Appendix A: California State Standards

Visits to coastal habitats can help students achieve California State Standards in many content areas. Listed below, in abbreviated form, are some of the grades 3-6 standards that can be taught through field trips to natural environments.

Grade Three

Social Studies Content Standards

3.1.1: Identify local geographical features
3.1.2: Trace ways that people have used and modified the local environment
3.2.2: Discuss ways that environment affected local Indian nations
3.4.2: Discuss the importance of public virtue and how to participate in the community and civic life

Mathematics Content Standards

Number Sense 1.1: Count, read, and write whole numbers
Measurement and Geometry 1.1: Use tools to measure…

English-Language Arts Content Standards

Writing 2.2: Write descriptions that use concrete sensory details
Writing 2.3: Write ...letters, thank you notes

Science Content Standards

Physical Sciences 1.d: Energy can be carried by waves
Physical Sciences 1.f: Evaporation…occurs when objects are heated

Life Sciences 3.a: Plants and animals have structures that serve…functions
Life Sciences 3.b: Examples of diverse life forms in different environments such as oceans…
Life Sciences 3.c: Living things cause changes in the environment
Life Sciences 3.d: When the environment changes, some plants and animals survive and reproduce; others move to new locations (or die)

Earth Sciences 4.b: The moon's appearance during the lunar cycle

Investigation and Experimentation 5.a: Repeat observations
Investigation and Experimentation 5.b: Differentiate evidence from opinion
Investigation and Experimentation 5.c: Use numerical data in describing…

Grade Four

Social Studies Content Standards

4.2.1: Discuss how California Indians depended on, adapted to, and modified the environment by…(the) use of sea resources
4.2.2: Identify…sea routes…noting ocean currents and wind patterns

Mathematics Content Standards

3.1: Using addition and subtraction

English-Language Arts Content Standards

Reading 1.3: Use knowledge of root words to determine meanings
Reading 1.4: Analyze complex words with Latin and Greek roots

Science Content Standards

Life Sciences 2.a: Plants are the primary source of matter and energy entering most food chains
Life Sciences 2.b: Producers and consumers…food chains and food webs
Life Sciences 2.c: Decomposers…recycle matter
Life Sciences 3.a: Ecosystems can be characterized by their living and nonliving components
Life Sciences 3.b: In any…environment, some…survive well, some less well, and some cannot survive at all
Life Sciences 3.c: Animals depend on plants for food and shelter

Earth Sciences 4.a: Methods of formation of sedimentary rocks
Earth Sciences 5.a: Some changes in the earth are due to slow processes such as erosion, and some changes are due to rapid processes such as …earthquakes
Earth Sciences 5.c: Moving water erodes landforms, reshaping…and depositing

Investigation and Experimentation 6.a: Observations and inferences
Investigation and Experimentation 6.b: Measure and estimate
Investigation and Experimentation 6.c: Formulate predictions…cause-and-effect
Investigation and Experimentation 6.d: Conduct multiple trials and draw conclusions
Investigation and Experimentation 6.e: Construct and interpret graphs…
Investigation and Experimentation 6.f: Follow…written instructions for a scientific investigation

Grade Five

Social Studies Content Standards

5.1.1: Describe how geography and climate influenced (California Indians)

Mathematics Content Standards

Measurement and Geometry 1.3: Understand the concept of volume and use appropriate units (for measuring)

English-Language Arts Content Standards

Writing 2.3: Write research reports…
Listening and Speaking 1.1: Ask questions that seek information
Listening and Speaking 1.2: Interpret a speaker's…messages, purposes, and perspectives

Science Content Standards

Physical Sciences 1.b: Matter is made up of atoms, which may…form molecules
Physical Sciences 1.h: Living organisms …are composed of…elements
Physical Sciences 1.i: Common properties of salts such as sodium chloride

Life Sciences 2.a: Many…organisms have… structures to support the transport of materials
Life Sciences 2.e: How sugar, water, and minerals are transported in a vascular plant
Life Sciences 2.f: Plants use carbon dioxide and energy from sunlight to guild molecules of sugar and release oxygen
Life Sciences 2.g: Plant and animal cells break down sugar to obtain energy…

Earth Sciences 3.a: Most of Earth's water is present as salt water in the oceans
Earth Sciences 3.b: When water evaporates, it turns into water vapor…
Earth Sciences 3.c: Water vapor…fog, clouds, rain (water cycle)
Earth Sciences 4.b: Influence of ocean on weather, and water cycle

Investigation and Experimentation 6.a: Classify objects
Investigation and Experimentation 6.b: Develop a testable question
Investigation and Experimentation 6.c: Plan and conduct simple investigation
Investigation and Experimentation 6.d: Variables
Investigation and Experimentation 6.e: Use of variables
Investigation and Experimentation 6.f: Selection and use of appropriate tools
Investigation and Experimentation 6.g: Make and interpret graphic representations of data
Investigation and Experimentation 6.h: Draw conclusions from evidence
Investigation and Experimentation 6.i: Write a report…

Grade Six

Social Studies Content Standards

6.1.1: Describe hunter-gatherer societies
6.1.2: Describe how humans adapted to…environments

Mathematics Content Standards

Statistics 2.1: Compare different samples of a population with data from the entire population
Statistics 2.2: Identify different ways of selecting a sample

English-Language Arts Content Standards

Writing 2.3: Write research reports

Science Content Standards

Earth Science 1.f: Features of California geology and plate tectonics
Earth Science 2.c: Beaches are dynamic systems…changed by waves
Earth Science 2.d: Landslides and floods change human and wildlife habitats

Physical Science 3.a: Energy can be carried from one place to another by…waves

Ecology (Life Science) 5.a: Energy enters ecosystems as sunlight…food webs
Ecology (Life Science) 5.b: Matter transferred between organisms and the physical environment in food webs
Ecology (Life Science) 5.c: Populations can be categorized by functions in ecosystem
Ecology (Life Science) 5.d: Different kinds of organisms may play similar ecological roles
Ecology (Life Science) 5.e: Numbers and types of organisms depends on abiotic factors

Resources 6.a: Consequences of energy resources
Resources 6.b: Types of energy and material resources
Resources 6.c: Origin of materials used to make common objects

Investigation and Experimentation 7.a: Develop a hypothesis
Investigation and Experimentation 7.b: Select and use tools to perform tests
Investigation and Experimentation 7.c: Construct graphs
Investigation and Experimentation 7.d: Communicate in written and oral presentations
Investigation and Experimentation 7.e: Recognize whether evidence is consistent with a proposed explanation
Investigation and Experimentation 7.f: Read topographic and geologic maps
Investigation and Experimentation 7.g: Interpret events by sequence and time
Investigation and Experimentation 7.h: Identify changes in natural phenomena over time

Appendix B: Glossary

Basic Vocabulary

Adaptation: a characteristic such as a body part or behavior that helps an organism survive

Alga (pl.: algae): a type of plant-like organism (protist) that doesn't bear seeds and does photosynthesize. Algae include one-celled organisms such as diatoms and dinoflagellates, multicellular fresh water algae, and marine algae sometimes called "seaweeds."

Camouflage: coloration or shape that enables an organism to hide by blending with the surroundings

Carnivore: an organism that mostly eats the flesh of other organisms

Current: water that flows within the ocean, sort of like a river within the ocean

Cycle: a series of events that lead back to the initial event

Decomposer: an organism that causes decay. Bacteria and fungi are examples of decomposers.

Ecology: the study of how organisms interact with the living (biotic) and non-living (abiotic) parts of their environment

Economy: a system of wealth and how it is used

Endangered species: a type of organism whose existence is threatened, especially by human actions

Environment: all living and non-living things in an area

Erosion: the wearing away of something, especially of land and rocks by wind and water

Evaporation: the movement of a liquid such as water from a liquid state into a gaseous state

Extinct: no individuals of the species are alive

Fertilizer: something which enriches the soil, promoting plant growth; generally refers to artificial chemicals applied by people to increase crop yields

Food chain: a sequence of organisms showing which organism is eaten by which other organism. It shows the direction of energy and matter transfer.

Food pyramid: a diagram in which the number or mass of organisms is arranged with the top carnivore at the top and the producers at the bottom, resulting in a pyramid shape with fewer top carnivores at the peak and many more producers at the base

Food web: an interconnected pattern of food chains. A network of organisms showing which organisms are eaten by which other organisms. It is a more realistic portrayal of what happens in an ecosystem than a food chain.

Glacier: a body of ice that doesn't melt away in the summer

Habitat: the place in which an organism lives

Herbivore: an organism whose food is primarily plant matter

High tide: one of the two daily periods when the ocean's water rises on a coast, especially the time at which the water is highest

Intertidal: the area between the high tide point and the low tide point

Kelp: a group of large brown algae

Larva (pl.: larvae): the immature form of some types of animal

Limiting factor: the thing (factor) that determines where an organism can live, e.g.: food, water, temperature, space, salinity, oxygen, etc.

Low tide: one of the two daily periods when the ocean's water falls on a coast, especially the time at which the water is lowest.

Marine: having to do with the ocean

Mean: midpoint between two extremes; average

Native: an organism or species found naturally in a place, not introduced or imported

Niche: the role of an organism in a community, its job

Nutrient: food, or materials that an organism needs to survive

Omnivore: an organism that feeds on both plants and animals

Organism: a living thing

Overpopulation: a condition in which there are more organisms in a place than it can support

Pesticide: a chemical used to kill pests

Photosynthesis: a process in which the sun's energy is captured in a chemical process. In photosynthesis, carbon dioxide and water are combined to produce carbohydrates such as sugars and starches, and oxygen as a byproduct.

Physical: non-living, the non-living (abiotic) part of an environment

Plankton: aquatic organisms suspended in the water or whose movement is not strong enough to move against currents

Pollution: chemicals or other factors such as heat that harm the environment, or the addition of harmful chemicals to the environment

Population: the number of a given kind of an organism in a place, or the organisms themselves

Predator: an animal that kills and eats other animals (adj.: predatory)

Prey: an organism that is killed and eaten by a predator

Respiration: a chemical process in which oxygen is used to release energy contained in foods such as sugars and starches, with carbon dioxide and water as waste products. (not the same as breathing, which is a physical process of taking air in and expelling gaseous wastes)

Runoff: water that runs off of the land, into a stream or other body of water

Salinity: the amount of salt, expressed as a percentage or parts per thousand, in a solution

Salt: minerals dissolved in water, especially sodium chloride (NaCl)

Sea level: the height of the surface of the sea, but usually refers to the average (mean) height of the surface of the sea

Sediment: particulate matter such as clay, mud, or sand that settles out of a solution or mixture

Sedimentation: the settling of particulate matter such as clay, mud, or sand, at the bottom of a body of water; often includes compression to form sedimentary rocks

Species: a type of organism; an organism is able to breed only with others of the same species

Tide: the periodic (twice a day) rise and fall of the earth's oceans (and atmosphere) due primarily to gravitational forces of the sun and moon

Tide pool: a pool of water left behind as the sea level falls (as the tide goes out)

Threatened species: a type of organism that is threatened with extinction, especially due to the actions of humans

Vertebrate: organism with a backbone or vertebral column

Zone: an area with particular characteristics, as in the splash zone along the coast

More Advanced Vocabulary

Abdomen: the part of the body that contains the digestive and reproductive organs

Abiotic: non-living, as in the physical parts of an environment such as the air, water, rocks, and light

Appendage: usually an arm, leg, or antenna of an organism; a body part extending out from an organism

Barbules: small hooks or barbs that connect the barbs on a feather's vane, giving it strength and flexibility while maintaining its shape

Bioluminescence: production of light by an organism

Biomass: the amount of living matter in a sample

Biotic: living, as in the living parts of an ecosystem

Blade: the leaf like part of an alga

Carrying capacity: the number of a kind of organism that an environment can support over a long period of time without damage to the environment

Centrifugal force: the apparent outward force resulting from the spinning of an object, or when two objects are turning around a point in space

Cephalothorax: a body region consisting of the head and thorax

Classification: the process of organizing things systematically, especially the organization of organisms into groups based on evolutionary relationships

Classify: see classification

Cnidocyte: a special type of cell found in certain organisms such as sea anemones, corals, and jellyfish. Contain nematocysts.

Common name: the name of an organism other than its scientific name

Community: a group of plants and animals and other organisms living in a place and depending on each other

Consumer: an organism that obtains its food by consuming other organisms (see producer)

Crest (of wave): the top portion of a wave

Detritus: particles of plant and animal matter

Diatom: microscopic protist with cell wall of silica

Dinoflagellate: microscopic protist with whip-like tails (flagella) used for locomotion

Ecosystem: a community of organisms and the physical environment in which they live

Estuary: an area where a stream enters the ocean and with significant mixing of salt and fresh water

Eutrophication: a condition in which aquatic nutrient levels increase, resulting in increased productivity (growth of plants and protists), which results in depletion of dissolved oxygen when the plants die

Exoskeleton: external skeleton of an arthropod, such as the shell of a crab or hard outer parts of an insect

Float: gas-filled bulb of some algae. The float helps keep the blades near the surface where they can have access to sun light for photosynthesis.

Genus: a group of closely related species of organisms

Gravitational: having to do with gravity

Gravity: the force which causes attraction between any two masses

Holdfast: the part of an alga that attaches it to the bottom

Indicator Organism: a type of organism that is found only in a particular habitat and is, therefore, an indicator of the biotic and abiotic conditions there

Invasive: an adjective describing a type of organism that invades an ecosystem, especially one that tends to take over and displace native species

Invertebrate: an organism without a vertebral column (backbone)

Littoral: along the shore

Mantle: the soft outer tissue of a mollusc, an extension of the dorsal body tissue; it secretes the shell and usually covers the gills

Mass: an amount of matter, or the measure of the amount of matter in an object

Mean sea level: average sea level

Microhabitat: a subdivision of a major habitat. For example, the various zones of the intertidal community could be considered subdivisions or microhabitats of the intertidal community. Further subdivisions are possible, for example, under a rock ledge, within an algal mass, or in a tide pool could be considered microhabitats.

Neap tide: a period of time in which the difference between high tide and low tide is at its minimum; occurs during the first and third quarters of the moon. See Spring tide.

Nekton: organisms that are active swimmers and are able to swim against the current

Nematocyst: a special type of organelle (cell part) found in certain organisms such as sea anemones, corals, and jellyfish. Nematocysts are used to sting and capture their prey.

Notochord: a dorsal rod-like supportive structure found in chordates (animals such as fish, reptiles, amphibians, birds, mammals, and some "primitive" chordates)

Phloem: tissue in a true plant that brings nutrients from the leaves down to the roots

Phytoplankton: photosynthetic plankton…plant plankton

Plate: a distinct large portion of the earth's crust

Plate tectonics: movement of the earth's crustal plates

Producer: an organism that uses light and simple chemicals to build complex chemicals, especially green plants and algae

Protist/Protista: one of the five kingdoms of organisms; includes the algae, diatoms, and dinoflagellates

Radula: the scraping or rasping tongue of many molluscs; used to scrape algae or bore into shells, etc. for feeding

Red tide: a period of time when certain toxin-producing dinoflagellates are especially numerous

Scavenger: an organism that feeds on dead organisms

Scientific name: the scientifically agreed upon name of a particular species of organism; includes both the genus (capitalized) and the species (epithet or trivial) (not capitalized) names, underlined or italicized; e.g.: *Homo sapiens*

Sedimentary (rock): rock formed by compression of small particles of clay, mud, sand, or gravel

Silt: fine particles of soil that settle out of suspension in water

Siphon: tube used by organisms such as clams to take water in or expel wastes

Specific heat capacity: a measure of the amount of heat energy that must be added to a gram of a substance to cause it to increase 1 degree (Celsius) in temperature. A substance with a high heat capacity, such as water, absorbs a lot of heat energy without changing temperature very much. A substance, such as sand or air, with a low heat capacity changes temperature a lot with a comparable amount of heat energy.

Spring tide: a time when the tides are at their highest and lowest; occurs with the new and full moons; see neap tide

Stinging cell: see nematocyst and cnidocyte

Stipe: the stem or stalk of a large alga; connects the blade(s) to the holdfast

Substrate: underlying structure or substance; that upon which something grows or lives

Subtidal: below the low tide zone (farther out to sea than the low tide zone)

Taxonomy: the science of classification. In biology, taxonomists attempt to classify or group organisms according to their evolutionary relationships.

Terrace: relatively level area of land; may be submerged or above sea level

Test: internal skeleton or "shell" of an organism such as a sea urchin or sand dollar

Thermal pollution: heat added to an environment, especially hot water dumped into a cold water system

Thorax: the portion of the body containing the heart and lungs; if an organism has appendages such as legs and wings, they are usually attached to the thorax

Tidal wave: see tsunami

Tide table: booklet or chart showing times and heights of high and low tides for each day

Toxic: poisonous

Trough (of a wave): lowest part of a wave

Tsunami: wave caused by an earthquake, usually an undersea earthquake. It may travel unnoticed while in the deep ocean and then build up to great heights in shallow water.

Upwelling: process in which water rises upward from deeper water, usually bringing nutrients from the bottom

Vascular: circulatory, as in our heart and blood vessels are our vascular system, while a plant's vascular system consists of its xylem and phloem

Wave: energy moving through a medium producing a disturbance, as a sound wave. Also refers to a ridge of water moving along the surface

Weather/weathering: wearing down of rocks by wind and water

Xylem: vascular tissue in a true plant; brings water and minerals from the roots to the leaves

Zonation: organization of plants and animals in a community into zones or bands where conditions for survival favor certain species

Zooplankton: animal plankton

Appendix C: Organizations and Agencies

Several of the resources listed below have good listings of organizations and agencies that deal with environmental or coastal issues. Since organizations frequently change addresses, phone numbers, or Internet addresses, the most recently published may be the most accurate. Listed below are some agencies that might be of particular interest. I have given the most recent information that I could find.

Organizations with a National or Worldwide Focus

American Cetacean Society
P.O. Box 1391
San Pedro, CA 90733-1391
310-548-6279
www.acsonline.org

American Oceans Campaign
725 Arizona Av., Suite 102
Santa Monica, CA 90401
310-576-6170

Center for Marine Conservation
1725 De Sales St, NW
Washington, DC 20036
202-429-5609
www.cmc-ocean.org

Cousteau Society
870 Greenbriar Circle,
Suite 402
Chesapeake, VA 23320
800-441-4395

Defenders of Wildlife
1130 17th St., NW
Washington, DC 20036
202-682-9400
www.defenders.org

Friends of the Sea Otter
125 Ocean View Blvd, Ste 204
Pacific Grove, CA 93950
831-373-2747
seaotter@seaotters.org

Greenpeace
75 Arkansas St.
San Francisco, CA 94107
415-255-9221
www.greenpeace.org/usa

National Audubon Society
700 Broadway
New York, NY 10003
212-979-3000
www.audubon.org

National Wildlife Federation
11100 Wildlife Center Dr.
Reston, VA 20190
800-822-9919
www.nwf.org

The Ocean Conservancy
1725 De Sales St., NW
Suite 600
Washington, DC 20036
202-429-5609
www.oceanconservancy.org

The Oceanic Society
Fort Mason Center
San Francisco, CA 94123
800-326-7491
www.oceanic-society.org

Save the Whales
1192 Waring Street
Seaside, CA 93955
831-899-9957
www.savethewhales.org

The Sierra Club
85 Second Street
San Francisco, CA 94109
415-977-5500
www.sierraclub.org

U.S. Fish and Wildlife Service
Public Affairs Office
1849 C St., NW, Room 3447
Washington, DC 20240
202-208-5634

U.S. Geological Survey
Marine and Coastal Issues
345 Middlefield Rd., MS999
Menlo Park, CA 94025
650-329-5042
marine.usgs.gov

Water Education Foundation
717 K Street, Suite 317
Sacramento, CA 95814
916-444-6240
www.watereducation.org

World Wildlife Fund
1250 24th St., NW
Washington, DC 20037
202-293-4800
www.panda.org

Organizations with a Focus on California

Adopt-A-Watershed
P.O. Box 1850
Hayfork, CA 96041
530-628-5334
www.adopt-a-watershed.org

Calif. Academy of Sciences
55 Concourse Drive
Golden Gate Park
San Francisco, CA 94118
415-750-7145
www.calacademy.org

Calif. Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105
800-coast-4u
www.coastforyou.org

Calif. Dept. of Conservation
Calif. Geological Survey
801 K Street, MS 12-30
Sacramento, CA 95814
916-445-1825
www.consrv.ca.gov

Calif. Dept. of Fish & Game
1416 Ninth St., 12th Floor
Sacramento, CA 95814
916-653-6420
www.dfg.ca.gov

Calif. Dept. of Water Resources
1416 Ninth St.
Sacramento, CA 95814
916-653-4791
www.dwr.water.ca.gov

Calif. Integrated Waste Management Board
Office of Integrated Education
1001 I Street, MS # 14-A
Sacramento, CA 95812
916-341-6000
www.ciwmb.ca.gov/schools

Calif. Regional Environmental Education Community (CREEC) Network (N. Coast Region)
Lake County Office of Education
1152 S. Main Street
Lakeport, CA 95453
707-263-7249
www.creec.org

California State Parks
1416 Ninth Street
Sacramento, CA 95814
800-777-0369
www.parks.ca.gov

Calif. State Parks Foundation
800 College Avenue
Kentfield, CA 94914
415-258-9975
www.calparks.org

The Marine Mammal Center
Marin Headlands
1065 Fort Cronkhite
Sausalito, CA 94965
415-289-7325
www.marinemammalcenter.org

Surfrider Foundation
P.O. Box 6010
San Clemente, CA 92674
949-492-8170
www.surfrider.org

Organizations with a Focus on the Central/North Coast of California

Coastal Watershed Council
P.O. Box 1459
Santa Cruz, CA 95061
831-464-9200
www.coastal-watershed.org

Cordell Bank National Marine Sanctuary
P.O. Box 159
Olena, CA 94950
415-663-0314
www.cordellbank.noaa.gov

Coyote Point Museum
1651 Coyote Point Drive
San Mateo, CA 94401
650-342-7755
www.coyoteptmuseum.org

Ecology Action
333 Front Street, Suite 103
Santa Cruz, CA 95061
831-426-5925
www.ecoact.org

Environmental Education Council of Marin
883 Fourth Street
San Rafael, CA 94901
415-485-4908
www.eecom.net

Farallones Marine Sanctuary Association
The Presidio
P.O. Box 29386
San Francisco, CA 94129
415-561-6625
www.farallones.org

Friends of the Dunes
P.O. Box 186
Arcata, CA 95518
707-444-1397
www.friendsofthedunes.org

Friends of Fitzgerald Marine Life Refuge
P.O. Box 451
Moss Beach, CA 94038
www.fitzgeraldreserve.org

Headlands Institute
G.G.N.R.A., Building 1033
Sausalito, CA 94965
415-332-5771
www.yni.org/hi

Lawrence Hall of Science
Marine Activities, Resources and Education (MARE)
U.C. Berkeley
Berkeley, CA 94720
510-642-5008
www.lawrencehallofscience.org

Marine Science Institute
500 Discovery Parkway
Redwood City, CA 94063
650-364-2760
www.sfbaymsi.org

Mattole Restoration Council
P.O. Box 160
Petrolia, CA 95558
707-629-3514
www.mattole.org

Mendocino Area Parks Assoc.
P.O. Box 1387
Mendocino, CA 95460
707-937-5397

Mendocino Environmental Center
106 West Standley Street
Ukiah, CA 95482
707-468-1660
www.mecgrassroots.org

Monterey Bay Aquarium
886 Cannery Row
Monterey, CA 93940
800-840-4880 or 408-648-4880
www.mbayaq.org

Monterey Bay National Marine Sanctuary
299 Foam Street
Monterey, CA 93940
831-647-4201
www.mbnms.nos.noaa.gov

N. Coast Environmental Cntr
575 H. Street
Arcata, CA 95521
707-822-6918
www.necandeconews.to

Point Reyes Bird Observatory
4990 Shoreline Highway
Stinson Beach, CA 94970
415-868-0655
www.prbo.org

Save Our Shores Marine Sanctuary Center
2222 East Cliff Drive, Suite 5
Santa Cruz, CA 95061
408-462-5660
saveoshore@aol.com

Save the Bay
1600 Broadway Av., Suite 300
Oakland, CA 94612
510-452-9261
www.savesfbay.org

Stewards of the Coast and Redwoods
P.O. Box 221
Duncans Mills, CA 95430
707-865-0180
www.stewardsofthe coastand redwoods.org

Appendix D: Resources

The **California Coastal Commission** has numerous resources, including free materials, video tapes, slide sets, posters, and others. Some are available in Spanish, and can be downloaded from their website. They also sponsor the annual Coastal Cleanup Day. Contact them at:

< **www.coastal.ca.gov** > or < **www.coastforyou.org** >

Books

Most Highly Recommended

Armstrong, Pam, ed. *Sea Searcher's Handbook*. Boulder, CO.: Roberts Rinehart, Publishers, 1996.

This book is an excellent combination of information and learning activities dealing with a wide range of marine topics. Sections (including "cards" describing organisms) on rocky and sandy shores, wetlands, kelp forest, open sea, deep sea canyons, groups of organisms, people and the sea, and more. It is produced by the good folks at the Monterey Bay Aquarium.

Berg, Alice. *Mendocino Coast Tidepool Guide*. Mendocino, CA: Mendocino Area Parks Association and the College of the Redwoods. (no date)

This pamphlet provides the very basic information on tidal zones and some common organisms of the tide pools in Mendocino County.

Cornell, Joseph. *Sharing Nature with Children.* Nevada City, CA: Dawn Publications, 1998.

A must-have collection of activities for teachers and parents who want their children to become more aware and appreciative of nature.

Davenport, Julia Copple. *Waves, Wetlands, and Watersheds: California Coastal Commission Science Activity Guide*. San Francisco: California Coastal Commission, 2003.

This free guide offers 3 science activities for each grade, from third through eighth, plus 4 more "Community Action Activities" for all grades. It also has several appendices, including an up-to-date listing of environmental organizations and programs. The Coastal Commission even offers training in the use of this resource.

Hedgpeth, Joel W. *Introduction to Seashore Life of the San Francisco Bay Region and the Coast of Northern California.* Berkeley: University of California Press, 1971.

Introduction to Seashore Life is the basic handbook for people who want to learn about northern California seashore life. It includes sections on the physical environment.

Lowrey, Lawrence F. *The Everyday Science Sourcebook – Ideas for Teaching in the Elementary and Middle School*. Palo Alto, CA.: Dale Seymour Publications, 1985.
This is an excellent collection of activities for teaching about science.

Rosenfeld, Anne. *The Intertidal Wilderness*. Berkeley, CA: University of California Press, 2002.
The subtitle for this book is "A Photographic Journey through Pacific Coast Tidepools." It includes a lot of information on tide pools, tide pool organisms and it is beautifully illustrated.

Science Framework for California Public Schools Kindergarten Through Grade Twelve. Sacramento: California Department of Education, 1990.
This Framework was written before the institution of state content standards, and it provides a very good outline of what to teach and also provides some suggestions re. how to teach science. All school teachers and administrators should be familiar with it, along with other Frameworks.

Snively, Gloria: *Beach Explorations: A Curriculum for Grades 5-10*. Sooke, British Columbia: Kingfisher Press, 2003.

or, depending on grade level,

Snively, Gloria. *Once Upon a Seashore: A Curriculum for Grades K-6*. Sooke, British Columbia: Kingfisher Press, 2001.
Snively's books provide lots of illustrations and a good combination of background information and activities.

Curricula

These three curricula require that the teacher take a training workshop. It is well worth it!

Project WILD and *Aquatic Project WILD*
Contact: California Project WILD coordinator at the California Department of Fish and Game < www.dfg.ca.gov/coned/projectwild >
These interdisciplinary conservation programs focus on wildlife and conservation.

Project WET
Contact: National Project WET (Water Education for Teachers) < projectwet.org >
Just as the name implies, this curriculum focuses on water, including the physical properties of water, its uses, importance, and conservation.

Other Resources

Consider these if you want additional resources or to do an extensive study of seashores.

Guides, Keys and Picture Books for Identification and Information

Braun, Ernest and Yinson Brown. *Exploring Pacific Coast Tide Pools*. Healdsburg, CA.: Naturegraph, 1966.
Lots of photographs and drawings

Connor, Judith. *Seashore Life on Rocky Coasts*. Monterey, CA: Monterey Bay Aquarium Press, 1993.
Very good pictures and info in a small booklet.

Conradson, Diane, ed. *The Natural History of the Fitzgerald Marine Reserve*. Moss Beach, CA.: Friends of Fitzgerald Marine Life Refuge, 1999.
Lots of information on plants and animals of the rocky central California coast, including many photographs and drawings.

Kozloff, Eugene. *Seashore Life of the Northern Pacific Coast*. Seattle: University of Washington Press, 1983.
Many good pictures, both color and black and white, and good discussions of the various organisms.

Light, S.F., revised by Smith et al. *Intertidal Invertebrates of the Central California Coast*. Fourth printing with corrections: Berkeley, CA: University of California Coast, 1989.
This is the classic resource for identifying (keying) organisms of the central California Coast. Probably useful only to those who are seriously interested in identifying organisms.

Marine Plankton Primer. Newport Beach, CA: Martek Instruments, Inc., 1969
This primer is a simple and basic resource on plankton. It has about 5 pages of information on plankton and their collection and study, and 4 pages of simple drawings of common planktonic organisms.

McConnaughey, Bayard and Evelyn McConnaughey. *Audubon Society Nature Guide to the Pacific Coast*. New York: Alfred A. Knopf, 1985.
Tons of information, including many photographs. Regarding scientific detail, it's in between Hedgpeth's *Introduction to Seashore Life* and Ricketts and Calvin's *Between Pacific Tides*.

Morris R.H., et al. *Intertidal Invertebrates of California*. Stanford, CA: Stanford University Press, 1980.

Excellent resource for people who are serious about learning about intertidal invertebrates. Expensive and out of print. Maybe ask the local library to order it through Amazon?

Niesen, Thomas. *Beachcomber's Guide to California Marine Life*. Houston: Gulf Publishing Company, 1994.

Good information, drawings, and photographs of coastal organisms…San Francisco south to San Diego, but includes many that occur north of San Francisco, too.

Ricketts, Edward and Jack Calvin. *Between Pacific Tides*. Stanford, CA: Stanford University Press, Fifth Edition: 1985.

This is the classic reference on tide pool life of the Pacific coast. Fans of Steinbeck will recognize Ed Ricketts.

Smith, Lynwood. *Common Seashore Life of the Pacific Northwest*. Healdsburg, CA: Naturegraph Company, 1962.

Similar to *Exploring Pacific Coast Tide Pools*, by Braun and Brown.

Video Tapes and DVDs

There are many well done video tapes and DVDs on intertidal communities. Those listed below are available from one or more of the sources listed in Appendix E. Examples include:

Biology of Seashores (originally a laserdisc, now reformatted in VHS format, with teacher's guide available for downloading). 2004. BioMedia Associates: P.O. Box 1234 Beaufort, S.C. 29901. phone 877-661-5355. < ebiomedia.com/prod/seasEdge.htm. >

Eyewitness Seashore (video). Dorling Kindersley. 375 Hudson St., New York, NY 10014. phone: 800-788-6262.

Worlds Below, A Wondrous Video Journey into the Undersea Worlds of California's Monterey Bay (video). Sea Studios, Inc. 810 Cannery Row, Monterey, CA. 93940. phone: 831-649-5152.

The World Between the Tides (video and DVD). Hatzoff Productions. P.O. Box 9465, Seattle, WA. 98109. 206-284-5577. < info@videotravelogues.com > or Earthwise Media: < earthwisevideos.com >

Curriculum and Activity Resources

Brown-Babcock, Maria. *Save Our Seas*. San Francisco: Center for Marine Conservation and the California Coastal Commission: 1993.
This is a collection of activities to teach students, grades K-12, about problems associated with marine debris.

Brown, Philip. *Exploring Tidepools*. San Luis Obispo, CA: EZ Nature Books, 1994.
A variety of activities, written and illustrated in a simple style

Castaldo, Nancy. *Oceans: An Activity Guide for Ages 6-9*. Chicago: Chicago Review Press, 2002.
Activities, many of them "artsy," for both in and out of the classroom

Cornell, Joseph. *Sharing the Joy of Nature*. Nevada City, CA. Dawn Publications, 1989.
This sequel to *The Joy Of Nature* provides more activities for people of all ages.

Gartside, Ellen. *Curriculum Guide for the James V. Fitzgerald Marine Reserve*. Moss Beach, CA.: Friends of Fitzgerald Marine Life Refuge, 1999.
Activities and information about organisms at Moss Beach, in San Mateo County

Littlefield, Cindy. *Awesome Ocean Science*. Charlotte, VT: Williamson Publishing Co., 2003.
Activities for younger children for classroom or home

Prime Science, Raising the Standard, Level C. Dubuque, IA: Kendall Hunt Publishing Company, 1998.
This is a junior high school curriculum that integrates earth, life, and physical sciences. It is based on an English curriculum that has been adapted for use in the U.S.A.

Roa, Michael. *Environmental Science Activities Kit*. West Nyack, N.Y.: Center for Applied Research in Education, 1993.
This is a collection of activities that can be used to teach about a wide variety of environmental issues, including ways to work towards solutions. Several of the activities in this Guide are adapted from this book.

Sly, Carolie, *et al*. Water *Wisdom - A Curriculum for Grades Four Through Eight*. Hayward, CA: Alameda County Office of Education, 1990.
This curriculum guide provides activities to help teach about water conservation.

Other References Used in This *Guide*

Alt, David and Donald Hyndman. *Roadside Geology of Northern California.* Missoula, Montana: Mountain Press Publishing Co., 1975.
Describes the geology and geological history along most of the main highways in California

Berlitz Cantonese Chinese Phrase Book & Dictionary. Singapore: Berlitz Publications, 2003.

Borror, Donald. *Dictionary of Word Roots and Combining Forms*. Palo Alto, CA: N-P Publications, 1960.
An inexpensive but good source for word roots, with an emphasis on science terms.

Carvajal, Carol and Jane Horwood, ed. *Oxford Spanish Desk Dictionary*. New York: Oxford University Press, 1997.

Gross, M. Grant. *Oceanography, A View of the World*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.
This is a commonly used text book on general oceanography.

Helfer, Jacques. *The Natural History of Mendocino*. Mendocino, CA: published by the author, 1970.
Nicely written and illustrated, mostly terrestrial, but some coastal information

Hinkel, Eli. *Barron's Russian Vocabulary*. Hauppauge, N.Y.: Barron's Education Series Publisher, 1994

Jeger, Edmund, ed. *A Source-Book of Biological Names and Terms*. Springfield, IL: Charles C. Thomas, Publisher, 1955.
Good source of the origins of biological terms

Lawlor, Elizabeth. *Discover Nature at the Seashore - Things to Know and Things to Do*. Harrisburg, PA: Stackpole Books, 1992.
Doesn't try to tell about everything…goes into a little depth on plants and animals of rocky shores, salt marsh, and sandy beach.

McArthur, David S. "Sea Level." *World Book Encyclopedia*. Chicago: World Book, Inc., 1993.

Merriam, C. Hart. *Indian Names for Plants and Animals Among Californian and Other Western North American Tribes*. Socorro, N.M.: Ballena Press, 1979.
This book gives the names of many plants and animals in many different Native American languages.

Morris, William, ed. *Grolier International Dictionary*. Vol. 2. Danbury, CN.: Grolier, Inc., 1981.

Prowe, Gunhild and Jill Schneider. *Oxford German Dictionary*. New York: Berkley Books, 1997

Steinhart, Peter. *California's Wild Heritage - Threatened and Endangered Animals in the Golden State*. Sacramento, CA: California Department of Fish and Game, 1990.
This book provides pictures and information about more than 100 of California's threatened and endangered animals, grouped by region. An excellent resource. It used to be free to teachers.

Thelander, Carl G., ed. *Life on the Edge - A Guide to California's Endangered Natural Resources: Volume 1: Wildlife*. Santa Cruz, CA.: BioSystems Books, 1994.
This large reference book provides great photographs of many endangered animals as well as both cultural and natural history.

Zottoli, Robert. *Introduction to Marine Environments*. Saint Louis: C.V. Mosby Co., 1973.
Written for advanced high school and college students, provides background information on abiotic factors and habitats

Appendix E: Sources of Books and Other Materials

Books

There are, of course many excellent sources of books.

- One can often find great bargains on Internet sources such as Amazon and eBay.
- You might want to join with other teachers or even other schools to create a library of resources for coastal studies.
- Public libraries often appreciate requests from teachers so that they can spend their limited budgets on books that will be used.

Acorn Naturalists: A source for natural history books and other materials, including plastic fish replicas for fish print making, books, and videos.
155 El Camino Real, Tustin, CA 92780
phone: 800-422-8886
< **www.acornnaturalists.com** >

Coastal towns such as Mendocino and Fort Bragg often have bookstores with a good selection of books on local natural history.

Some state and federal agencies, including the California Coastal Commission, have excellent resources.

Many parks, including several on the coast, have visitor centers where books and other resources can be purchased.

Science Education Materials

The list below is not complete, but includes most major supply houses. For more, do an Internet search for "science supply houses."

Arbor Scientific < www.arborsci.com >

Carolina Supply < www.carolina.com >

Delta Education < www.delta-education.com >

Edmund Scientific < www.scientificsonline.com >

Fisher Scientific < www.fischersci.com >

Flinn Scientific < www.flinnsci.com >

Sargent-Welch < www.sargentwelch.com >

Science Kit and Boreal Laboratories < www.sciencekit.com >

Wards Natural Science < www.wardsci.com >

Other

Dick Blick Art Materials (one source for rubber fish for fish prints)
P.O. Box 1267, Galesburg, IL 61402-1267
phone: 800-828-4548
< www.dickblick.com >