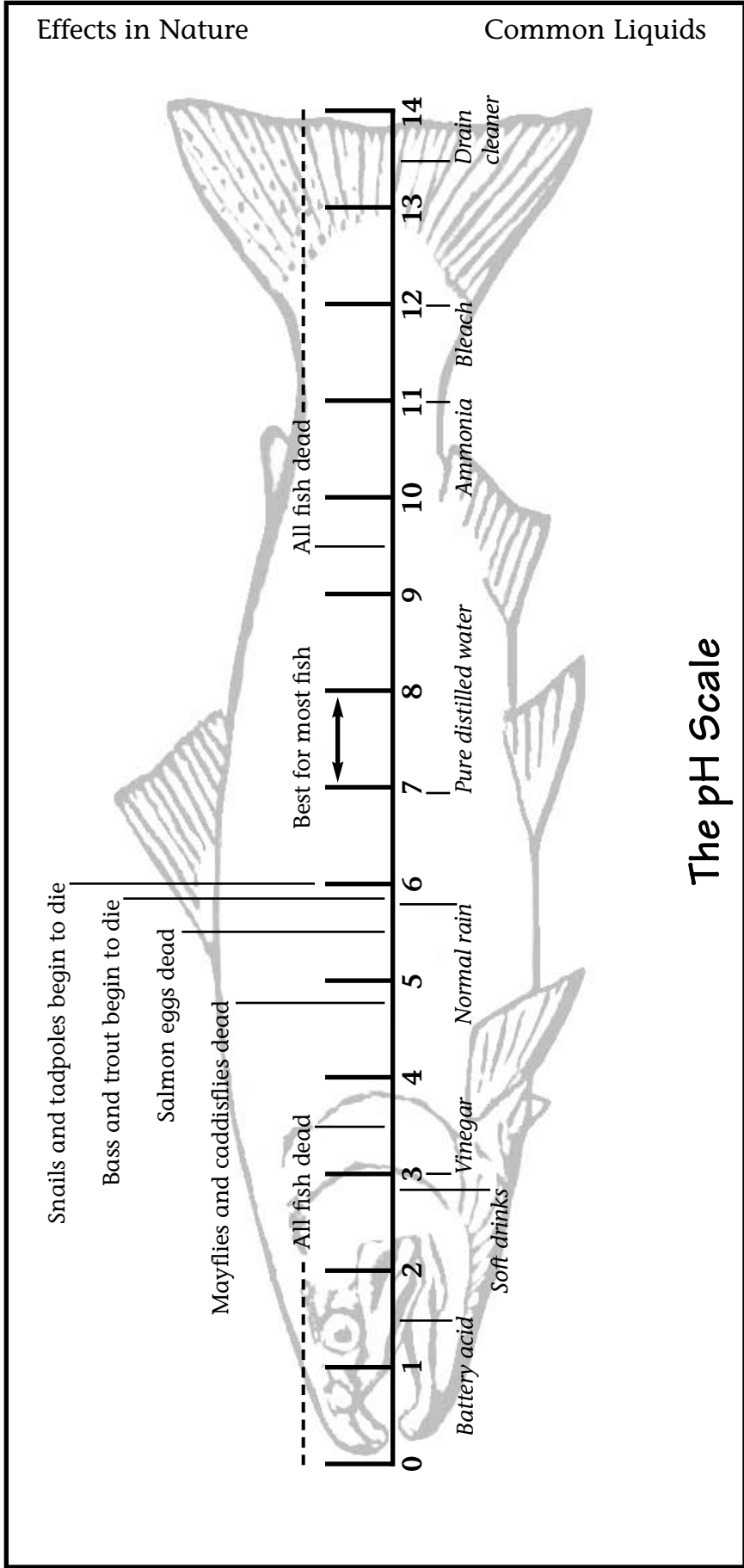


Teacher Master

Water Test	Dissolved Oxygen	pH	Temperature
What It Measures	<i>Amount of oxygen in the water</i>	<i>Acid/base of the water</i>	<i>Average amount of heat in the water</i>
Precautions When Performing Tests	<i>Do not touch the tablets. When test is completed, do not pour the water into the creek.</i>	<i>Avoid unnecessary handling of the pH strips. Match colors carefully when using the pH key.</i>	<i>Handle thermometer carefully. Keep thermometer in for full length of time.</i>
Natural Reading	<i>7–14 ppm (parts per million)</i>	<i>Generally 6.5–8.5 (Bogs are naturally acidic, can be as low as 4.2)</i>	<i>Varies</i>
Danger Reading	<i>3–5 = stress 1–2 = poor 0 = anoxic</i>	<i>Below 6.5, above 8.5</i>	<i>Generally above 81 degrees Fahrenheit</i>
Possible Source	<i>Low wind Low waves Running water</i>	<i>Acid rain Industrial pollution Chemical spills</i>	<i>Waste heat Solar heat</i>
Remedies	<i>Control nutrient content Control algae growth More wind/water movement</i>	<i>Pollution controls</i>	<i>Cooling towers (decreased temperature will increase dissolved oxygen)</i>



Teacher Master



The pH Scale

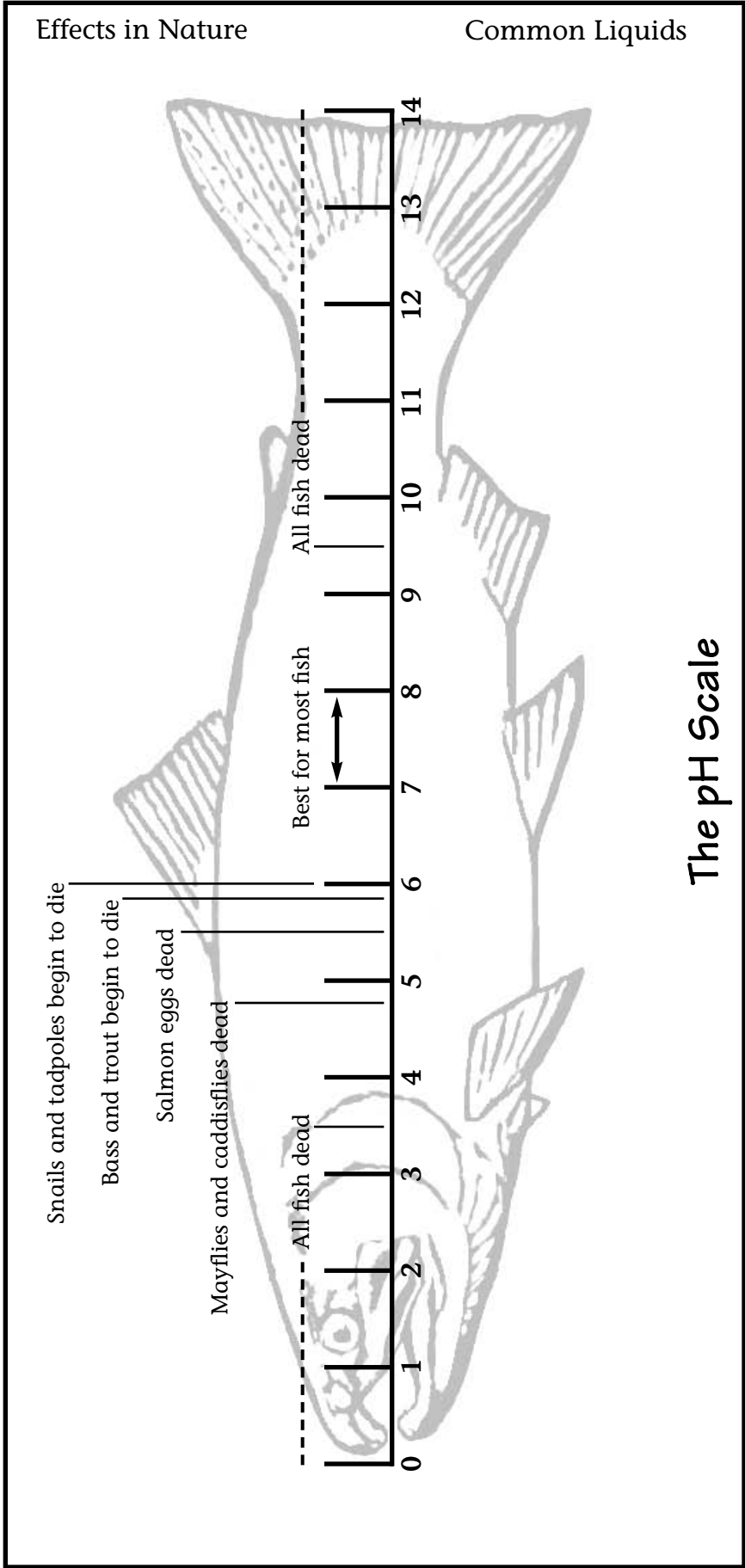
Water Data Analysis Information



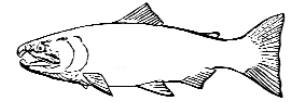
Field Journal Sheet

Water Test	Dissolved Oxygen	pH	Temperature
What It Measures			
Precautions When Performing Tests			
Natural Reading			
Danger Reading			
Possible Source			
Remedies			

Field Journal Sheet



Who Is in the Aquatic Food Pyramid and What Is Their Relationship to the Health of an Ecosystem?



Students explore aquatic ecosystem health by building an aquatic food pyramid and creating aquatic insect field guides.

Time required: 2–hours

Location: classroom/homework

Suggested group size: entire class, individually and/or in teams

Subject(s): aquatic ecology, life science, ecosystems

Concept(s) covered: habitat requirements, life cycles, creek ecology

Written by: Tricia Corsetti, Tomales Middle School

Last updated: 03/09/00

Student Outcomes

At the end of this activity, the students will be able to:

- Determine an aquatic food pyramid based on aquatic insect research.
- Create aquatic insect field guides used to monitor water quality.
- Understand aquatic insects are indicators of water quality and parts of various food chains.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade: 5a- food webs;

5b- organisms and the physical environment;

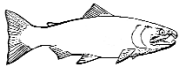
5e- resources available and abiotic factors.

7th grade: 7b- utilize a variety of print and electronic resources.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Think critically and logically to make the relationship between evidence and explanations.



- Content Standard C – Structure and function of living systems; population and ecosystems; regulation and behavior.
- Content Standard F – Populations, resources, and environments.
- Content Standard G – Science as a human endeavor.

Materials

To be photocopied from this guide:

- **Aquatic Organism Field Guide** activity sheet
- **Aquatic Food Pyramid** activity sheet

Vocabulary

Generated by student inquiry

Procedures

1. **Begin a discussion of aquatic food systems**

Brainstorm a list of components included in an aquatic habitat. Remember, many insects begin life in an aquatic environment.

2. **Distribute activity sheets**

Each student should receive both activity sheets.

3. **Independent work**

Students (or student teams) will be assigned or choose an insect (or other aquatic organism) from the list at the end of this lesson. It is their responsibility to complete **Aquatic Organism Field Guide** activity sheet for their species and to supply a picture or drawing.

4. **Create food webs**

Using the blackboard (or large sheets of butcher paper), have all students, one at a time, place their food webs (from activity sheets) on the blackboard. If a representative of their food web is already listed on the board, they should incorporate their food web with that organism.

5. **Create food pyramid**

Let the entire class examine the food web. What would be the base of the food pyramid? What would be at the top? How does the sun's energy flow through an ecosystem? Discuss the role of producers, consumers, scavengers, and decomposers. Complete an **Aquatic Food Pyramid** activity sheet, or draw on blackboard.

6. **Processing questions**

How can a food pyramid be used to determine the health of an aquatic ecosystem? What would happen if organisms at the base went extinct as opposed to organisms at the top? Which species could potentially have the greatest positive or negative impact on this food pyramid? Define the components of this ecosystem and discuss humans' role in aquatic ecosystems.



7. Aquatic insects are long-term quality monitors

In a random collection of aquatic insects, some are tolerant of pollution while others are very sensitive. A stream with very few sensitive aquatic insects is probably not very healthy.

8. Water quality tests vs. aquatic insect surveys

What can each tell you about the health of a creek? Water quality tests will tell you about the water in that second of time. Variables can be thrown off very quickly if you test a sample that includes storm runoff from an area where someone has just washed a car. Aquatic insect surveys are indicators of long-term health. But aquatic insect surveys can be inconclusive if done at the time of the year those insects are never present (in terms of their life cycle). Each of these tests provides us with different information and complements the other. Both types of tests will be conducted on the upcoming field visit to Point Reyes National Seashore.

9. Create aquatic insect field guide

A field guide may be created in many forms. Following are some suggestions:

Collect all of the **Aquatic Insect Organism Field Guide** sheets. Assemble in a binder to be brought on the field visit. Full-sized activity sheets can be used or smaller copies laminated.

Break the class into four groups (the groups they will work with on the field trip). Each group receives a copy of all **Aquatic Insect Field Guide** sheets. It is up to each group to produce a field guide. Some students may scan sheets into computer and use a layout program to create a guide; some may choose to replace drawings with pictures from other sources. Remind students that what they are designing will be used on their field trip. Creativity and functionality are their guideline.

(continued)



Aquatic Species

Aquatic Insects

Alderfly (nymph, adult)
Amphipod
Backswimmer
Black fly (larvae*, adult)
Caddisfly (larvae*, adult)
Crane fly (nymph, adult)
Damsel fly (larvae, adult)
Dragonfly (larvae, adult)
Hellgrammite
Mayfly nymph*
Midge larvae*
Mosquito (larvae, adult)
Riffle beetle*
Stonefly (nymph, adult)
Water penny larvae*
Water strider*
Water beetle (larvae*, adult)
Waterboatman

Other Aquatic Organisms

Aquatic worms*
Gilled snails
Leeches
Pouch snails
Watersnail eggs
Crayfish
Sculpin
Roach fish
Lampreys
Suckers

* indicates common occurrence

Extension ideas

1. Visit "The Stream Study" website (listed in the Resources section) to use an online key for identifying and learning about aquatic insects.
2. Discuss the water cycle and the sun's role as a major source of energy.

Name _____ Date _____



Aquatic Organism Field Guide

Activity Sheet

Name of your organism _____

What eats your organism? _____

What does your organism eat? _____

Use the information above to draw a food chain

What are three characteristics of this organism that may differentiate it from other organisms?

1. _____

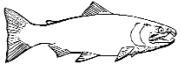
2. _____

3. _____

Where is it found (calm areas, under rocks, etc)? Is it found year-round?

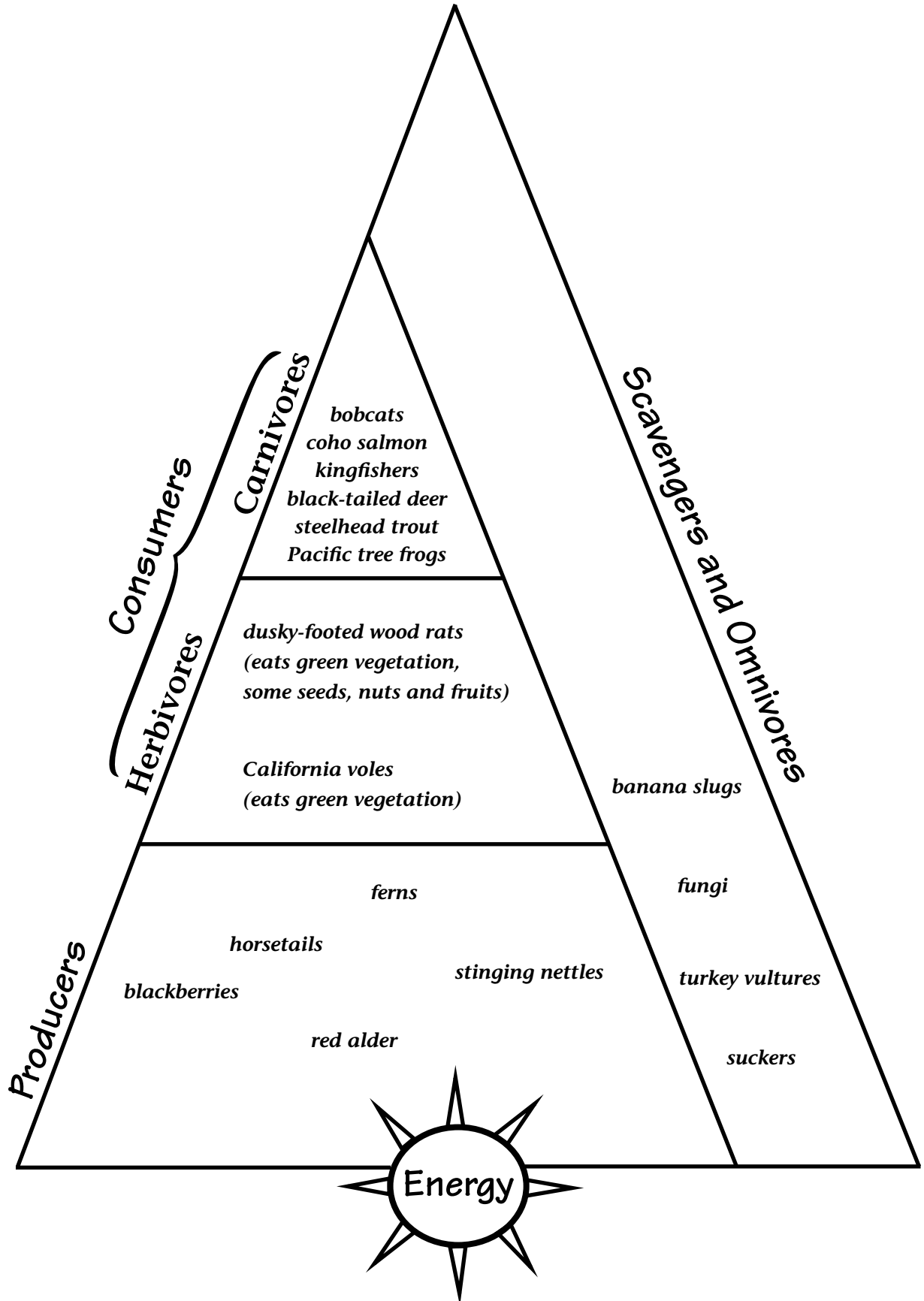
Provide or create an illustration. It will need to be detailed enough to identify actual specimens in the field.



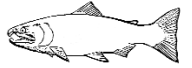


Aquatic Food Pyramid

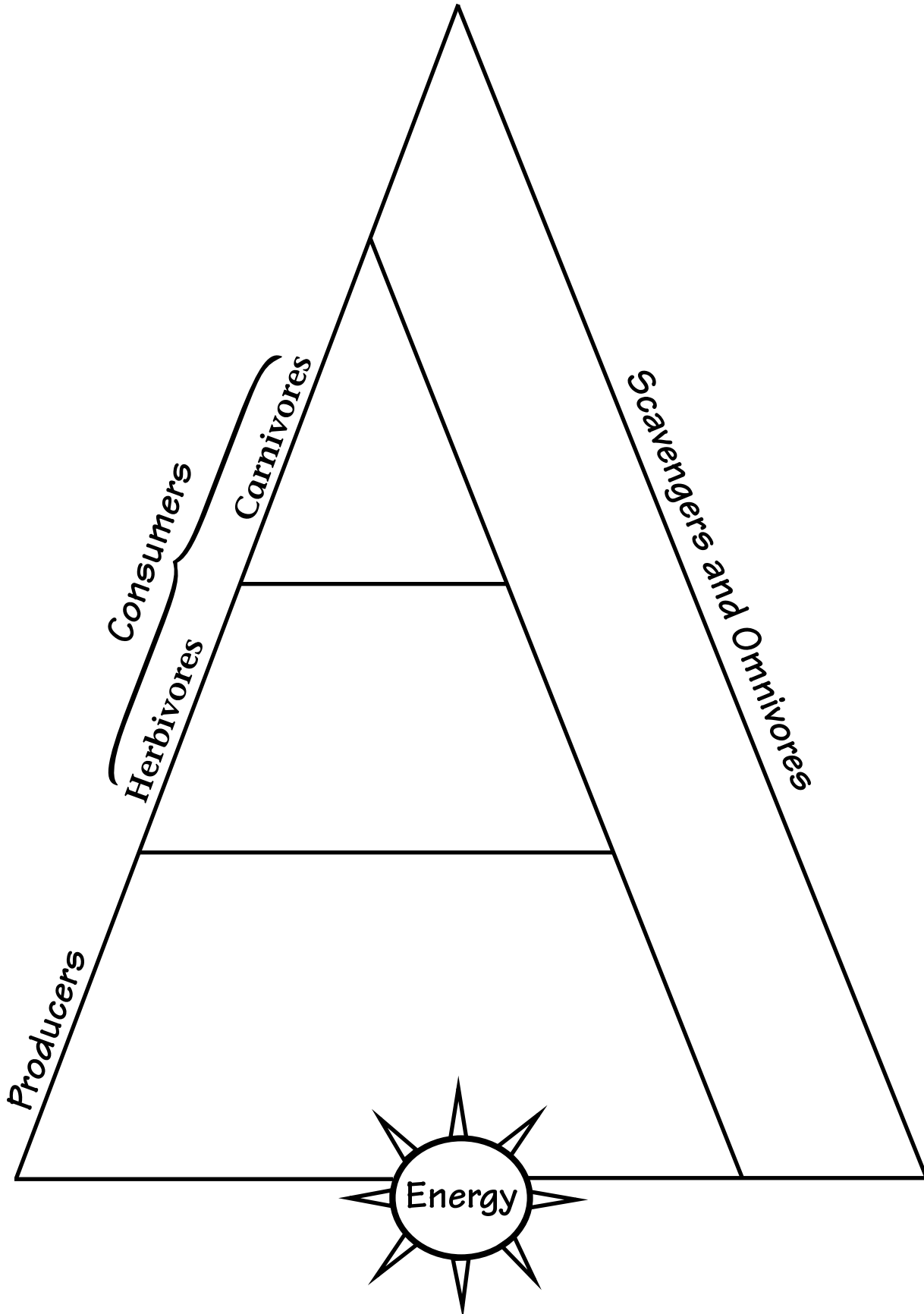
Teacher Preparation



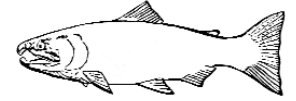
Aquatic Food Pyramid



Activity Sheet



What Can We Expect on Our Field Trip to the Creeks of Point Reyes?



Students prepare for upcoming field visit by constructing and reviewing field journal sheets.

Time required: 1-hour

Location: classroom

Suggested group size: all students

Subject(s): science, math, language arts, and art

Concept(s) covered: water quality testing, creek ecology, and salmonid identification

Written by: Tricia Corsetti, Tomales Middle School

Last updated: 03/05/00

Student Outcomes

At the end of this activity, the students will be able to:

- Use field journals in conjunction with a creek visit.

California Science Standard Links (grades 6-8)

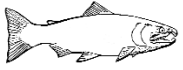
This activity is linked to the California Science Standards in the following areas:

- 6th grade: 7b- appropriate tools and technology to perform tests, collect data, and display data;
- 7h- identify changes in natural phenomena over time.
- 7th grade: 7a- appropriate tools and technology to perform tests, collect data, and display data;
- 7c- communicate logical connections.
- 8th grade: 9b- evaluate the accuracy and reproducibility of data.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Use appropriate tools and techniques to gather, analyze, and interpret data; understanding about scientific inquiry.
- Content Standard G – Science as a human endeavor; nature of science: students formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models.



Materials

To be provided by the teacher:

- Colored paper, pens, binding materials, graph paper and laminated covers

To be photocopied from this guide:

- **Field Journal Sheets** for each student and chaperone

Vocabulary

anadromous fish, aquatic insects, creek ecology, salmonids, stewardship

Procedures

1. Construct field journals

Distribute photocopies of **Field Journal Sheets** for the students to assemble and personalize. Refer to **Tips for Constructing Field Journals** following this lesson.

REMINDER: students should include **Water Data Analysis Information** and **The pH Scale** activity sheets in their journals (from **What Can We Learn about Water?** pre-visit lesson).

Also, if students created **Aquatic Insect ID Cards** (from **Who is in the Aquatic Food Pyramid** pre-visit lesson) these should become a part of the journal or a separate field guide to be brought on field trip.

2. Review field journals

Once journals are completed, review field activities by having students turn to appropriate pages in their journals as you review expectations. Students should also record their names and school name at the bottom of each journal sheet.

- **Things to remember**

This sheet will be used following the next lesson **Safety and Stewardship Challenge**.

- **Site information**

Students will record information relevant to their particular creek visit.

- **Creek observations**

These questions will facilitate observations prior to drawing a creek map.

- **Creek map**

Students will draw a bird's-eye view of their creek section.

- **Tests on water samples**

Students will record temperature, pH, and dissolved oxygen of two water samples.

- **Creek testing**

Water clarity and velocity will be determined and recorded.

- **Aquatic insect survey**

Students will identify and count the numbers of individual aquatic insects found in the creek.



- **Field journal summary**

Students will draw conclusions about the creeks' suitability for salmon habitat based on their field measurements.

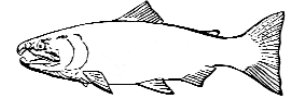
3. Field trip preparation

Review the list of what students should bring with them on the field trip.

Extension ideas

1. Preview the website, www.mywatershed.org, for testing results collected by other school groups in Marin County.
2. Research the role of fish biologists and creek ecology specialists. What organizations currently work to protect creek/stream habitats for anadromous fish?
3. Compare a rural creek's water quality with an urban creek. Discuss the similarities/differences.

Tips for Creating Field Journals



Journal Tips

Materials

- Field Journal Sheets** for each student, teacher and chaperone
- One package blank paper and one package lined paper
- colored paper, card stock, or cardboard for journal covers
- magic markers or colored pencils for decorating covers
- 3-hole punch
- string, binding tape, or twigs and rubber bands for binding
- pencil on a string for each student
- two plastic pencil sharpeners and extra pencils for field trip
- one box of large ziplock bags to rainproof journals

Procedures

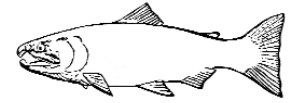
1. Photocopy all of the unit handouts and provide each student with double-sided copies. Use recycled paper if it is available.
2. Provide five additional blank sheets of paper and five lined sheets of paper to each student.
3. Have students create front and back covers for their journals using blank sheets of paper.
4. Have students bind their journals using binding tape, hole punches and string, cardboard, or twigs bound by rubber bands threaded through holes. If they do not bind their journals, it is essential that students use a clipboard on the field trip.
5. Once journals are bound, have them decorate the covers.
6. Have each student attach a sharpened pencil on a long string through a hole in the journal binding.
7. Have students use magic markers to write their names on the front covers of their journals.
8. Students will need a sturdy writing surface behind their field journals. Incorporate cardboard as the last page or have clipboards available for each student.

Extension ideas

1. Create a journal that is used throughout the year.
2. Share student journals with parents at open houses and/or to educate others.
3. Students may choose to use their journals to create a class newsletter, resource newspaper, or a class website.

Safety and Stewardship Challenge

Students learn methods for conducting observations in and near a creek, and understand proper behaviors in a National Park. This will be accomplished by simulating a class “game show” and completing the first page of their field journals.



Pre-Visit Lesson Plan

Time required: 1–hour
(depending on predetermined limits)

Location: classroom

Suggested group size: any

Subject(s): science

Concept(s) covered: low impact use of natural areas, visitor behaviors in a National Park, safety

Written by: Christie Denzel Anastasia and Lynne Dominy,
National Park Service

Last updated: 05/20/00

Student Outcomes

At the end of this activity, the students will be able to:

- List three safety precautions for upcoming field trip.
- Understand concepts of National Park System and stewardship.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard F – Personal health; Injury prevention; Populations, resources, and environment.

Materials

To be provided by the teacher:

- Desk bell (or other device to indicate which team can answer question first)

To be photocopied from this guide:

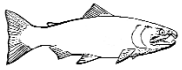
- Game Show Questions labeled **Safety and Stewardship Challenge Questions** (one set)

Vocabulary

stewardship

Creating
**COASTAL
STEWARDSHIP**
through Science





Procedures

1. Divide class into teams

Option A: If class can work as large teams, divide the class into two teams. Each team will need a spokesperson and team name. Answers will come from the entire group. Spokesperson can change throughout the game.

Option B: If class may get too loud, students can still be divided into teams, but answers will come from individuals on each team. One person from each team will be assigned a number. Team A and Team B will each have a #1, #2, etc. Randomly choose a number from hat. The student with that specific number from each team will be responsible for answering the question. Random choice of numbers will help students pay attention if they aren't quite sure when their turn will occur.

2. Draw challenge grid and scorecard on blackboard

There are four categories with questions of varying value. As a finale, there is a final challenge question. Draw this grid on the chalkboard:

Safety and Stewardship Challenge			
Category #1 Take Care of Yourself	Category #2 Minimize Your Impact	Category #3 Creek Etiquette	Category #4 The National Park Service
1 point	1 point	1 point	1 point
2 points	2 points	2 points	2 points
3 points		3 points	
4 points	3 points	4 points	3 points
		5 points	
Final Challenge			

3. Choose game show hosts

Option A: Teacher is responsible for asking all of the questions.

Option B: Four students will become "Challenge Hosts". Each student receives questions for a specific category and will ask appropriate questions according to point value.



4. Rules of the game

- A coin flip will determine which team goes first.
- The game will end when a predetermined time runs out or when all questions have been answered.
- Team will decide which category and value of question will be asked.
- Spokespersons or individuals will poise themselves on either side of the desk bell with one hand behind their backs.
- After the question is asked, the first team to have an answer will ring the bell and respond. If it is correct, the team receives the full point value.
- If it is incorrect, the other team gets a chance. If the second team also gets it wrong, the first team can try again for one less point.
- When brainstorming answers, students should whisper, or the other team may hear their answer.
- When all of the categories are complete (or five minutes before a predetermined “game over” time), class will go into “Final Challenge”. Each team decides on amount of wager, listens to question and writes down answer on a sheet of paper. Each team reveals answer.
- At the end of the game, the team with the most points “wins”, but everyone wins if your visit to Point Reyes National Seashore is safe for themselves and the resources.

5. Complete first page of field journal

Using the information gained in this “game show”, have students list at least three items under each category on the first page of their journals (“Things to Remember While on Field Trip”). Use the **Safety Issues: Creek Health Unit** at the end of this lesson as a guide.



Safety and Stewardship Challenge Questions

CATEGORY #1: Take Care of Yourself

1 point

Bring a water bottle and drink plenty of water because ...

- A ...you will not be able to speak well with a dry throat.
- B ...not drinking enough water can give you a headache and cause you to make bad decisions.**
- C ...a heavy water bottle will slow you down as you are walking.
- D All of the above

2 points

If the sun feels warm, you should ...

- A ...try to get a tan.
- B ...use sunglasses, sunscreen, and/or a hat.**
- C ...take off your shoes and walk barefoot.
- D All of the above

3 points

Cliff edges in Point Reyes National Seashore are ...

- A ...made of granite and are safe as long as you have one foot flat on the ground at all times.
- B ...sandy, loose, and slippery; be careful at all times.**
- C ...safe if you have good balance.
- D ...the best places for a good view.

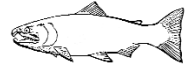
4 points

The best way to dress for a field trip:

- A Comfortable close-toed shoes.
- B A t-shirt and a heavy, waterproof jacket.
- C "Like an onion", many thin layers with a waterproof one on the outside.
- D A and C**



Safety and Stewardship Challenge Questions



CATEGORY #2: Minimize Your Impact

1 point

When visiting Point Reyes National Seashore, you should stay on trails because...

- A ...you are more likely to pick up a tick in grassy areas.
- B ...when you travel off-trail you can damage plants.
- C ...you are speeding up erosion.
- D All of the above

2 points

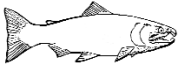
It's okay to take home just one rock from Point Reyes National Seashore...

- A Sure, it's just one, but let your teacher know.
- B No, every rock is home to many bugs and plants.
- C No, with 2.5 million visitors, the Seashore would be rock-less if every visitor collected just one.
- D B and C

3 points

Trash is...

- A ...okay to hide behind bushes in a National Park because it will eventually break down.
- B ...not a good source of food for hungry animals.
- C ...not a part of the Point Reyes National Seashore ecosystem and should be properly disposed of whether it's your trash, or trash that someone else accidentally left behind.
- D ...only the responsibility of the maintenance staff, wherever it is.



Safety and Stewardship Challenge Questions

CATEGORY #3: Creek Etiquette

1 point

When you're collecting water samples, you should ...

- A ...take a swim in the creek.
- B ...find the deepest part of the creek and wade in by yourself.
- C ...practice low-impact behavior, by carefully walking out into a shallow section of the creek to collect a sample.
- D ...have your whole group wade out into the creek and splash around.

2 points

Stay at least ...

- A ...2 feet from the creek's edge.
- B ...100 feet from the creek's edge.
- C ...20 feet from the creek's edge.
- D Get as wet and muddy as you want.

3 points

The best way to observe coho salmon in the creek is to:

- A Stand quietly on the creek's edge, looking for movement in the stream.
- B Move slowly and try not to cast shadows on the water's surface.
- C Whisper.
- D All of the above

4 points

Walking near the creek is ...

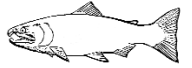
- A ...very slippery because of water and algae growing on rocks.
- B ...solid footing because of sticky mud.
- C ...safe because there isn't usually a long distance to fall.
- D ...the same as walking on a sidewalk.

5 points

Disturbing plant life near creeks will ...

- A ...do nothing, there are plenty of plants.
- B ...disturb some of the natural processes occurring.
- C ...always kill the plant you disturb.
- D ...keep animals from wanting to eat a plant with human scent.

Safety and Stewardship Challenge Questions



Teacher Master

CATEGORY #4: The National Park Service

1 point

Which of the following is not in the National Park Service?

- A Grand Canyon National Park, AZ
- B Keweenaw National Historical Park, MI
- C **Monterey Bay Aquarium, CA**
- D Golden Gate National Recreation Area, CA
- E Yosemite National Park, CA

2 points

I should treat Point Reyes National Seashore with respect because ...

- A ... it belongs to everyone in the entire United States.
- B ... it preserves a part of the ecosystem you live in and depend on.
- C ... it's one of the few places natural processes can happen with little intervention from human society.
- D **All of the above**

3 points

Which of the following is the mission of the National Park Service?

- A Preserve natural and cultural resources.
- B Provide for the enjoyment, education, and inspiration of this generation.
- C To care for special places saved by the American people so that all may experience our heritage.
- D Cooperate with other resource-conservation and outdoor-recreation organizations in our country and the world.
- E **All of the above**

Bonus for one additional point:

Is the mission of the National Park Service a law? Yes / No

FINAL CHALLENGE

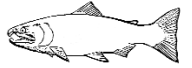
This question is worth the amount that each team agrees to wager.

What does stewardship mean?

Teacher is the final judge on this answer.



Safety Issues: Creek Unit



Personal Safety

- Watch where you are walking; the ground may be rocky and uneven.
- Stay with your group.
- Drink plenty of water to avoid dehydration.
- Protect yourself from the sun's rays; use sunscreen and/or a hat.
- Stay on paths and in picnic area. Grassy areas may have ticks known to transmit Lyme disease.
- Be aware of personal allergies or conditions that may cause concern on the trail.

Creek Survey Tips

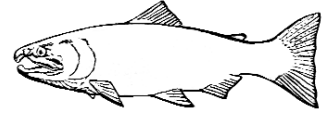
- If rocks are overturned during aquatic insect survey, they should be gently returned to their original location.
- Rocks may have slippery algae growing on them; be careful of your footing in the creek.
- Watch out for stinging nettle and poison oak!
- Throwing rocks into the creek is tempting, but not appropriate.
- Leave no trace of your visit.

Remember... You are in a part of the National Park System

- Point Reyes National Seashore is a natural area set aside to protect living and nonliving components of an ecosystem. Treat everything with respect.
- Allow plants and rocks and everything to continue their existence as part of an ecosystem by leaving things as they are found.
- Stay on established trails.
- Pack out trash or use garbage cans.
- Enjoy your visit and know this is your National Seashore!



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through Science



Monitoring Creek Health

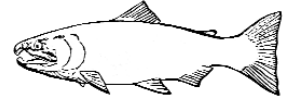
On-Site Activities

How Healthy Is This Creek? 79

Field Journal Sheets 81

How Healthy Is This Creek?

Students conduct water quality tests and record observations in their field journals. The Park Ranger leading this visit will also discuss implications between water quality and healthy coho salmon and steelhead trout populations.



On-site Lesson Plan

Time required: 2 – hours

Location: Point Reyes National Seashore

Suggested group size: limit of 32, discuss with Education Coordinator when making reservations

Subject(s): aquatic ecology, chemistry, biology

Concept(s) covered: riparian zone, ecology, water quality

Written by: Christie Denzel Anastasia, Lynne Dominy, and Melinda Repko, National Park Service

Last updated: 07/02/00

Student Outcomes

At the end of this activity, the students will be able to:

- Investigate a riparian zone and record results of experiments and observations in their field journals.
- Understand the significance of habitat monitoring through discussion.
- Promote behaviors conducive toward healthy creek habitats in and outside of Point Reyes National Seashore.

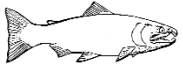
California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

- 6th grade: 5e- resources available and abiotic factors;
7b- appropriate tools and technology to perform tests, collect data, and display data;
7d- communicate steps and results from an investigation;
7e- evidence is consistent with a proposed explanation;
7h- identify changes in natural phenomena over time.
- 7th grade: 7a- appropriate tools and technology to perform tests, collect data, and display data;
7c- communicate logical connections;
7e- communicate steps and results from an investigation.
- 8th grade: 1b- average speed is the total distance traveled divided by the total time elapsed.

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through Science





National Science Standard Links (grades 5-8)

This activity is linked to the national science standards in the following areas:

- Content Standard A – Abilities necessary to do scientific inquiry, design and conduct a scientific investigation; use appropriate tools and techniques to gather, analyze, and interpret data; think critically and logically to make the relationships between evidence and explanations.
- Content Standard C – Diversity and adaptation of organisms.
- Content Standard F – Populations, resources, and environments.

Materials

To be provided by the teacher:

- Constructed field journals, one for each student and chaperone.

Vocabulary

none

Procedures

1. Reservations

You must make reservations for this Ranger-led field visit. Locate the reservation form in the “Teachers Preparation” section of Monitoring Creek Health.

2. Expectations

Teacher

- Make reservations and receive confirmation form.
- Enlist chaperones for a 1:5 adult/student ratio.
- Insure that each chaperone and students have their own field journal for the day of the visit.
- Assume responsibility for discipline issues which may arise and detract from group’s experience.

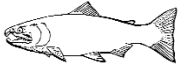
Chaperones

- Each chaperone will be responsible for a team of students and for a Creek Monitoring Kit to assist students collecting data.

Ranger

- Facilitate each chaperone-led student group with creek monitoring activities.
- Reserve Creek Monitoring Kits.

Things to Remember While on Creek Field Trip

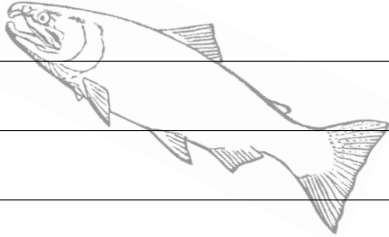


THREE SAFETY PRECAUTIONS:

- 1. _____

- 2. _____

- 3. _____



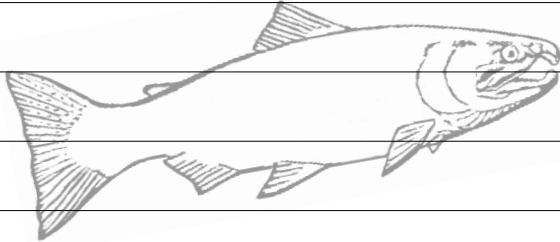
FOUR RESOURCE PROTECTION BEHAVIORS:

- 1. _____

- 2. _____

- 3. _____

- 4. _____

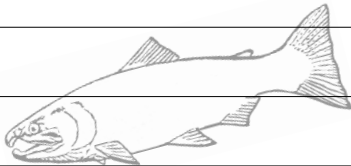


THREE THINGS TO KEEP IN MIND WHEN VISITING ANY PART OF THE NATIONAL PARK SYSTEM:

- 1. _____

- 2. _____

- 3. _____





Field Journal Sheet

Site Information

Date:	
Other students in your group:	
Location:	State: County: Town:
Name of creek:	
Weather:	<input type="checkbox"/> clear <input type="checkbox"/> cloudy <input type="checkbox"/> rainy
Season:	<input type="checkbox"/> winter <input type="checkbox"/> spring <input type="checkbox"/> summer <input type="checkbox"/> fall
Creek appearance:	<input type="checkbox"/> clear <input type="checkbox"/> oily sheen <input type="checkbox"/> silty <input type="checkbox"/> muddy <input type="checkbox"/> foamy
Animal tracks: Sketch the tracks you see, or list the animals that created these tracks.	



Creek Observations

VEGETATION

Terrestrial:

- _____ % Trees
- _____ % Shrubs
- _____ % Plants
- _____ % Grasses

Aquatic:

- _____ % Plants
- _____ % Grasses
- _____ % Ferns
- _____ % Algae

GEOLOGY

Terrestrial:

- sandy
- dirt
- rocky
- boulders

Aquatic:

- sand
- small gravel
- large gravel
- boulders

HUMAN INFLUENCE AND EFFECTS

List one clue that tells you someone was here recently:

List one clue that tells you someone was here 50 years ago:

Land use in this watershed:

- buildings
- logging
- crops
- fields
- recreation
- livestock pasture
- dams
- culverts

SMELLS AND SOUNDS

Describe three smells and sounds at this location:



Creek Map

Field Journal Sheet

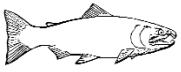
Your Rope



Field Journal Sheet

Tests on Water Samples		
	Creek Edge	Mid-creek
Temperature	Fahrenheit or Celsius	Fahrenheit or Celsius
pH		
Dissolved Oxygen	parts per million	parts per million

Creek Testing			
Channel Width			
Water Depth	right	center	left
Length of Rope (5-10 feet)			
Float Method to Determine Velocity time to travel distance:	right	center	left



Aquatic Insect Survey

Aquatic Insect Survey		
<i>Tolerate Pollution</i>	<i>Tolerate Some Pollution</i>	<i>Do not Tolerate Pollution</i>
<input type="checkbox"/> Aquatic worms	<input type="checkbox"/> Amphipod/scud	<input type="checkbox"/> Alderfly adult
<input type="checkbox"/> Black fly adult	<input type="checkbox"/> Backswimmer	<input type="checkbox"/> Alderfly nymph
<input type="checkbox"/> Black fly larvae	<input type="checkbox"/> Crane fly adult	<input type="checkbox"/> Caddisfly adult
<input type="checkbox"/> Leeches	<input type="checkbox"/> Crane fly nymph	<input type="checkbox"/> Caddisfly larvae
<input type="checkbox"/> Midge larvae	<input type="checkbox"/> Damselfly adult	<input type="checkbox"/> Gilled snails
<input type="checkbox"/> Mosquito adult	<input type="checkbox"/> Damselfly larvae	<input type="checkbox"/> Hellgrammite
<input type="checkbox"/> Mosquito larvae	<input type="checkbox"/> Dragonfly adult	<input type="checkbox"/> Mayfly nymph
<input type="checkbox"/> Pouch snails	<input type="checkbox"/> Dragonfly adult	<input type="checkbox"/> Riffle beetle adult
<input type="checkbox"/> Watersnail eggs	<input type="checkbox"/> Dragonfly larvae	<input type="checkbox"/> Stonefly adult
	<input type="checkbox"/> Water beetle adult	<input type="checkbox"/> Stonefly nymph
	<input type="checkbox"/> Water beetle larvae	<input type="checkbox"/> Water penny larvae
	<input type="checkbox"/> Water strider	
	<input type="checkbox"/> Waterboatman	
Summary		
How many insects did you find that TOLERATE pollution?	How many insects did you find that TOLERATE SOME pollution?	How many insects did you find that DO NOT TOLERATE pollution?



Field Journal Summary

TEMPERATURE (C)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Record your temperature readings on the line above. Higher temperatures will decrease the amount of dissolved oxygen available to aquatic organisms and decrease the rate of photosynthesis by aquatic vegetation. Salmon need cool water in the 10–13 degree Celsius range (50–57 degree Fahrenheit).

pH

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Record your pH readings on the line above. A pH ratings of 6 and below or 9 and above is a “poor” rating because it limits life in most streams. A pH rating of 6–8 would be an “excellent” rating because most life forms survive best in neutral conditions.

DISSOLVED OXYGEN

1 2 3 4 5 6 7 8

5–6 parts per million: required for most fish
Below 3 parts per million: stressful to most aquatic organisms
Below 2 parts per million: fatal to most species
Below 1 part per million: will not support fish

AQUATIC INSECT SURVEY

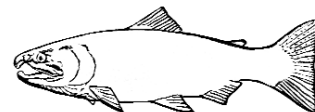
In which category did you find the most aquatic insects?

- those that tolerate pollution.
- those that tolerate some pollution.
- those that do not tolerate pollution.

Healthy streams with high water quality will contain many different kinds of aquatic insects and more pollution sensitive types.



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Monitoring Creek Health

Post-Visit Activities

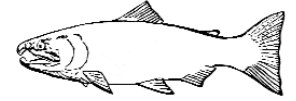
What Can We Learn from Our Field Journals? 89

What Is Your Role in Preserving Our Watershed? 99

How Can We Compare and Share Our Creek Data? 103

How Can We Choose and Complete the Best
Stewardship Project? 107

What Can We Learn from Our Field Journals?



Post-Visit

Lesson Plan

Students compile data from their field journals to evaluate the suitability for coho salmon and/or steelhead trout habitat. Class presentations by each team will recreate the entire creek in class.

Time required: 2–hours

Location: classroom

Suggested Group size: all students

Subject(s): science, math, language arts, and art

Concept(s) covered: water quality testing, creek ecology

Adapted from: Izaak Walton League of America
Aquatic Insect Survey

Written by: Tricia Corsetti, Tomales Elementary
Christie Denzel Anastasia, National Park Service

Last updated: 03/05/00

Student Outcomes

At the end of this activity, the students will be able to:

- Understand how scientists evaluate fieldwork results and tests.
- Discuss factors and conditions which influence various results and observations.
- Compare and contrast field-test results and observations.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

- 6th grade: 7b- appropriate tools and technology to perform tests, collect data, and display data;
7c- conduct qualitative statements about the relationships between variables;
7d- communicate steps and results from an investigation
7e- evidence is consistent with a proposed explanation.
- 7th grade: 7a- appropriate tools and technology to perform tests, collect data, and display data;
7c- communicate logical connections.
- 8th grade: 1b- average speed;
9b- evaluate the accuracy and reproducibility of data.

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National Science Standard Links (grades 5-8)

This activity is linked to the national science standards in the following areas:

- Content Standard A– Use appropriate tools and techniques to gather, analyze, and interpret data; think critically and logically to make the relationship between evidence and explanations; recognize and analyze alternative explanations and predictions; communicate scientific procedures and explanations; use mathematics in all aspects of scientific inquiry; understandings about science and technology.
- Content Standard G– Science as a human endeavor

Materials

To be photocopied by teacher:

- **Field Results Analysis** activity sheets, one set per team
- **Pre- and Post-evaluation** activity sheets (see procedure #4 in this lesson)

To be provided by the teacher:

- Colored paper, chart paper, pens, and graph paper
- One calculator per team

Vocabulary

Generated by student inquiry

Procedures

1. Hand out activity sheets

Allow students to re-form groups from field visit. Their assignment is to work as a team to complete activity sheets and prepare for a class presentation. Have available large sheets of paper, drawing supplies and calculators. Each team will need at least two large pieces of paper, one for a creek drawing and one for data.

2. Class presentations

Each will have about five to ten minutes for their class presentation. The first group to present will tape its creek map to a wall or blackboard and its large data sheet directly above it. The next presentation will be a group that worked directly left or right of them in the field. Their map will be taped directly next to the first map. This will provide an actual recreation of the creek in the classroom. Students should spend a couple of minutes sharing their data and drawings with the class.

3. Class discussion

Once all of the groups have recreated the creek in class, compare and contrast their findings to determine if this creek could potentially be a healthy habitat for coho salmon and/or steelhead trout based on their data observations.



Examples of discussion questions:

- If the pH readings were relatively different along creek sections, what might account for this?
- How can stream temperature increase as a result of logging next to streams? How does increased temperature affect coho salmon or steelhead trout?
- Will stream velocity, weather, or time of day cause dissolved oxygen and temperature readings to fluctuate? How?
- Is the creek a healthy habitat for coho salmon and steelhead trout based on your data observations (absence of barriers for the upstream migration of adults, sediment/fine gravel for rearing young)?

4. Pre- and Post-evaluation

If you saved the **Pre-** and **Post-evaluation** activity sheets from the first pre-visit lesson, redistribute them to the original students. Explain that students may change their answers based on what they have learned in class and on their field trip. If you choose this option, have students write in a different color pen or pencil with the date written in that color.

If you did not choose to save the original activity sheets, make copies for each student of the **Pre-** and **Post-evaluation** (located in the first pre-visit activity: “How Can We Learn More about the Coho Salmon and Steelhead Trout?”). We would like to see the results of these evaluations! Please consider mailing completed Pre- and Post-evaluation activity sheets back to Point Reyes National Seashore. We would like to measure the success of your use of this curriculum in changing knowledge, skills and abilities.

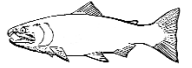
Mail to: National Park Service
Point Reyes National Seashore
Division of Interpretation
attn: Education Specialist
Point Reyes Station, CA 94956

Extension ideas

1. Access the web site, www.mywatershed.org, for testing results collected by other school groups in Marin County. Ask for a few student volunteers to update the class information on this website and to share other results with the class.
2. Formalize the results as a Scientific Paper. Include title, abstract, introduction, methods, results, discussion, acknowledgments, and references.
3. Continue to survey your creek once every month. Evaluate the results at the end of the year.
4. Survey a creek in your local area. Compare those results with your results from Point Reyes National Seashore.



Name _____ Date _____



Field Results Analysis

Working as a team, you will present your section of the creek to other teams in your class.

Use this activity sheet to create a “Summary Sheet” from field data and a “Creek Map” drawing to be used as visual aids in your presentation.

Activity Sheet

Directions for Summary Sheet

Create a “Summary Sheet” listing the most relevant and interesting information that your entire team was able to collect on your section of the creek. Complete these activity sheets and transfer this information to a large sheet of paper provided by your teacher.

- **Site information**

What was the most interesting or important information recorded on the “Site Information” sheet of your journals?

Was the creek appearance related to the health of the creek?

What animals do you think depend on this creek based on animal tracks recorded in your journal?





Name _____ Date _____

Activity Sheet

Field Results Analysis (continued)

- **Creek Observations**

Which land use in this watershed do you believe has the most impact on your creek?

- **Tests on Water Samples**

Temperature

Record temperature readings from all field journals below:
(convert to Celsius if necessary by using $C = F - 32 \times 5/9$)

What was your average temperature?

pH

Record pH readings from all field journals below:

What was your average pH reading?



Name _____ Date _____



Field Results Analysis

(continued)

Dissolved oxygen

Record dissolved oxygen readings from all field journals below:

What was your average dissolved oxygen reading?

Using your average temperature and average dissolved oxygen, determine the percent saturation:

% Saturation			
Dissolved Oxygen			
Temperature (C)	0 ppm	4 ppm	8 ppm
2	0	29	58
4	0	31	62
6	0	32	64
8	0	34	68
10	0	35	71
12	0	37	74
14	0	39	78
16	0	41	81
18	0	42	84
20	0	44	88
22	0	46	92
24	0	48	95
26	0	49	99
28	0	51	102
30	0	53	106



Name _____ Date _____

Activity Sheet

Field Results Analysis
(continued)

• Creek Testing

Channel Width

Record the channel width:

Water Depth

Record the three depth readings:

What was the average depth?

Float Method to Determine Velocity

Use the following equation to determine the average velocity for each orientation, and overall.

length of rope / time to travel distance = average velocity rate

right:

center:

left:

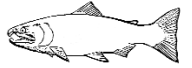
Record the average of all velocities:

Discharge

Use the following equation to determine the discharge, or flow rate, for the creek:

channel width X average of depths X average of velocities =
measurement/time (example: cubic feet per second)





Field Results Analysis

(continued)

• **Aquatic Insect Survey**

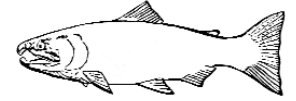
Use the following graph to determine the water quality rating based on your aquatic insect survey.

Aquatic Insect Survey		
Tolerate Pollution	Tolerate Some Pollution	Do Not Tolerate Pollution
<input type="checkbox"/> Aquatic worms	<input type="checkbox"/> Amphipod/ Scud	<input type="checkbox"/> Alderfly adult
<input type="checkbox"/> Blackfly adult	<input type="checkbox"/> Backswimmer	<input type="checkbox"/> Alderfly nymph
<input type="checkbox"/> Blackfly larvae	<input type="checkbox"/> Crane fly adult	<input type="checkbox"/> Caddisfly adult
<input type="checkbox"/> Leeches	<input type="checkbox"/> Crane fly nymph	<input type="checkbox"/> Caddisfly larvae
<input type="checkbox"/> Midge larvae	<input type="checkbox"/> Damselfly adult	<input type="checkbox"/> Gilled snails
<input type="checkbox"/> Mosquito adult	<input type="checkbox"/> Damselfly larvae	<input type="checkbox"/> Hellgrammite
<input type="checkbox"/> Mosquito larvae	<input type="checkbox"/> Dragonfly adult	<input type="checkbox"/> Mayfly nymph
<input type="checkbox"/> Pouch snails	<input type="checkbox"/> Dragonfly larvae	<input type="checkbox"/> Riffle beetle adult
<input type="checkbox"/> Watersnail eggs	<input type="checkbox"/> Water beetle adult	<input type="checkbox"/> Stonefly adult
	<input type="checkbox"/> Water beetle larvae	<input type="checkbox"/> Stonefly nymph
	<input type="checkbox"/> Water strider	<input type="checkbox"/> Water penny larvae
	<input type="checkbox"/> Waterboatman	
Summary		
How many insects did you find that TOLERATE pollution?	How many insects did you find that TOLERATE SOME pollution?	How many insects did you find that DO NOT TOLERATE pollution?

Directions for Creek Drawing

Using everyone's drawings, recreate your section of the creek onto a large piece of paper. Try to use the entire sheet of paper so that it can be taped next to other team drawings representing other sections of the creek.

What Is Your Role in Preserving Our Watershed?



Post-
Visit

LESSON PLAN

Students investigate various professions to decide which actions promote a healthy watershed. Posters are created based on this information and shared with community members.

Time required: time varies

Location: classroom

Suggested Group size: entire class

Subject(s): ecology, language arts

Concept(s) covered: watersheds, pollution, stewardship

Written by: Lynne Dominy and Christie Denzel Anastasia,
National Park Service

Last updated: 07/02/00

Student Outcomes

At the end of this activity, the students will be able to:

- Understand how humans impact watersheds.
- Design posters with suggested actions for specific professions/roles in our society.
- Devise a strategy for their households, promoting clean and plentiful water supplies.

California Science Standard Links (grades 6-8)

This activity is linked to the California science standards in the following areas:

6th grade: 2a- water running downhill is the dominant process in shaping the landscape;

2b- rivers and streams are dynamic systems;

5b- organisms and the physical environment.

7th grade: 7e- communicate steps and results from an investigation.

National Science Standard Links (grades 5-8)

This activity is linked to the national science standards in the following areas:

- Content Standard A – Abilities necessary to do scientific inquiry, think critically and logically to make the relationships between evidence and explanations.

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- Content Standard F –Personal health; populations, resources, and environments; risks and benefits.

Materials

To be provided by the teacher:

- In advance of this lesson, contact Marin County Stormwater Pollution Prevention Program to request free brochures. Refer to Resources section of this unit for contact information.
- Art supplies and poster paper.

Vocabulary

watershed

Procedures

1. Order materials from MCSTOPPP

Free materials for students are available through the Marin County Stormwater Pollution Prevention Program (MCSTOPPP). Contact information is listed in the Resources section of this unit. Allow two to four weeks to receive information. Students may also be able to locate applicable information on the Internet.

Free consumer publications to choose from

- Less Toxic Home and Garden
- Grow It!
- Fact Sheets
- Clean It!
- Creek Care Guide
- Yard Clippings and Your Creek Bank
- Repairing Streambank Erosion
- Erosion Control for the “Weekend Warrior”
- We’re Dying to Tell You
- Boating Clean and Green
- Animal Waste
- Composting
- Swimming Pools and Spas
- Moving
- Used Motor Oil Recycling
- Horse Owner’s Guide to Water Quality Protection
- How You Can Help Improve Coho Salmon and Steelhead Habitat

2. Instructions for students

Review concept of watershed and locate your watershed on a local map. Next, assign student teams and profession/role they will represent (see list below). Each team will review materials from MCSTOPPP to list five watershed conservation recommendations for their profession/role. Each recommendation should also include the specific action and the rationale for the action. These lists will become the information for their posters.



Professions/Roles

- Boat Owner (sewage disposal, painting, cleaning, gray water)
- Landscaper (planting natives, using fertilizers)
- Gardener (composting, mulching, lawn care, yard waste disposal)
- Home Owner (recycling household batteries/computers, reducing water use)
- Pest Controller (natural remedies for pests)
- Automobile Repair Shop (washing vehicles, changing oil/antifreeze, recycling car batteries/unwanted cars/tires)
- Horse Stable Owner (water quality next to pasture, erosion of streambanks)
- House Painter (disposal of paints, washing brushes)
- Pool/Spa Maintenance Person (chemical disposal, algae control)
- Housecleaner (carpet cleaning, disposal of cleaning agents/dirty water)

3. Design poster

Teams will design posters to present information they were able to gather. These posters can be displayed at an Open House event or around the community. They can also be placed in a publication that includes all posters.

4. Prioritize threats to watersheds

Generate a class discussion on threats to watersheds based on students' ideas. Once the list is long enough, prioritize the top three threats for your local area.

5. Design a household clean-water strategy

Based on the top three threats to your local area, each student will design a "Household Clean-Water Strategy". This strategy should be based on individual households and shared with family members.

6. Conclusion

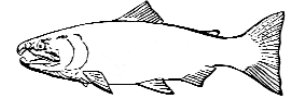
Relate clean, healthy watersheds back to coho salmon and steelhead trout population numbers. If everyone were to do their part in clean, plentiful water supplies, these fish and all life would have safer habitat to live in and utilize.

Extension ideas

1. Design a "School Clean-Water Strategy" based on information generated in this lesson.
2. Review the water cycle and how pollutants are introduced into this cycle. Compare and contrast an inland water cycle to one closer to the ocean.



How Can We Compare and Share Our Creek Data?



Post-Visit

Lesson Plan

Creek data collected at Point Reyes National Seashore or local creeks can become more meaningful when compared and contrasted with other creeks in the North San Francisco Bay region. The North Bay Riparian Station is a perfect opportunity to share creek data and learn more about the entire watershed's health.

Time required: 1-hour

Location: classroom

Suggested group size: all students can participate and access website

Subject(s): science and math

Concept(s) covered: technology used for data and research, internet in the classroom, environmental stewardship

Written by: Tricia Corsetti, Tomales Elementary School

Last updated: 03/04/00

Student Outcomes

At the end of this activity, the students will be able to:

- Find real applications for creek ecology research.
- Access environmental data from other sites of the North San Francisco Bay Riparian Station website.
- Use the computer as an educational tool.

California Science Standard Links (grades 6-8)

This activity is linked to the National Standards in the following areas:

- 6th grade: 7b- appropriate tools and technology to perform tests, collect data, and display data;
7d- communicate the steps and results from an investigation;
- 7th grade: 7a- appropriate tools and technology to perform tests, collect data, and display data;
7b- utilize a variety of print and electronic resources;
7c- communicate the logical connections;
7e- communicate the steps and results from an investigation.
- 8th grade: 9b- evaluate the accuracy and reproducibility of data.

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National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Understanding about scientific inquiry.
- Content Standard E – Understanding about science and technology.

Materials

To be provided by the teacher:

- Computer with access to the Internet (Netscape 3.04 or higher).

To be photocopied from this guide:

- **Field Journal Sheets** with data results from on-site visit.

Vocabulary

None

Procedures

1. Order instruction manual

Teachers need to contact the North Bay Riparian Station at (415) 332-1941 or www.mywatershed.org for a copy of the Online GIS/Database Training Manual to assist in the data-entry process for their classroom.

2. Explore website

After the students have collected, analyzed, and compiled their creek ecology data as a class, they will access the North Bay Riparian Station website listed above.

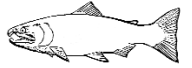
3. Enter creek information online

See the attached teacher information from the training manual to begin the website program.

Extension ideas

1. The Internet is an excellent resource for classrooms to participate in environmental research projects and to link with other classrooms doing similar projects. The EPA, Trout Unlimited, and local universities all have websites for classrooms to access and do research.

North Bay Riparian Station Website

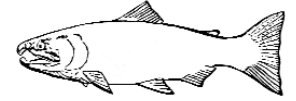


Teacher Information

1. To begin the website program, access www.mywatershed.org and click on the maps/data link.
2. The main screen has four functional areas: Top Tool Bar, Main Map Area, Profile Selection Frame, and the Project List.
3. Zoom in on the map by clicking on the “Zoom-In” icon (magnifying glass) and then click on the map near the Droplet icons on the map (droplets identify locations where schools and community groups are conducting field activities.)
4. Practice zoom-in and zoom-out controls to access the different sites on the map. The zoom-all button zooms out to the original small-scale map that was originally displayed.
 - In order to view project descriptions and other information, click twice on project icons.
 - Once you’ve selected a project, click on the data icon in the tool bar to view the data for that site. To display a graph of the data for a specific field (ex. turbidity, pH, etc.), click on the “view graph” icon. To close graph, simply click on the little “x” in the upper right corner to close the browser window.
 - To add a station for your class, click on the Upload New Project button (liferaft icon). You will be prompted with a password box requesting a group name or password. Contact site administrator by following the instructions on the screen. After entering your information, click the submit button.
 - You will be prompted to complete a station entry form. Click the “digitize point” button to calculate latitude and longitude. This will automatically calculate your site location.
 - After hitting the “insert data” button, the “Entry was Successfully Submitted” window will be displayed. Click the “redraw map” button to view the droplet icon you’ve just inserted onto the map.
 - To enter data, select the all fields from the pull-down menu in the lower left corner of the screen. Click the set button, then click the Upload Event Data.
 - Follow the prompt “Please Enter Your Name and Password.” Click the submit button. In the Data Entry window, click on the item for which you wish to enter data. To enter data to the site, click on the data form. Click the launch button to enter data on the form.
5. Contact the North Bay Riparian Station at (415) 332-1941 for a copy of the Training Manual to give specific instructions for uploading a photo to the website, and for creating and editing a profile.



How Can We Choose and Complete the Best Stewardship Project?



Post-Visit

Lesson Plan

The final lesson for this unit synthesizes all previous learning experiences. Students have gained an understanding of creek ecology and some of the threats to its sustainability. Now it's time to take action in making creeks healthier places for the variety of organisms that depend on them, from aquatic insects to humans.

Time required: time varies

Location: classroom, community, or Point Reyes National Seashore

Suggested group size: entire class

Subject(s): biology, art, computer skills, community service

Concept(s) covered: stewardship, educating others, environmental responsibility

Written by: Lynne Dominy and Christie Denzel Anastasia,
National Park Service

Last updated: 07/30/00

Student Outcomes

At the end of this activity, the students will be able to:

- Synthesize all other pre-visit, on-site, and post-visit lessons from this unit.
- Plan and implement an environmental stewardship activity to benefit the ecosystem they live in and depend upon.

National Science Standard Links

As a result of this activity, all students in grades 6-8 should develop:

- Content Standard F- Science in Personal and Social Perspectives; Populations, Resources, and Environments.

Materials

To be provided by the teacher:

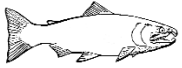
- Varies by project, see teacher information "Monitoring Creek Health: Environmental Stewardship Projects"

Vocabulary

stewardship

Creating
COASTAL STEWARDSHIP
through Science





Procedures

1. **Decide on lesson approach based on time limitations**

Review the teacher resource **Monitoring Creek Health: Environmental Stewardship Projects** following this lesson. This teacher resource explores the range of Stewardship Projects your class can complete according to time constraints. There are many possibilities ranging from short lessons to more in-depth, interdisciplinary projects that may fulfill educational standards for other subject areas.

2. **Prior to any lesson, introduce concept of environmental stewardship**

Begin a discussion of who has responsibilities for natural resources. There are federal agencies such as the National Park Service and United States Forest Service, state agencies such as California Fish and Game, and local organizations. Introduce the concept that organizations such as schools, and individuals such as students also have responsibility.

Every day we decide on an individual level what our impact will be on the environment based on our actions. It's usually positive or negative, rarely neutral.

3. **Lesson options**

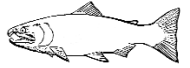
- How to positively effect species and their habitats
- Create tools to educate others
- Implement a community project
- Participate in volunteer programs at Point Reyes National Seashore
- Support stewardship organizations and be an advocate for your beliefs

(see the teacher information **Monitoring Creek Health: Environmental Stewardship Projects** following this lesson for more details)

4. **Assist with evaluation of “Creating Coastal Stewardship through Science”**

Please share your project ideas and results! If you develop a website, host a “Coastal Stewardship Day”, or participate in a beach cleanup, let us know by sending photos, stories or student materials. Call (415) 663-8522 Extension 259 to leave a message with the Education Division of Point Reyes National Seashore.

Monitoring Creek Health: Environmental Stewardship Projects



How to Positively Affect Endangered Species and Their Habitat

One to two lessons

Students use the “How to Positively Effect Species and Their Habitats” activity sheet to learn more about a particular federally listed species associated with coho salmon, steelhead trout, and riparian corridors. Based on that research, students devise action plans for which they assume responsibility for contributing toward a healthy riparian cooridor.

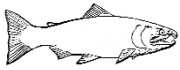
Create Tools to Educate Others

Arranged in order of possible time commitment, shortest to longest

Lead a class discussion to brainstorm ways students can educate others. Use the list below to help students generate ideas. Once there are a number of ideas, decide which project can be completed within a designated time frame. The next step is to have students create a “plan of action”. What are all the things that need to be done, in which order do they need to be done, who is going to do them, and what are the deadlines? How can students not only teach about the resource, but also impart stewardship values? Remind students to think about any safety issues and address these as a group.

Educational tool ideas:

- Develop a newsletter or newspaper to distribute to other students.
- Build an exhibit that is displayed for a Parents’ Open House.
- Paint a mural, draw posters, or create a website that encourages Creek Stewardship.
- Interview a researcher about a creek restoration project. Share the answers.
- Organize a Coastal Stewardship Contest. Have students define stewardship through writing essays or creating art, poetry or music.
- Videotape your field trip and stewardship activities. Have the students narrate this video and develop a presentation for other students sharing what they have learned and accomplished.
- Create a mentoring program that enables your students to teach younger students about resources and their stewardship.



Monitoring Creek Health Environmental Stewardship Projects

(continued)

Teacher Information

Implement a Community/School Project

Arranged in order of possible time commitment, shortest to longest

Instruct students as a homework assignment to find at least one local environmental issue that is being discussed among community members. Students may gain this information by looking through newspapers, talking to their parents, watching the local news, or listening to a public radio station. The next day in class, all local environmental issues should be discussed to some extent. Choose one project around which students may design a stewardship project. What are the possible stewardship activities that can be completed by students, and/or their parents and communities? Follow the ideas in the procedure above to create a “plan of action”.

Community/School Project Ideas:

- Water conservation at school and home.
- Paint fish symbols on storm drains to discourage dumping of toxics into water supplies. (See Marin County Stormwater Pollution Prevention Program in Resources section)
- Create a green school: investigate recycling and composting facilities or water conservation. Have students write a plan about how to make your school more environmentally friendly. Have them take action and implement some of their ideas.
- Raise steelhead trout in the classroom. (See Trout Unlimited in Resources section)
- Creek restoration: participate in creek restoration and stewardship projects. Visit the North Bay Riparian Station’s website at www.mywatershed.org for more information on restoration projects.

Participate in Volunteer Programs at Point Reyes National Seashore

2 hours, full day, or regular commitment on weekly/monthly basis

Students may participate in programs such as restoration, rehabilitation, or research projects. Consult with the Volunteer Coordinator or Education Specialist for the most recent options as projects can change according to time of year and staffing availability. One example of participating in a restoration project would be to remove exotic plants from natural areas. To participate in the habitat restoration projects at Point Reyes National Seashore call (415) 663-8522 x 259.

Support Stewardship Organizations and Be an Advocate for Your Beliefs

1 lesson to lifelong commitment

Introduce students to the concept of advocacy. Have them research and represent the missions of local and national stewardship organizations. Examples include: the National Park Service, the Marine Mammal Center, the Humane Society, the Sierra Club, the National Parks and Conservation Association and the Audubon Society. Have students write letters to their local, state and national government officials regarding stewardship issues or have them submit articles to local newspapers. Encourage students to form educated opinions and to voice them.

Name _____ Date _____



How to Positively Affect Species and Their Habitat

Choose one of the following federally or state listed species occurring in riparian corridors of Point Reyes National Seashore to answer the questions below:

- | | |
|---|---|
| <input type="checkbox"/> Pacific lamprey | special concern (federal) |
| <input type="checkbox"/> Tidewater goby | endangered (federal) |
| <input type="checkbox"/> Unarmored threespine stickleback | endangered (federal and state) |
| <input type="checkbox"/> California red-legged frog | threatened (federal) |
| <input type="checkbox"/> Alameda striped racer | special concern (federal)
threatened (state) |
| <input type="checkbox"/> San Francisco forktail damselfly | special concern (federal) |
| <input type="checkbox"/> San Francisco lacewing | special concern (federal) |

INVESTIGATION

1. How have population numbers of this particular species changed over time?

2. What are the threats to this species as an individual?

3. What are specific threats to the riparian habitat for this species?

4. Does this species depend on other types of habitat?

5. What is the federal government doing to increase population numbers?

6. Why should we care about preserving this species?



How to Positively Affect Species and Their Habitat

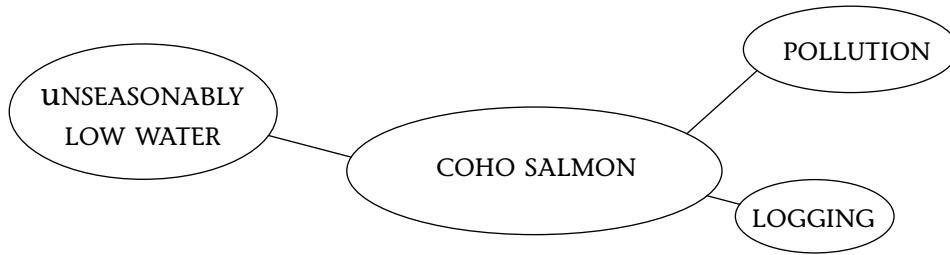
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Activity Sheet

PROBLEM SOLVING

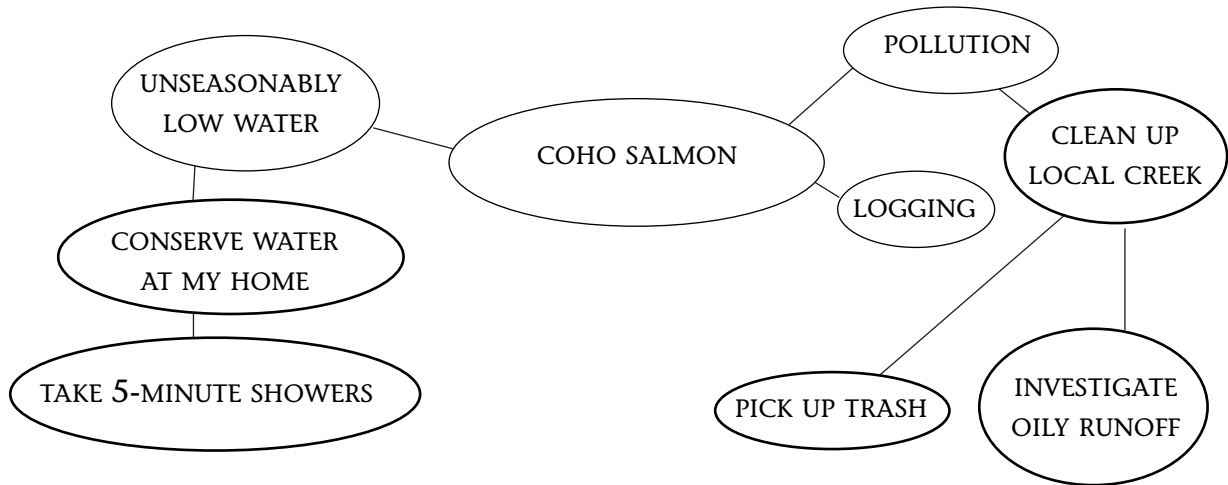
Using a blank piece of paper, you will create a “mind-map”.

Begin by writing the name of your species in the center of the paper and drawing a circle around it. Choose some of the threats to its survival and write those around the species name. Draw circles around each of the threats and connecting lines to the circle in the center. You should have something that looks like this:



Begin problem solving by thinking about actions that lessen the impact of specific threats. Write those actions in circles connected to the threat it seeks to solve.

Example:



RESOLUTION

Review your mind-map to determine what type of actions YOU can take that will positively affect these species and/or their habitat.

Place “*” next to actions you are already doing,

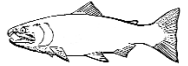
Place a “1” next to actions individuals can do,

Place a “2” next to actions groups can do, and

Place a “?” next to things you believe are not within your control.

➔ Select an option and implement your plan.

This following list is incomplete, but is meant to provide ideas for additional teaching resources.



Education and Reference Materials

Creek Watchers: Exploring the World of Creeks and Streams

Guardianes Del Aqua Fresca (Spanish Language)

4-H Series Project/CASEC, Human & Community Development,
One Shields Avenue, University of California, Davis, California 95616
(916) 752-8824

Dipping Into Creeks. Sacramento Chapter of the Urban Creeks Council. 1997

Guiberson, Brenda Z. **Salmon Story.** Holt. 1993 (grades 1-7)

Higgins, Diane. **California's Salmon and Steelhead: Our Valuable Heritage.**

A Teacher's Guide and Student Activities for grades K-6.

Diane Higgins, 1271 Fieldbrook Rd., Arcata, CA 95521

Kids in Creeks: An Interdisciplinary Creek Exploration Program

Aquatic Outreach Institute, 1325 South 46th St., #180, Richmond, CA, 94804

Pond and Stream Safari, A Guide to the Ecology of Aquatic Invertebrates.

Cornell Cooperative Extension Publishers. 1996

Steelquist, Robert. **Field Guide to the Pacific Salmon.** The Adopt-A-Stream

Foundation. Sasquatch Books. 1992

Watershed Education Project. **The Stream Scene.** Published by the Oregon

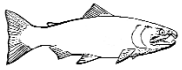
Department of Fish and Wildlife. 1990

WOW! The Wonders of Wetlands. An Educator's Guide, Environmental Concern

Inc. and the Watercourse

Yates, Steve. **Adopting A Stream: A Northwest Handbook.** Seattle: University of

Washington Press, 1991



Related Publications

“Upstream”

Sierra Club, 4171 Piedmont Ave., #204, Oakland, CA 94611-5175

“Kids in Creeks News”

c/o San Francisco Estuary Institute, 1325 South 46th Street, #180,
Richmond, CA 94804

Internet Addresses

American Fisheries Society

<http://www.fisheries.org>

Aquatic Outreach Institute

<http://www.aoinstitute.org>

California Coastal Commission

<http://www.ceres.ca.gov/coastalcomm/web>

California Department of Fish and Game

<http://www.dfg.ca.gov/dfghome.html>

California Steelhead Trout: Essential Information Regarding Species Recovery

<http://www.caltrout.org/steelhead/steelindex.htm>

Coho Salmon and Steelhead Trout Restoration/ Point Reyes National Seashore

<http://www.nps.gov/pore/resources/natural/coho.html>

River of Words: Environmental Art and Poetry Contest

<http://www.irn.org/row>

For the Sake of Salmon

<http://www.4sos.org>

The Salmon Page

<http://www.riverdale.or.us/salmon.htm>

Salmon Protection and Watershed Network

<http://www.spawnusa.org>

The Stream Study

<http://www.people.virginia.edu/~sos-iwla/streamstudyhomepage/streamstudy.html>

This site includes an online key for identifying and learning about aquatic insects.

Free



Salmonid-oriented Information/game sheets (ages 8 to 12)

Community Involvement/SEP
Fisheries and Oceans Canada
400 - 555 W. Hastings St. Vancouver, BC V6B 5G3

Wild Salmon Are Forever (video)

Sierra Club
4171 Piedmont Ave., #204
Oakland, CA 94611

MCSTOPPP: Marin County Stormwater Pollution Prevention Program

P.O. Box 4186
San Rafael, CA 94913-4186
www.mcstoppp.org
Free consumer publications and assistance for storm drain stenciling.

Sonoma County Water Agency/ Water Education Program

P.O. Box 11628
Santa Rosa, CA 95406-1628
Free water education materials and classroom visits (K-6) in Sonoma County.

Posters

Life Stages of a Salmon (eight posters)

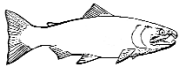
BCTF Lesson Aids
105-2232 Burrard St.
Vancouver, BC V6J 3N9 (604) 731-8121.

Trout, Salmon, and Char of North America

Hatfield Marine Science Center
Extension Sea Grant
Newport, OR 97365.

Pacific Ocean Salmon Species and Steelhead (six posters)

BC Wildlife Federation,
5659 176th Surrey, BC V3S 4C5



Videos

Resources

Currents of Change

KGW-TV (Channel 8 in the Portland, OR area) aired a special program in early April titled, "*Willamette River: Currents of Change*". The first part was a documentary on the Willamette Basin and the second part a town hall meeting discussing issues facing the Willamette Basin, including growth and water quality. You can order videotape copies for \$7.95/tape by sending a check or money order to: VME, PO Box 81120, Atlanta, Georgia 30366 or for credit card orders call: (800) 337-3273. Product code #34.

The Streamkeeper

A 25-minute video starring Bill Nye "The Science Guy" - An upbeat training tool for teachers, community groups and students of all ages who want to learn more about watersheds and how to take effective action to protect them. To order: Adopt A Stream Foundation, 600 - 128th St. SE, Everett, WA 98208 (206) 316-8592

Workshops and Classes

Aquatic Outreach Institute offers classes on weekends teaching about creeks, water quality and wetlands.

Aquatic Outreach Institute, 1327 South 45th St., #155, Richmond, CA 94804, (510)231-9566

Bay Institute offers an entire network of resources concerning water related issues and education.

www.bay.org

MCSTOPPP: Marin County Stormwater Pollution Prevention Program

P.O. Box 4186, San Rafael, CA 94913-4186

www.mcstoppp.org

Point Reyes National Seashore Association offers naturalist classes. Please call for a calendar and registration form.

PRNSA Field Seminars, Point Reyes National Seashore, Point Reyes Station, CA 94956, (415) 663-1200

SPAWN: Salmon Protection and Watershed Network

POB 400, Forest Knolls, CA 94933

www.spawnusa.org

Trout Unlimited offers a class to certify educators to raise steelhead eggs in the classroom.

Trout Unlimited, 11447 Terrace Drive, Forestville, CA 95436

Friends of San Leandro Creek offers student contests, cleanup days and community activities.

Friends of San Leandro Creek, 300 Estudillo Avenue, San Leandro, CA 94577



Grants and Awards

National Conservation Achievement Awards Program: These annual awards honor individuals and organizations whose achievements in natural resource conservation deserve national recognition.

National Wildlife Federation, 1400 Sixteenth Street NW, Washington, DC 20036-2266, (703) 790-4363

National Fish and Wildlife Foundation Grants: NFWF provides support for community based education projects about the conservation of fish, wildlife, plants and their habitats.

NFWF Conservation Education Initiative, 1120 Connecticut Avenue NW, Suite 900, Washington, DC, 20036, (202) 857-0166

