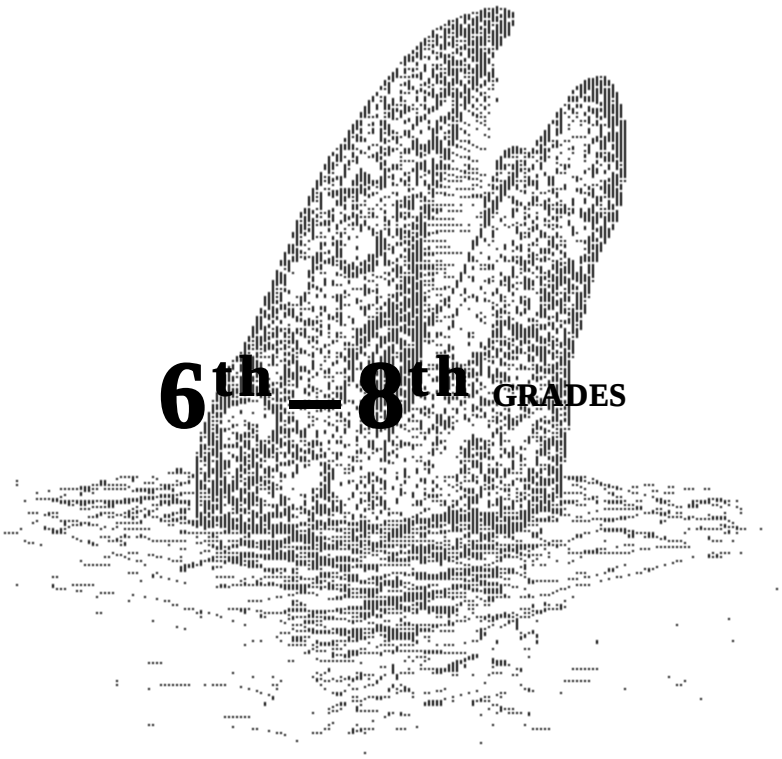
Creating
COASTAL
STEWARDSHIP
through Science

Observing Pacific Gray Whales

at Point Reyes National Seashore

2000 First Edition



6th – 8th GRADES

This project was made possible by funding from:

EXXON

National Park FOUNDATION

POINT REYES NATIONAL SEASHORE ASSOCIATION

Publishing Information

© 2001 by Point Reyes National Seashore Association

This curriculum guide was funded with grants through the National Park Foundation.

All rights are not reserved. Materials in this guide may be reproduced by teachers for classroom use — i.e., student handouts, transparencies, etc. All rights are reserved for all other uses. Written permission from Point Reyes National Seashore must be obtained for all other uses.

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.

Printed on recycled paper using soy-based inks.

ISBN: 0-911235-10-8

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.

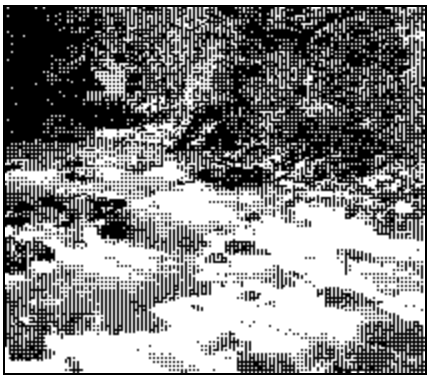
Following this preface, you will find background information on the National Park Service and an overview of Point Reyes National Seashore. To provide your students with a better understanding of the place they will be visiting, we recommend you share this information with them. For an in-depth overview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

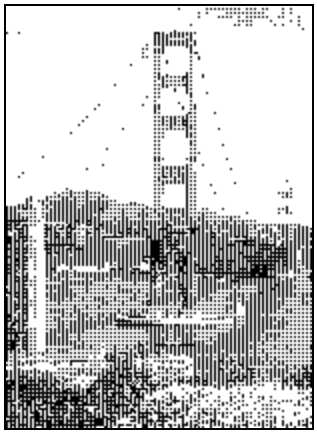
The National Park Service cares for special places saved by the American people so that all may experience our heritage.

Experience Your America


Olympic National Park

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.

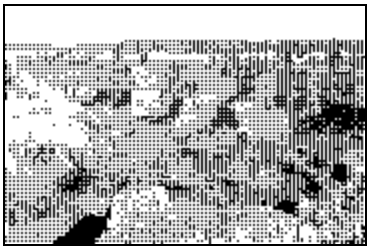
This "Organic Act" of 1916 states that "the Service thus established shall promote and regulate the use of Federal areas known as national parks, monuments and reservations . . . by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose 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.

Mesa Verde National Park

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. 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

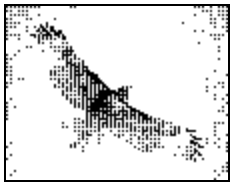
Bruce Farnsworth

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.

Sue Van Der Wahl

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.

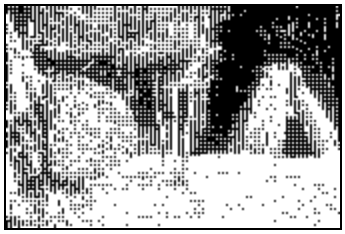
The San Andreas Fault separates the Point Reyes Peninsula from the rest of the North American continent. Granite bedrock found here and not found again until the Sierra Nevada range suggests the peninsula is geologically dynamic. According to geologists, the land that is now called Point Reyes has moved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


Rich Stalkup

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

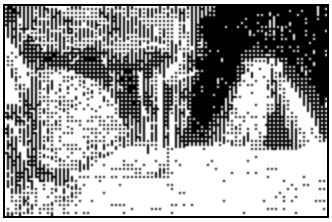
Point Reyes National Seashore provides an outdoor classroom and learning laboratory for the study of geological and ecological processes and changing land-use values in which a greater understanding of and caring for public lands can be fostered.

Ranger-led Curriculum-based Education Programs

Reservations for Ranger-led programs are requested in writing and assigned on a first-come, first-served basis. Visit **nps.gov/pore** for the reservation form and calendar.

NPS Collection

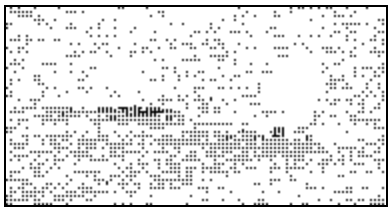
K - 2 Students explore the natural resources of the Seashore with Park Rangers in the Bear Valley area or in their classroom.


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

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

NPS Collection

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).

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

NPS Collection

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.

Classroom and Field Trip Curriculum

Based on the National and State Science and Social Science Standards

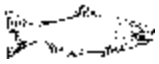
3 - 4

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 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.

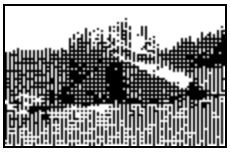
Completion of the ***Observing Pacific Gray Whales Curriculum,*** as a companion to a whale watching field trip, will enable students to observe and understand gray whale adaptions and behaviors, and the factors that influence their survival.

Educational Facilities

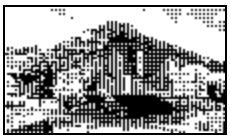
The **Historic Lifeboat Station** is available to educational groups for overnight use. Nightly fees are charged. Group size must be under 25 (including chaperones). Reservations are made on a first-come, first-served basis by completing the boathouse form on our website at **www.nps.gov/pore**.

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 information, contact Point Reyes National Seashore Association at (415) 663-1200, website **www.ptreyes.org**.

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.

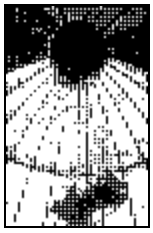


The **Bear Valley Visitor Center** is a day-use facility open to school groups Monday through Friday from 9 A.M. to 5 P.M. Exhibits on natural and cultural resources are found here. Books, brochures, and other educational materials are available.



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 from 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) 464-5100 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 domitory-style group cabin with a fully equipped kitchen and showers. For additional information and reservations, call (415) 663-8811 during office hours 7:30 to 9:30 A.M. and 4:30 to 9:30 P.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 the 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 the website at **www.marconiconfctr.org.**

National Park Foundation

Creating Coastal Stewardship through Science

EXXON

Observing Pacific Gray Whales

Teacher Preparation 1

Pre-Visit Activities 31

On-Site Activities 109

Post-Visit Activities 153

Resources 167

Creating COASTAL STEWARDSHIP through Science

Observing Pacific Gray Whales

Teacher Preparation

Introduction 1
Considerations 1
Weather 2
Seasonal Events 2
Chaperone Preparedness and Assistance 2
Suggested Lesson Plan 3
Field Trip Logistic 4
Evaluation Process 5
Reservations 5
Pacific Gray Whales Kit Contents 5
California Science Standard Links 6
Correlations to "A Child's Place in the Environment" 7
Acknowledgments 8

Attachments:
Map of Point Reyes National Seashore 9
Map of the Point Reyes Lighthouse Area 11
Map of the Chimney Rock Area 13
"The Historic Point Reyes Lighthouse" brochure 15
Lyme Disease, Stinging Nettle, and Poison Oak 17
Reservation Form 19
Evaluation Form 21
Vocabulary 23

Observing Pacific Gray Whales

Point Reyes National Seashore is an ideal place to view a portion of the Pacific gray whale's annual migration. This amazing whale swims over 10,000 miles each year, and has the longest migration of any whale species. This spectacular event is visible from the Point Reyes Headlands in the late winter and early spring.

Completion of this unit, as a companion to your Park field trip, will enable your students to observe and understand the phenomenal features and behaviors of Pacific gray whales.

Considerations

When: January through April (February is a slow month); on Mondays, Thursdays, and Fridays between 10 a.m. and 4:30 p.m. (the Lighthouse Visitor Center is closed on Tuesdays and Wednesdays).

Where: Lighthouse Observation Deck and Visitor Center. Whales are also visible from the Chimney Rock trail in March and April. Due to the narrowness of the Chimney Rock road, school buses cannot access the trailhead. Cars or vans (shorter than 24 feet) must be used.

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 "Discovering Northern Elephant Seals" unit if you are visiting January through March. Elephant seals are usually visible from the Elephant Seal Overlook, located near the Chimney Rock parking lot.

Weather: The chart below lists average climate expectations based on previous years' data. The weather is subject to quick change 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												
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												
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	X		X	X								
Elephant Seal Breeding	X	X	X									
Bird Migration									X	X	X	X
Coho Spawning	X											X
Steelhead Trout Spawning		X										X
Tule Elk Rut Season							X	X	X			
Peak Flower Blooms				X	X							
Tidepooling	X	X	X									
Geology	X	X	X	X	X	X	X	X	X	X	X	X
Ocean and Land Habitats	X	X	X	X	X	X	X	X	X	X	X	X
Resident Birds	X	X	X	X	X	X	X	X	X	X	X	X

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 with the field observations and with the journal questions. Provide each chaperone with their own copy of the student journals and encourage them to complete it with the students.

Suggested Lesson Plan

PRE-VISIT		Time Needed: 8 hours
Activity #1	How Can I Learn about the Lives of Pacific Gray Whales? *Students use a newspaper and vocabulary list to complete questions and activities about gray whales.*	2 hours
Activity #2	How Have Gray Whales Adapted to Life in the Ocean? *Students explore gray whales' adaptations for marine life.*	2 hours
Activity #3	Of What Importance are Whales and Dolphins in the Ecology of the Pacific Ocean? *Niches, habitat, and ecosystem components for cetaceans are examined.*	2 hours
Activity #4	What Can We Expect on our Field Trip to Observe Gray Whales at Point Reyes National Seashore? *Students create field journals for use on their field visit to Point Reyes National Seashore.*	1 hour
Activity #5	Safety and Stewardship Challenge *Proper behaviors around National Park resources are examined in a game format.*	1 hour
Activity #6	How Do I Use Binoculars? *Students practice using binoculars in the classroom and outside.*	varies
ON-SITE		**Time Needed: 3 hours**
Field Journal	How Can Teachers, Chaperones, and Students Make the Most of Their Field Trip? *Students observe gray whales and complete their field journals while visiting Point Reyes National Seashore.*	3 hours
Optional	How Can I Capture My Experience in a Story, Poem, or Drawing? *There are many ways to appreciate gray whales; here are some suggestions to foster creativity.*	time varies
POST-VISIT		**Time Needed: 3 hours**
Activity #1	What Can We Learn from Our Field Trip to Observe Pacific Gray Whales? *Students compile data from their field journals to draw conclusions between what they have previously learned in class and what they experienced in the field.*	2 hours
Activity #2	How Can I Access More Information on Whales? *Students and teachers are encouraged to participate and learn more about current whale research.*	1 hour
Activity #3	How Can I Choose and Complete the Best Stewardship Project? *Students develop action plans to complete a project that will benefit oceans and coastal areas.*	time varies

Field Trip Logistics

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

Other Things to Remember:

- Gray whales pass Point Reyes during the rainy and windy season. Students need warm, waterproof clothing. Sunscreen is needed on sunny days.
- If you decide to visit the Chimney Rock area, remember ticks are abundant. Have everyone wear light-colored clothing and tuck their pant legs into their light-colored socks. Everyone will need to check themselves thoroughly for ticks before returning home.
- Binoculars and spotting scopes will assist the students in viewing the gray whales. These may be checked out from the Bear Valley Visitor Center. If you plan to use this equipment, it is essential that you train the students in how touse binoculars before their visit. See the enclosed binocular activity.
- Travel time from Point Reyes Station to the Lighthouse Visitor Center and Observation Deck is 1 hour. Most groups visit the Lighthouse area between10 a.m. and 1 p.m. If you plan to visit during this time, have students bring a bag lunch and something to sit on. Following lunch, have them check the entire area for trash.
- Bathrooms are available at Bear Valley Visitor Center, Chimney Rock and the Lighthouse Visitor Center. A water faucet is located next to the Lighthouse Visitor Center and Bear Valley Visitor Center.
- 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 work. Following the teacher preparation is a pre-addressed 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. A class portfolio illustrating lesson activities
4. Any completed stewardship activities, including posters or newsletters
5. Any completed classroom projects or photographs of projects
6. Other ways of illustrating student feedback

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

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

Reservations

To avoid conflicts with other groups and to be notified about any unusual closures, please call the Park to notify us about your field trip date and time. Call (415) 464-5139 or e-mail **PORE_education@nps.gov**. You may also use the reservation form provided in this Teacher's Preparation unit.

Pacific Gray Whale Kit Contents

Kits are available for checkout at the Bear Valley Visitor Center. These are available on a first-come, first-served basis.

- ☐ 20-40 pairs of binoculars
- ☐ 1 spotting scopes
- ☐ teacher backpack with field guides
- ☐ 20-40 clipboards

California Science Standard Links

	"Observing Pacific Gray Whales" Unit										
	Pre-Visit						On-Site	Post-Visit			
	#1	#2	#3	#4	#5	#6	Field Journal	#1	#2	#3	#4
Sixth Grade											
1											
2											
3											
4											
5	a,b,-e		a,b,-c,d,e				a,b,e	a,b,-c,e			
6											
7	b,c		b	b		b	b,c,f,h	b,c,-d,e,-f,h	b,d,-e		
Seventh Grade											
1											
2	a										
3	e	a									
4											
5	a,d	a	a,c								
6						b,d					
7	a,d			a		a	a	a,c,e	a,b,-c,e		
Eighth Grade											
1											
2											
3											
4											
5											
6											
7											
8											
9	b							b			

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

	"Observing Pacific Gray Whales" Unit									
	PRE-VISIT						ON-SITE	POST-VISIT		
	#1	#2	#3	#4	#5	#6	Field Journal	#1	#2	#3
A Child's Place in the Environment: Grade 6 Lessons										
What Are Some Components of an Ecosystem?	X		X				X	X		
What Role Does Diversity Play in an Ecosystem?	X		X				X	X		
How Does the Sun's Energy Flow Through an Ecosystem?			X							
What Interrelationships and Niches Can Be Identified in an Ecosystem?	X		X				X	X		
What Cycles Exist in an Ecosystem and How Do They Sustain an Ecosystem?	X		X							
What Examples of Ecological Principles Can Be Observed in an Ecosystem?			X				X	X		
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?	X						X			
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?	X									X
What Have Communities Done to Become More Sustainable?										X
What Projects Can Students Implement to Make Their Classroom and School or Community More Sustainable?										X

Acknowledgments

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

Point Reyes National Seashore: Division of Science

Dr. Sarah Allen, Chief Science Advisor
Dawn Adams, Natural Resource Specialist

Workshop Participants

Jules Evens, author and naturalist
Trudie Behr-Scott, Hill Middle School, Novato
Steve Ladresh, Bolinas School
Erin Blackwood, Marine Mammal Center
Jimmy Corsetti, Petaluma Middle School
Sue McCullough, West Marin School

Point Reyes National Seashore: Division of Interpretation

John Dell'Osso
Loretta Farley
Heidi Strickfaden
Melinda Repko
John Golda
Stephen Anastasia
Kim Linse
Jessica T. Taylor

Unit Evaluation

Alan Gere, retired teacher, Novato
Amy Marweg, West Marin School
Mary Barton, Pittsburgh, CA
Bob Gross, Santa Rosa, CA
Beverly Lindquist, Teacher, Vallejo

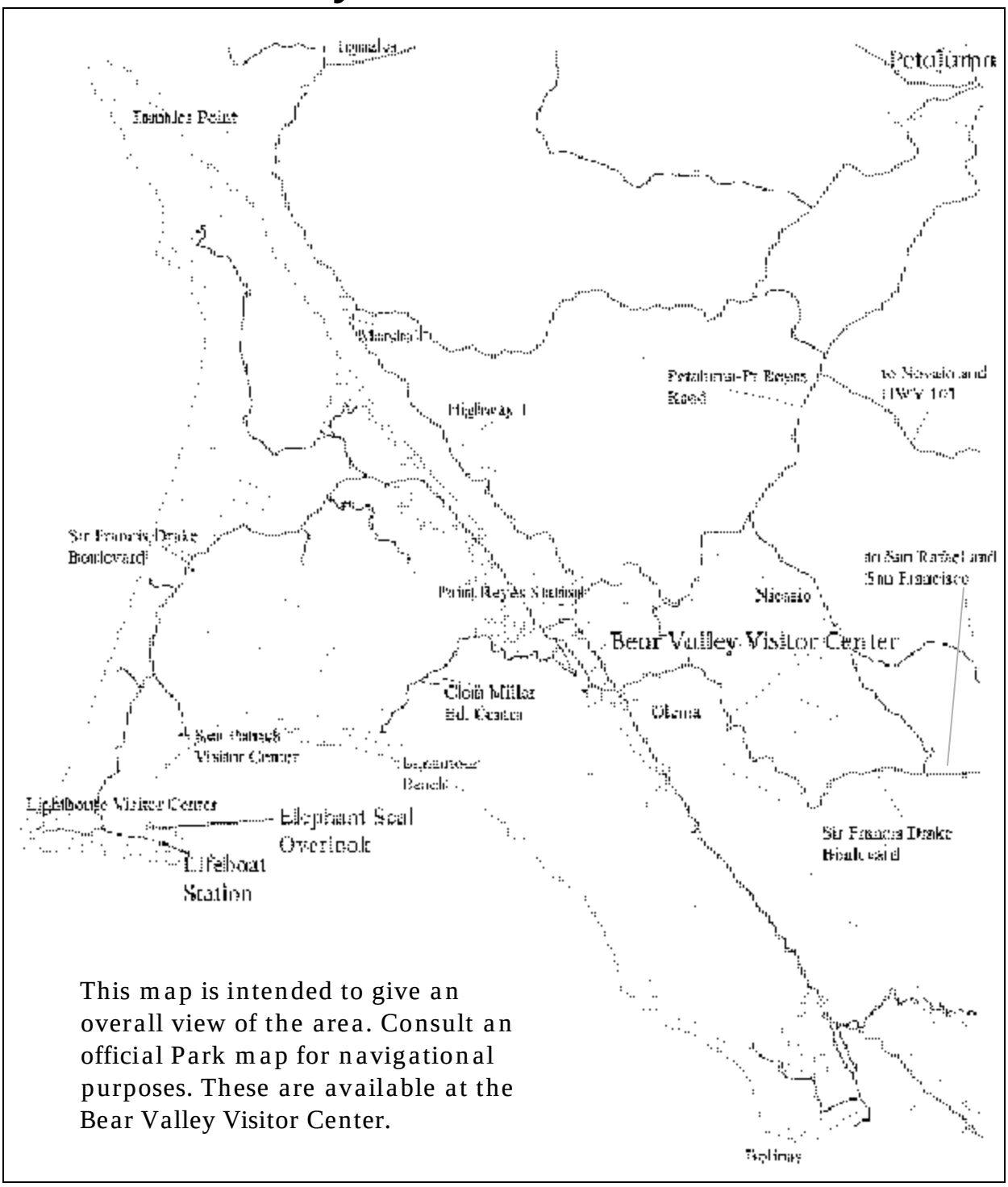
Unit Design

Lynne Dominy
Christie Denzel Anastasia

Special Thanks

Dude Williard, Artist, Bolinas
Tom Parsons, Cartographer, National Park Service

Point Reyes National Seashore

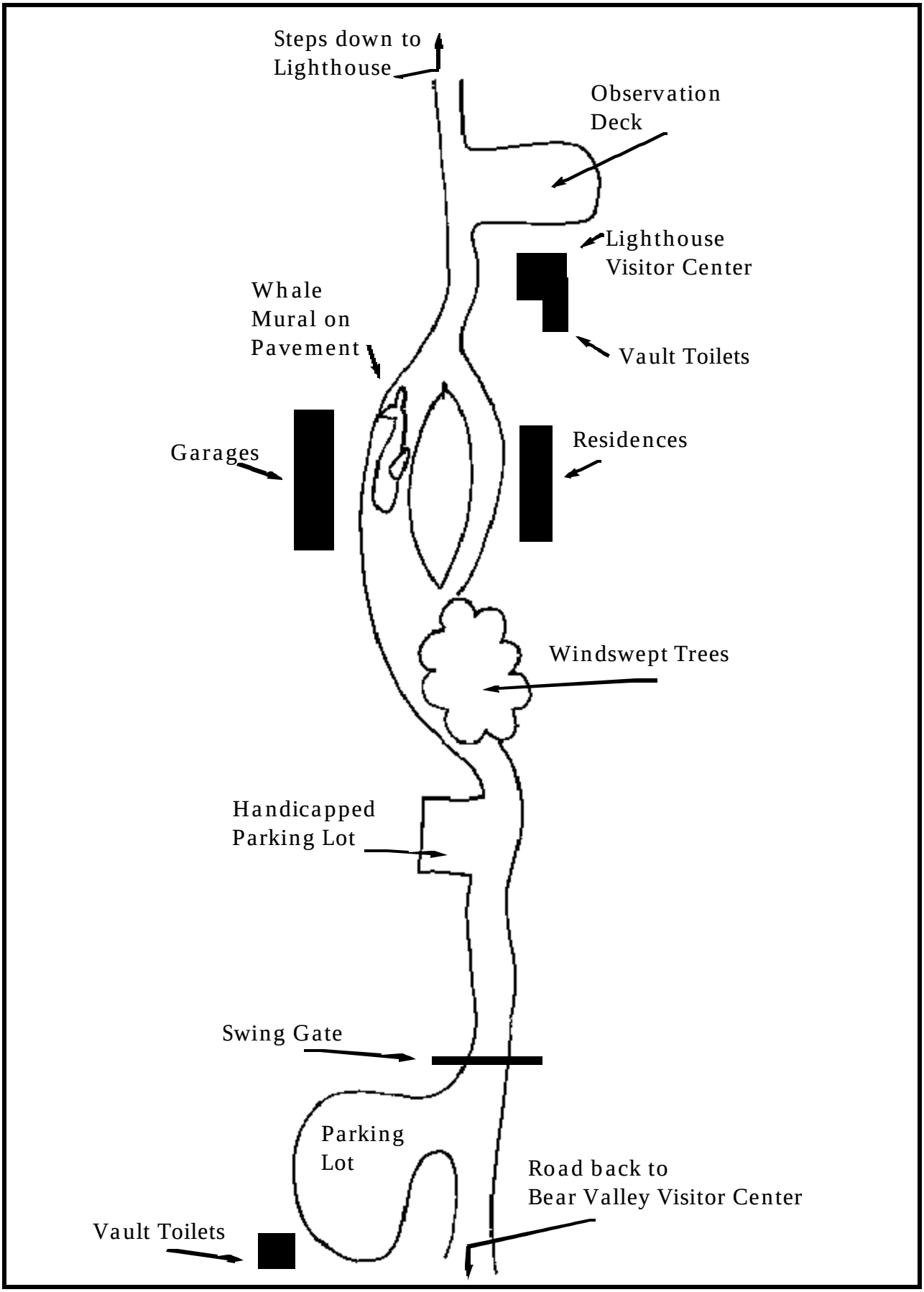


This map is intended to give an overall view of the area. Consult an official Park map for navigational purposes. These are available at the Bear Valley Visitor Center.

Approximate Driving Times/Distances

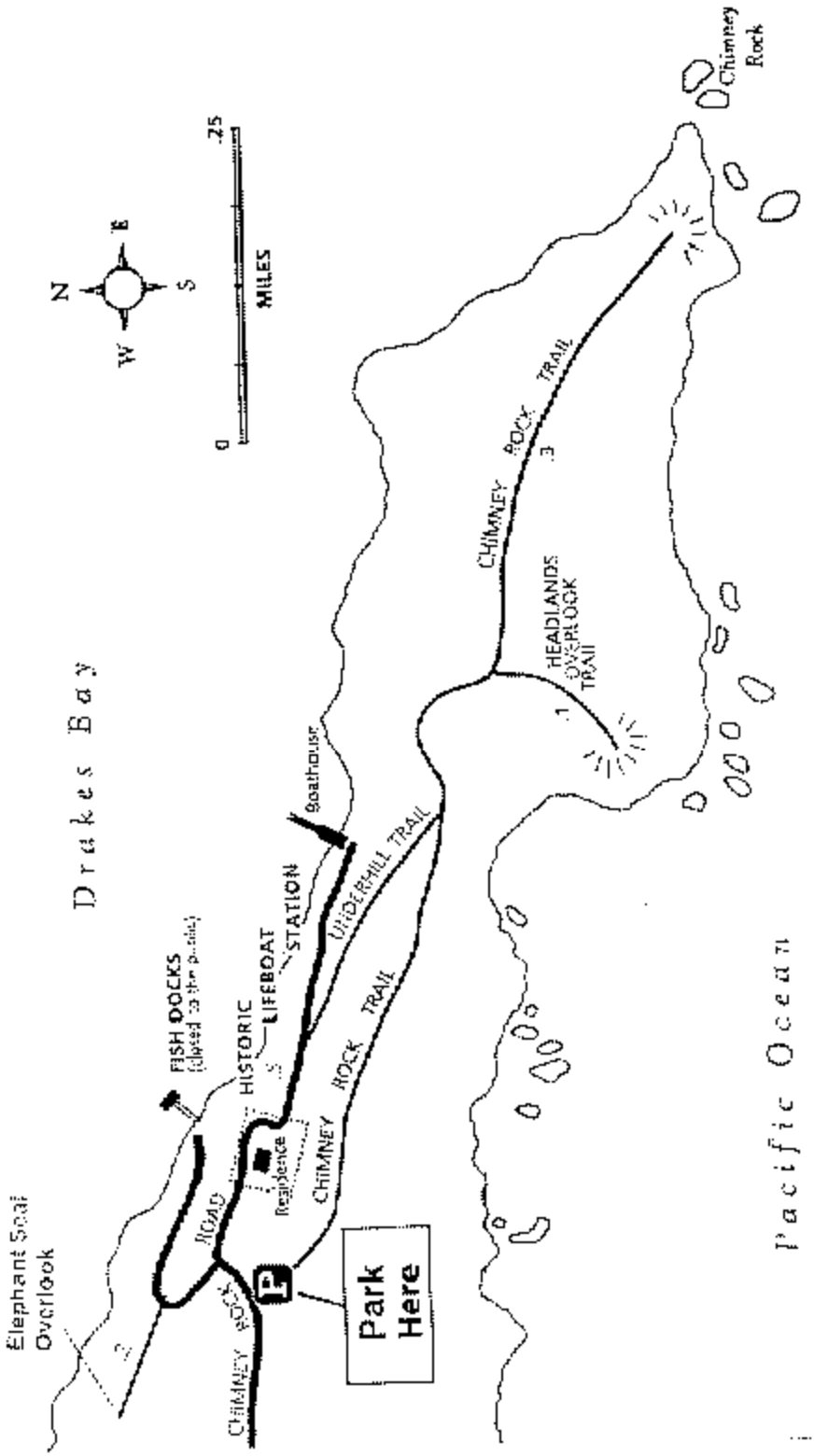
Petaluma to Bear Valley VC	40 min./19 miles
Novato to Bear Valley VC	40 min./19 miles
San Anselmo to Bear Valley VC	30 min./20 miles
Bear Valley VC to Limantour Beach	20 min./9 miles
Bear Valley VC to Tomales Point	30 min./19 miles
Bear Valley VC to Ken Patrick VC	30 min./15 miles
Bear Valley VC to Elephant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

Point Reyes Lighthouse Area Map



Attachment

Map of the Chimney Rock Area



The Chimney Rock Road is CLOSED to buses. Use cars or vans to transport students to the overlook or trail.

Attachment

The Historic Point Reyes Lighthouse

Punta de los Reyes . . . God help the hapless mariner who drifts upon it!"- San Francisco Chronicle 1887

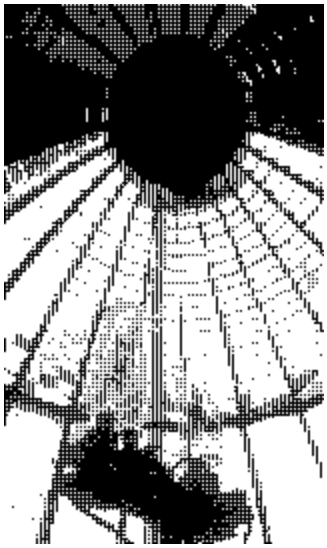
Point Reyes: A Treacherous Obstacle to Mariners

Point Reyes is the windiest place on the Pacific Coast and the second foggiest place on the North American continent. Weeks of fog, especially during the summer months, frequently reduce visibility to hundreds of feet. The Point Reyes Headlands, which jut 10 miles out to sea, pose a threat to each ship entering or leaving San Francisco Bay. The historic Point Reyes Lighthouse warned mariners of danger for more than a hundred years.

The historic Point Reyes Lighthouse, built in 1870, was retired from service in 1975 when the U.S. Coast Guard installed an automated light. They then transferred ownership of the lighthouse to the National Park Service, which has taken on the job of preserving this fine specimen of our heritage.

All lighthouses in the United States are now automated because it is cheaper to let electronics do the work. Many decommissioned lighthouses were transformed into restaurants, inns, or museums. The lighthouse at Point Reyes National Seashore is now a museum piece, where the era of the lightkeepers' lives, the craftsmanship, and the beauty of the lighthouse are actively preserved.

The Point Reyes Light First Shone in 1870



First-order Fresnel lens seen from inside the lens, Point Reyes Lighthouse. The electric lights are a modern addition.

The Point Reyes Lighthouse lens and mechanism were constructed in France in 1867. The clockwork mechanism, glass prisms, and housing for the lighthouse were shipped on a steamer around the tip of South America. The parts from France and the cast iron tower, which was built in San Francisco, were then hauled on ox-drawn carts from the landing on Drakes Bay to the cliff 600 feet above sea level. Meanwhile, 300 feet below the top of the cliff, an area had been blasted with dynamite to clear a level spot for the lighthouse. To be effective, the lighthouse had to be situated below the characteristic high fog. It took 6-weeks to lower the materials from the top of the cliff to the lighthouse platform and construct the lighthouse.

Finally, after many years of tedious political pressure, transport of materials, and difficult construction, the Point Reyes Light first shone on December 1, 1870.

"No keepers ever volunteer to transfer to Point Reyes, and almost without exception the keepers on the station are the ones who have entered the service there." -Superintendent of Lighthouses, 1926

The Lighthouse, Fog Signal and Lifesaving Station Saved Lives

Lighthouses provide mariners some safety by warning them of rocky shores and reefs. They also help mariners navigate by indicating their location as ships travel along the coast. Mariners recognize lighthouses by their unique flash pattern. On days when it is too foggy to see the lighthouse, a fog signal is essential. Fog signals sound an identifying pattern to signal location to the passing ships. However, the combination of lighthouses and fog signals does not eliminate the tragedy of shipwrecks.

The highest wind speed recorded at Point Reyes was 133 m.p.h., and 60 m.p.h. winds are common.

Because of this ongoing problem, a lifesaving station was established on the Great Beach north of the lighthouse in 1890. Men walked the beaches in 4-hour shifts, watching for shipwrecks and the people who would need rescue from frigid waters and powerful currents. This lifesaving station was later moved to Drakes Bay near Chimney Rock and was active until 1968. Today it is a National Historic Landmark and can be viewed from the Chimney Rock Trail.

The Lonely Life of a Lighthouse Keeper

Keeping the lighthouse in working condition was a 24-hour job. The light was lit only between sunset and sunrise, but there was work to do all day long. The head keeper and three assistants shared the load in four 6-hour shifts. Every evening, a keeper walked down the wooden stairs to light the oil lamp, the lighthouse's source of illumination. Once the lamp was lit, the keeper wound the clockwork every 2 hours and 20 minutes to turn the lens so the light would flash. Then, throughout the night, he kept the lampwicks trimmed so that the light would burn efficiently, thus the nickname "wickie."

Daytime duties included cleaning the lens, polishing the brass, stoking the steam-powered fog signal, and making necessary repairs. At the end of each shift, the keeper trudged back up the wooden staircase. Sometimes the winds were so strong that he had to crawl on his hands and knees to keep from being knocked down by the wind.

The hard work, wind, fog, and isolation at Point Reyes made this an undesirable post. Even so, one keeper stayed for more than 20 years, a testament to his devotion and love of Point Reyes!

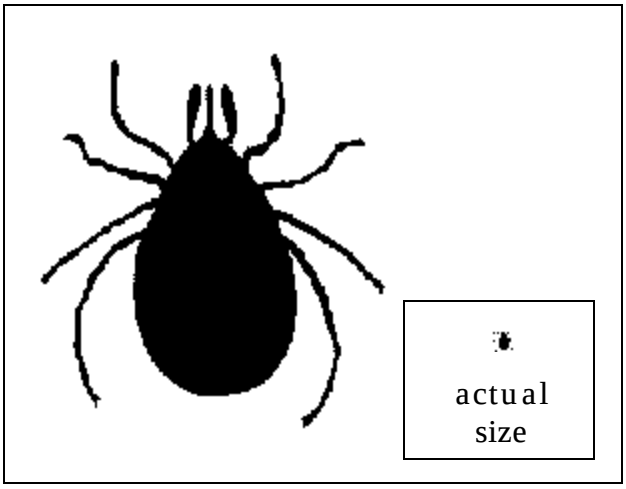
The Lighthouse Is an Enduring Historical Legacy

The historic Point Reyes Lighthouse served mariners for 105 years before it was replaced. It endured many hardships, including the 1906 earthquake, during which the Point Reyes Peninsula and the Lighthouse moved north 18 feet! The only damage to the Lighthouse was that the lens slipped off its tracks. Thirteen minutes after the earthquake, the Lighthouse was once again in working order.

The National Park Service is now responsible for maintenance of the Lighthouse. Park rangers now clean, polish, and grease it, just as lighthouse keepers did in days gone by. With this care, the light can be preserved for future generations - to teach visitors of maritime history and of the people who worked the light, day in and day out, rain or shine, for so many years.

Lyme Disease, Stinging Nettle, and Poison Oak

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
bull's-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.

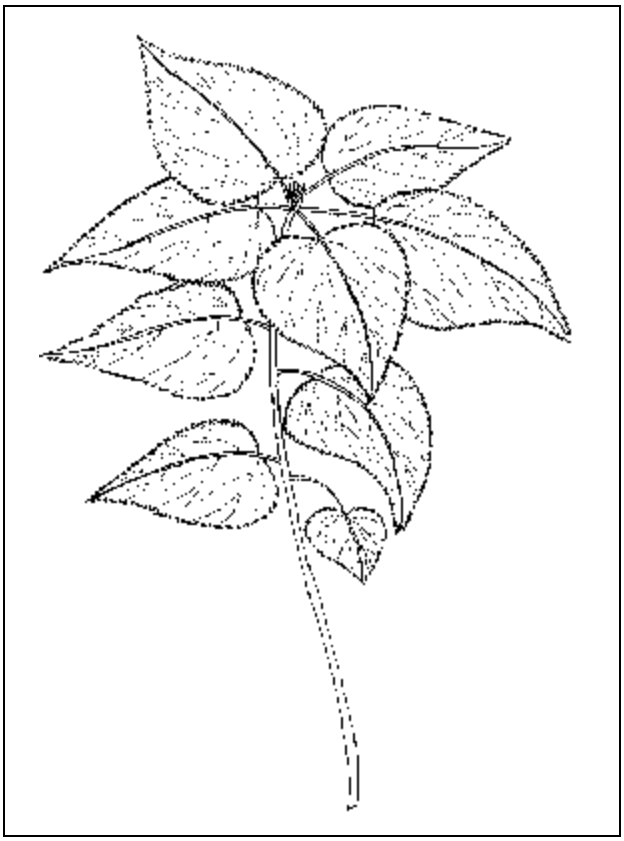
What to do if bitten:

- 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 from 24 to 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:

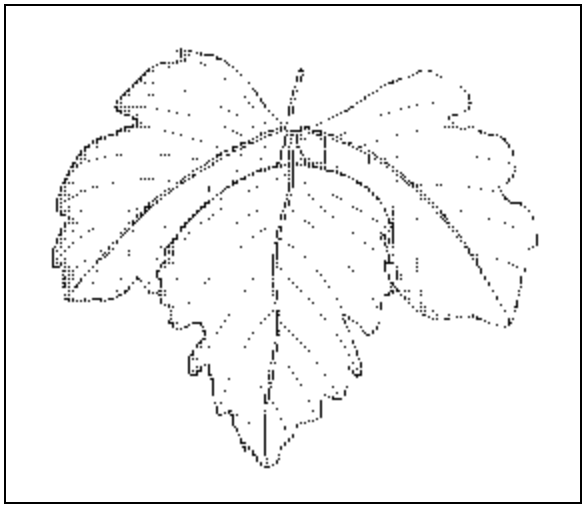
Ticks and Lyme Disease in the National Parks
Lyme Disease Foundation/**www.lyme.org**

Lyme Disease, Stinging Nettle, and Poison Oak
(continued)



Stinging nettle is native to Europe, but grows at Point Reyes National Seashore. It can cause a painful rash that stings for up to 12 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 its 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 911 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

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 2 weeks in advance (fold in thirds and affix postage) or call (415) 464-5139, to leave a message.

Teacher Name: _____

School Name: _____

School Address: _____

City/State: _____ Zip Code: _____

School Phone: _____ School Fax: _____

Email: _____

Grade: _____ Class Size: _____

Home Phone: _____

Field Trip Options

Monitoring Creek Health
Observing Pacific Gray Whales
Discovering Northern Elephant Seals
Defining Habitats
Investigating Tule Elk
Uncovering the San Andreas Fault
Identifying Resident Birds

Field Trip Preferences

Field Trip Topic	Dates (list three in order of preference)	Time
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

Creating Coastal Stewardship through Science

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, e-mail comments to: **PORE_Education@nps.gov**

Name: _____ School Name: _____

School Address: _____

City/State/Zip Code: _____

School Phone: _____ School Fax: _____

Email: _____

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 Program Coordinator
Point Reyes Station, California 94956

Creating
COASTAL
STEWARDSHIP
through Science

Amphipod a small crustacean with a laterally flattened body (order Amphipoda). Four families of amphipods make up 90% of gray whale diet.

Aphotic zone a zone in the ocean lacking light

Baleen plates that grow from the upper jaw of whales in the suborder Mysticeti. These plates form a fringe like sieve to filter food from seawater. The hardened tissue that makes up baleen is keratin which is made up of fingernails, hooves, and horns.

Benthic division the zone at the bottom of the ocean

Blowhole the nostril(s) of a whale that opens on top of the head

Blubber the layer of fat beneath the skin of marine mammals

Breaching the leaping of a whale above the water's surface

Carnivore a flesh-eating organism

Cetacean of the order Cetacea of aquatic marine mammals including the whales, dolphins, and porpoises

Community all of the plants, animals, and nonliving components living in the same area

Competition the active demand by two or more organisms, or kinds or organisms, for some environmental resource in short supply

Consumer an organism which obtains food by preying on other organisms or eating organic matter

Decomposer an organisms that returns organic substances to ecological cycles by feeding on and breaking down tissues

Diatom any of a class of small planktonic unicellular or colonial algae with silicified skeletons

Dorsal upper surface of an organism, the area along the backbone for whales

Dorsal fin the somewhat triangular appendage protruding above the backbone of some cetaceans

Dorsal ridge the area along the backbone of some species of whales (when viewed from the side, looks like a series of knuckles). Gray whales have a dorsal ridge instead of dorsal fin. It may act as a keel to help keep the whale oriented upright.

Ecosystem the sum total of interacting communities, biotic (living) and abiotic (nonliving) components, in a unit of the environment

Euphotic zone the uppermost layer of ocean water that receives sufficient light for photosynthesis and the growth of green plants

Fluke the tail of a whale; when swimming the whale's fluke moves up and down, not side to side like a fish tail; used for propulsion through the water

Food chain a method to illustrate the transfer of body-building substances and energy when one organism eats another

Food web the multiple interrelationships between all species in an ecosystem or habitat; a series of organisms related by predator-prey and consumer-resource interactions; the entirety of interrelated food chains in an ecological community.

Forestomach the first stomach of a baleen whale which is surrounded by muscles to aid in grinding food

Habitat the place in the ecosystem where populations of organisms live and grow

Herbivore a plant-eating organism

Invertebrate an animals without a backbone

Krill small shrimplike marine crustaceans (order Euphausiacea); principal food of some baleen whales, not typically eaten by gray whales

Lagoon a shallow body of water located near, and at times connected with, a larger body of water

Latitude the angular distance north or south of the equator, measured in degrees along a meridian, as on a map or globe; Point Reyes' latitude is 38° North

Longitude the angular distance east or west of the prime meridian in Greenwich, England, measured in degrees along a meridian, as on a map or globe; Point Reyes' longitude is 123° West

Mammal a warm-blooded animals that breathes air, has hair, gives birth to live young, and nurses their young with milk from mammary glands

Midstomach the second stomach of a baleen whale which further digests food for nutrient absorption

Migration a seasonal movement from one region to another, usually for breeding or feeding

Migration route the general path of travel used by most animals in a species for their seasonal movements

Mottled color variegated pattern of shading with spots or blotches

Mysticete baleen whale (suborder Mysticeti); translates to "mustached whale"

National Park an area of national significance, scenic beauty, or historical importance, preserved for the use and enjoyment of this and future generations

Neuritic province well lighted zone of the ocean with seasonal variations in light, temperature, salinity, dissolved oxygen, nutrients, wave action, currents, and organisms. It has the greatest abundance and variety of fish.

Niche the ecological role, position, or function of an organism in a community of plants and animals; "profession"

Oceanic province a less productive zone than the neuritic province, but with less seasonal variation

Odontocete a toothed whale (suborder Odontoceti)

Omnivore one that eats both animal and vegetable substances

Organism a living species

Parasite an organism living in or on another organism

Pectoral flippers appendages located on either side of a whale, used to balance and steer

Peduncle muscles that run length of whale's tail, and attach to fluke

Pelagic division living in open oceans

Plankton the drifting sea life floating near the surface of water. Zooplankton (animal in origin) examples include fish eggs, amphipods, larvae, and krill. Phytoplankton (plant in origin) examples include diatoms and other photosynthesizers.

Pod a group of traveling whales, usually segregated by age or sex

Population a number of individuals of the same species living in a distinct geographical area

Producer an organism such as a plant which can produce its own food and serves as a food source for other organisms

Pyloric stomach the third stomach of a baleen whale

Rostrum the long, flat ridge on dorsal side of a baleen whale's head, extending from blowhole to tip of mouth

Scavenger an organism feeding on dead things or garbage

Sounding a whale's dive from the ocean surface into the depths. As the whale begins a long dive, you may get a chance to see the fluke propelling the whale downward.

Species a distinct type of animal or plant. Members of the same species can breed naturally. Members of different species cannot interbreed naturally.

Spouting the exhalation of a whale at the water's surface. Warm air from the lungs condenses in the cooler air and creates the telltale "geyser" appearance, like a puff of smoke.

Spy-hopping a whale poking its head vertically above the water's surface

Stewardship choices and actions to protect our environment

Trachea passageway that carries air from nostrils to lungs. In humans, tracheas are for breathing and eating; in whales the trachea only carries air.

Umbilicus a small opening or depression similar to a navel

Upwelling the vertical movement of cold, nutrient-rich water from depths to surface

Ventral pleats grooves on the underside of a whale's mouth that allow the mouth cavity to expand when feeding. Gray whales have two to four ventral pleats.

Whalebone the term used by early whalers for baleen