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Exploring the islands: An educator's manual for teaching primary students about the Channel Islands

Debra Jean Everton

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EXPLORING THE ISLANDS:
AN EDUCATOR'S MANUAL FOR TEACHING
PRIMARY STUDENTS ABOUT
THE CHANNEL ISLANDS

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education: Environmental

by
Debra Jean Everton
September 1994
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Debra Jean Everton
September 1994
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Abstract

The purpose of this project was to create an educator’s manual for primary teachers interested in teaching about the Channel Islands and to offer background knowledge and activities for classes visiting Channel Islands National Park. Constructivist teaching, as an approach to teaching environmental education, is integrated into each subject area of the teacher’s manual. The primary teacher’s manual includes information and activities related to island geography, marine mammals, tides and the intertidal, kelp forests, and protecting the resources of Channel Islands National Park.
Introduction

World citizens came together for the first Earth Day in 1970, more than 20 years ago. The 20-year anniversary of Earth Day in 1990 spawned reaffirmation of the level of concern and significance of the human role in the natural world. It symbolized the problematic interactions between the quality of life and the quality of the environment for the planet's inhabitants. And once more, the world looked to its educational system for answers (Ramsey, Hungerford, & Volk, 1992).

The defense and improvement of the environment on behalf of the present and future generations of all living things has become an imperative educational goal according to Ramsey, Hungerford and Volk (1992). The message of Earth Day is that each individual must recognize and accept this goal and become an active participant in working towards its achievement. Because education is the vehicle through which society prepares its citizens to carry out their responsibilities, education must be environmental.

Effective environmental education (EE) emphasizes the links between the actions of today to the consequences of tomorrow.

The educator's manual, "Exploring the Islands" was created to offer teachers and their students background knowledge and activities about the Channel Islands and to promote their participation in preserving the unique ecology
of the islands. The background knowledge introduces some of the natural resources of Channel Islands National Park. The activities promote basic study skills and critical thinking. This manual is one of a series of educator's programs at Channel Islands National Park.

Significance of the Project

At the close of the World's First Intergovernmental Conference on Environmental Education in Tbilisi, Georgia, USSR, a document known as the Tbilisi Declaration was adopted by acclamation. A recommendation of this document was that environmental education "should bring about a closer link between educational processes and real life, building its activities around the environmental problems of a particular community" (Engleson, 1985, p. 76). All global problems arise locally somewhere, and almost any environmental issues can be interpreted in a global context. Interpreting local issues in a global context can provide a link between teaching local and global environmental issues. Another rationale for teaching students about local resources is that "the local, immediate benefits of solutions to environmental problems are powerful examples to help empower students" (Schaefer, 1992, p. 5).
Statement of Needs

Channel Islands National Park is an extraordinary place. It is the home of over 128 endangered or threatened animals and plants. The animals, plants, and human history of the islands need to be protected and preserved so that future generations can experience them.

This project was designed to aid teachers and their students in learning more about a local natural resource. It is hoped that by using "Exploring the Islands," teachers and their students will be enlightened and excited about the wonders of Southern California's only national park. It is desired that this excitement will promote efforts in preserving the resources of this ecologically diverse area.
Program Plan

Goal: To increase the learning for kindergarten through second grade students visiting Channel Islands National Park (CINP).

Objective: To develop a manual for educators interested in teaching primary students about CINP.

Title: Educator Manual Development

Strategies: Teacher will dialog with Park Rangers to establish needs.

Teacher will research natural resources of CINP.

Teacher will review the way students learn.

Teacher will write manual.

Review by Park Rangers at CINP.

Measure: The educator’s manual will be available for field-testing in September 1994 (after master’s project is completed).
Review of Related Literature

In the review of related literature, environmental education (EE) is defined. The goals and categorical objectives of effective EE are outlined. A brief summary of legislation supporting EE is given. The last section of the review of related literature connects constructivist teaching to EE.

Defining Environmental Education

Many definitions of environmental education have been formed. In October 1977, the World's First Intergovernmental Conference on Environmental Education, organized by UNESCO in cooperation with the United Nations Environment Programme, convened in Tbilisi, Georgia, USSR. At the close of the conference, the Tbilisi Declaration was adopted by acclamation. Included in the Tbilisi Declaration was the following description of EE:
Environmental education should be provided for all ages, at all levels and in both formal and nonformal education. Environmental education, properly understood, should constitute a comprehensive lifelong education, one responsive to changes in a rapidly changing world. It should prepare the individual for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values. By adopting a holistic approach, rooted in a broad interdisciplinary base, it recreates an overall perspective which acknowledges the fact that natural environment and man-made environment are profoundly interdependent. It helps reveal the enduring continuity which links the acts of today to the consequences for tomorrow (Engleson, 1985, pp. 74-75).

More than 15 years later, John Disinger gave a similar definition of EE in the First Report of the National Advisory Council on Environmental Education:

Environmental education is the interdisciplinary process of developing a citizenry that is knowledgeable about the total environment — including both its natural and built aspects — that has the capacity and the commitment to engage in inquiry, problem-solving, decision-making, and action that will assure environmental quality (1993, p. 20).

While other definitions vary in length and focus, the following unifying themes underlie all of them. Firstly, effective environmental education includes the development of awareness, knowledge, attitudes and skills necessary to take thoughtful, positive action toward the resolution of environmental issues and problems. Secondly, all processes
which sustain life on this planet are interconnected, and each individual's personal actions have an impact, not just on the immediate locale, but on the entire ecosphere as well.

Goals of Environmental Education

Engleson, in *A Guide to Curriculum Planning in Environmental Education*, stated that "a goal statement describes in general terms a desirable condition to be achieved by certain actions" (1985, p. 5). Similar to defining EE, goals of the subject have also been stated in many different ways. These goals were stated as simply as "responsible environmental behavior" (Ramsey, 1993, p. 31) or "to assist learners of any age in developing awareness, knowledge, and commitment to result in informed decisions, responsible behavior, and constructive actions concerning wildlife and the environment" (Western Regional Environmental Education Council, 1983, p. viii). A generic goal of EE, according to Kalinowskii, is "to help students become environmentally aware, knowledgeable, skilled, and dedicated citizens who are committed to work, individually and collectively, toward achieving and maintaining a dynamic equilibrium between the quality of life and the quality of the environment" (1990-1991, p. 8).

A more specific goal statement as the desired outcome of an EE program, in grades kindergarten through high school, follows:
The goal of environmental education is to help students become environmentally knowledgeable, skilled, dedicated citizens who are willing to work, individually and collectively, toward achieving and maintaining a dynamic equilibrium between the quality of life and the quality of the environment (Engleson, 1985, p. 5).

In order to achieve the goals of EE, a number of specific actions are required. These actions should be established as program objectives that act to guide the teaching-learning process.

Objectives of Environmental Education

Environmental education should combine a strong environmental science emphasis with a multidisciplinary approach. Because of the breadth and depth of environmental concepts and their dispersion throughout the curricula, categories of environmental objectives in general terms, rather than specific, are usually given. This method is consistent with the Tbilisi Declaration which lists the categories of EE as follows:

Awareness - to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.
Knowledge - to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.
Attitudes - to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
Skills - to help social groups and individuals acquire the skills for identifying and solving environmental problems.
Participation - to provide social groups and
individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems (Engleson, 1985, p.77).

Stoner and Overbey (1989) listed objectives of EE as promoting awareness, appreciation, understanding and knowledge of the interrelationship between one's self and one's total environment. These objectives are consistent with the Tbilisi Declaration objectives.

Legislation Supporting Environmental Education

The Environmental Education Act of 1970, Public Law 91-516, was the first major United States legislative act directly addressing the issue of EE (Engleson, 1985). This law was funded through 1975. In October 1975, UNESCO organized an international workshop on EE in Belgrade, Yugoslavia. This workshop produced a statement of "needs, goals, objectives, and guiding principles for developing environmental education programs, The Belgrade Charter" (Engleson, 1985, p. viii). Following the meeting, six regional workshops were held in 1976 to discuss The Belgrade Charter and its recommendations.

One year later, in October 1977, another conference organized by UNESCO occurred. The World's First Intergovernmental Conference on Environmental Education was held in Tbilisi, Georgia, USSR. This conference produced the Tbilisi Declaration which was a "refined statement of needs, goals, objective categories, and guiding principles
for environmental education program development" (Engleson, 1985, p. viii). The Tbilisi Declaration is accompanied by an extensive set of recommendations, one of which encouraged each nation to hold its own national leadership conference on EE.

In March 1978, five months after the meeting in the USSR, the National Leadership Conference on EE took place in Washington, D.C. At the conference, the report From Ought to Action in Environmental Education was produced. This report encouraged educators to clarify the goals and objectives of EE and "to utilize the total environment in all curriculum areas in program development and implementation" (Engleson, 1985, p. viii). It also included recommendations targeted to groups at national, state and local levels.

The First National Congress for Environmental Education Futures: Policies and Practices brought together more than 30 EE organizations in August 1983. The purpose of this meeting was to assess the effect and degree of implementation of the recommendations of the 1978 National Leadership Conference. The result was another report containing new recommendations for EE actions including a proposal for similar meetings at no less than five year intervals (Gustafson, 1983). However, for the next decade following the meeting of the Congress there was "a noticeable gap in federal support for EE" (Marcinkowski,
Finally, on November 16, 1990, President Bush signed into law the National Environmental Education Act. Marcinkowski states that this was a "truly a historic occasion for the field of EE because it marked a renewal of federal commitment to EE" and that the gap of the previous 10 years would "be partially filled through the provisions of this new act" (1990-1991, p. 7). The law consists of 11 sections. In Section 2, the act established the following comprehensive policy:

It is the policy of the United States to establish and support a program of education on the environment, for students and personnel working with students, through activities in schools, institutions of higher education, and related educational activities, and to encourage post-secondary students to pursue careers related to the environment (Marcinkowski, 1990-1991, p. 7).

The remaining sections of the document established the mechanisms through which this policy would be implemented. For example, Section 4 established the National Office of Environmental Education within the Environmental Protection Agency. The Office serves a variety of roles including support, development, and dissemination of model curricula, educational materials, and training programs for elementary and secondary students (Klein & Merritt, 1994).

Public support for the environment and for the resolution of its allied problems has steadily grown over
the 1970's and the 1980's, and by all appearances, has remained relatively stable in the 1990's. With the advent of the National Environmental Education Act, the United States has a national policy statement that is intended to serve both general education and professional education purposes (Marcinkowski, 1992).

Constructivist Teaching in Environmental Education

Constructivism has been described as consisting of two main hypotheses. The first hypothesis is "knowledge is actively constructed by the cognizing subject, and not passively received from the environment." The second hypothesis is "coming to know is an adaptive process that organizes one's experiential world; it does not discover an independent, pre-existing world outside the mind of the knower" (Lerman, 1989, p.11). Environmental education and constructivism require students to take an active role in learning and building on factual knowledge to improve investigation and critical thinking skills (Klein & Merritt, 1994).

According to Klein and Merritt (1994, p.16), there are four main components of a successful constructivist lesson or unit. As identified for the classroom teacher, these four components are: "(a) introduction of a real-life problem by the students or the teacher for the students to resolve; (b) student-centered instruction facilitated the teacher; (c) productive group interaction during the
learning process; and (d) authentic assessment and demonstration of student progress."

At the beginning of a lesson or unit, the teacher or students pose a question or real-life problem for students to investigate. All lessons in EE focus on real-life problems such as land use, global warming, and the effects of water pollution on human and wildlife habitats. After the problem has been presented to students, they must take initiative and risks in attempting to solve the problem. As students engage in investigating problems, they are responsible for making sense of their world and constructing new relationships (Klein & Merritt, 1994).

The second component of constructivism according to Klein and Merritt (1994) was that instruction should be student-centered, facilitated by the instructor. Students should be actively engaged in classroom learning tasks such as experimentation, investigation, observation, and discussion.

Peer interaction is an essential step in the learning process. Klein and Merritt stated productive group interaction as the third component of constructivism. They elaborate on this position by saying that "for learners to practice new skills, they must interact with their peers" and that "explaining or defending views stimulates learning" (1994, p. 16).

Klein and Merritt (1994) stated that the last component
of constructivism is authentic assessment of student progress. In their view, authentic assessment in a constructivist learning environment pairs the student and teacher as a team that examines the new knowledge and habits of mind. The students should have an active role in the process of assessment, and effective assessment should be integrated into instruction. Rather than including multiple-choice tests or short answer questions, EE should list processes and skills consistent with the lesson and give suggestions of extension options such as open-ended questions. Teachers and students should create portfolios of student progress including items such as: video or audio tapes of presentations by students, position papers on environmental problems, checklists of student interaction skills or science process skills, answers to open-ended questions, and anecdotal notes (Klein & Merritt, 1994).
Conclusion

Environmental education is becoming a necessary component in quality education. Although there has been legislative support for EE, many students are not receiving education relating to their local environments. Many visitors to Channel Islands National Park come without sufficient preparation. This project was designed to make readily available to kindergarten through second grade teachers in Ventura County information and activities about this local resource. Constructivist teaching as an effective approach to teaching EE was utilized. This project will help fill the need of Ventura County educators to teach a curriculum based on a rich local environment.
Appendix: Exploring the Islands: An Educator’s Manual for Teaching Primary Students About the Channel Islands
THE CHANNEL ISLANDS

Exploring the Islands

U.S. Department of the Interior
National Park Service
Channel Islands National Park
Acknowledgements

Many people have contributed to the development of this series of educator's manuals, "The Channel Islands." Numerous hours of volunteer time and work time have been offered to make this manual exciting and useful to both students and teachers. Special recognition must be given to the following people for their help with the primary manual, "Exploring the Islands."

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Channel Islands National Marine Sanctuary:
Los Marineros Curriculum Guide

Santa Barbara Museum of Natural History
Exploring Tidepools
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  • Lesson 5: Kelp Forests
  • Lesson 6: Resource Protectors
  • Lesson 7: Putting It All Together
Setting Up A Group Visit At Channel Islands National Park

A visit to the Channel Islands National Park Visitor Center can be a rewarding experience for your students. The staff at Channel Islands National Park would like to help you get the most out of your experience. The best way to do this is to make a reservation so that there will not be another group at the visitor center when you are there.

Reservations:

For reservations, call (805) 658-5730, and ask for the Visitor Center Supervisor. You will be asked for the date you would like to bring your group, what time you would like to arrive, how many students and adults will be in your group, (we prefer a 10:1, pupil:adult ratio), your school name, address, and phone number, and what kind of visit you would like.

There are two kinds of group visits at Channel Islands National Park.

Self-guided Visit:

- gather in the outdoor amphitheater (see A on the accompanying map)
- five to ten minute orientation by a Park Ranger
  - explaining why Channel Islands is a National Park
  - the rules of the Visitor Center
- 23-minute-long film, "A Treasure In The Sea"
  - in the auditorium (B on map).
- observation tower (C on map)
  - half of group if larger than 20 people
  - ocean displays in the stairwell
  - telescopes at the top of the tower
  - teacher designates amount of time (10-15 minutes suggested)
- museum area (D on map)
  - half of group if larger than 20 people
  - view the exhibits, including a marine life display
  - bookstore (optional)
  - teacher designates amount of time (10-15 minutes)
• self-guided activity
  - refer to the "Visitor Center Activities" listed in this manual

**Formal Visit:**

• the same as a self-guided visit
• addition of a 20 to 30 minute Park Ranger program after the movie.
  - refer to the "Ranger Program" described in this manual
  - tell the Visitor Center Supervisor which ranger program you would like when you call for your reservation.
  - programs are offered based on ranger availability

<table>
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<th>Formal Visit</th>
<th>Time</th>
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<tr>
<td>Ranger Orientation</td>
<td>Ranger Orientation</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Park Movie</td>
<td>Park Movie</td>
<td>23 minutes</td>
</tr>
<tr>
<td>Self-guided Activity</td>
<td>Park Ranger Program</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Museum and Tower</td>
<td>Museum and Tower</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>

**Bus Stop:**

Please tell your bus driver to stop the bus at the bus stop located next to the beach parking lot (E). Do not stop in front of the Visitor Center as this is a "No Stopping" area and a safety hazard. Your group can walk the short distance to the Visitor Center without crossing a street. The bus may be parked in the beach parking lot.

**Picnic Area:**

There are picnic tables on the back deck (F) of the Visitor Center. Feel free to use the tables at any time. Groups have also used the beach area for picnics.
**Bookstore:**

There is a bookstore (G) in the Visitor Center with educational materials for all ages. A list of materials on the topic of this curriculum is in this manual. Please encourage the students to think about tax and how much money they have before they bring their purchases to the counter. There is a listing of books available at the Visitor Center that apply to teachers and students.

**Discipline:**

You are responsible for the discipline of your group. A ratio of 1 adult to 10 students is recommended. Misbehavior by students will not be tolerated and students will be asked to leave. Please follow all the safety rules the Park Ranger describes in the orientation.

**Questions:**

Please do not hesitate to call the Channel Islands National Park Visitor Center, at (805) 658-5730, if you have any questions about group visits, the Visitor Center, or Channel Islands National Park.
Lesson 1: Island Geography

Objective

Students will become familiar with the five northern Channel Islands, map their location, and identify specific characteristics that are a part of the Channel Islands' unique ecosystem.

Vocabulary

Islet - a very small island.
Coreopsis sp. - a plant with daisy-like flowers and a thick, wood-like stem.
Endangered - threatened with extinction.
Ecosystem - a system made up of a community of plants and animals, and their interaction with the environment.
Channel Islands - an island chain of eight islands located off the coast of Southern California.
Endemic - found only in a certain place.
Terrace - a nearly level strip of land with descending sides, located near the coast.
Lagoon - a small area of shallow water that is occasionally open to the ocean.
Caliche - sand and mineral castings formed around plants roots and stems.
Diversity - a variety of things.
Pinnipeds - a group of sea mammals that includes seals, sea lions and walruses.
Extinction - the process of dying out or no longer existing.
Channel Islands National Park - a national park made up of the five northern Channel Islands and their surrounding one nautical mile of ocean.
Ecology - the study of relationships between living things and their environment.
Background

Eight islands lie off the coast of southern California. On clear days, these islands are visible from the mainland. To many people, the islands are just jagged rocks rising from the sea. Upon closer examination, the islands reveal their wealth of history and nature. This lesson will introduce the riches of the islands and their surrounding area.

What is an island? Mountain peaks surrounded by water is an appropriate description. A complex and jumbled geologic history has shaped the mountain peaks that make up the Channel Islands. Fourteen million years of volcanic eruptions, earthquakes, ice ages, and ocean sedimentation have produced the present island geography.

During the last Ice Age the northern Channel Islands were linked together to form one vast island geologists call Santarosae. The sea level was then much lower, and large areas of today's seabed were dry. Later, when the great continental ice sheets melted and the sea level rose, the islands were separated. Today, these northern islands, Anacapa, Santa Cruz, Santa Rosa, and San Miguel, lie east to west, parallel to the mainland coast.

The southern Channel Islands are linked geologically with Mexico. As the tectonic plates of the earth continue to move, San Clemente, Santa Catalina, San Nicolas, and Santa Barbara drift northward.

Geologists believe no land bridge to these islands ever existed. Isolation from the mainland helped form the Channel Islands unique character. The plants and animals are similar to those on the mainland, but thousands of years of isolation in unique island environments have resulted in size, shape, or color variations among some plants and animals.
A complicated system of ocean currents contribute to the diversity of life surrounding the islands by mingling cold water with warm. Both cold and warm water species of plants and animals are found in the resulting mix. Giant kelp forests, growing in relatively shallow water around the islands, provide an environment for other living creatures in the same manner as trees do in a terrestrial forest.

The natural resources of the islands and surrounding waters have beckoned to people throughout history. Seafaring Indians plied the Santa Barbara Channel in swift, seaworthy boats called tomols. The Chumash, or "island people," had villages on the northern islands. Evidence that human use began as early as 11,000 years ago has been found on the northern islands. The southern islands were home to the Gabrieliño, or Tongva people. These island cultures traded with mainland people for goods and services not available to them on the islands. In exchange, the island people provided fish, shellfish, seabird eggs, and sea mammals to the mainland.

Europeans were introduced to the island resources when Juan Rodriguez Cabrillo sailed through the Santa Barbara Channel in 1542. Cabrillo wintered on an island he called San Lucas (San Miguel or possibly Santa Rosa Island). The Spanish laid claim to the area but didn't effectively impact the area until the late 1700s. Subsequent explorers included Sebastian Vizcaino, Gaspar de Portola, and English Captain George Vancouver, who in 1793 fixed the present names of the islands on nautical charts.

Beginning in the late 1700s, and on into the 1800s, Russian, British, and American fur traders searched the islands' coves and shorelines for sea otter. Because its fur was highly valued, the otter was hunted almost to extinction. The Spanish, in an effort to protect their land claim and bring Christianity to native people, established missions along the mainland coast. Interaction between Europeans and Natives exposed the island people to European diseases and culture, forever altering their way of life.
By 1853, when California became a state, sealing and ranching were established. The Santa Cruz Island ranch produced sheep, cattle, honey, olives, and some of the finest early California wines. In the late 1800s the ranch on Santa Rosa Island was a major supplier of sheep to Santa Barbara and Los Angeles County markets. Sheep ranching was also established on San Miguel, Anacapa, San Nicolas, and San Clemente. Santa Barbara Island was cultivated. Santa Catalina soon became an established recreation destination with mining becoming a year-round economic mainstay.

In 1932 the U.S. Lighthouse Service - later the U.S. Coast Guard - began its stay on Anacapa Island. The U.S. Navy assumed control of San Miguel, San Nicolas and San Clemente Islands during World War II.

A series of federal and landowner actions have helped preserve these islands. Federal efforts began in 1938, when President Franklin D. Roosevelt proclaimed Santa Barbara and Anacapa Islands as Channel Islands National Monument. In 1976 a U.S. Navy and National Park Service agreement allowed supervised visits to San Miguel Island. In 1978 a conservation partnership between the Nature Conservancy, a national nonprofit conservation organization, and the Santa Cruz Island Company provided for continued protection, research, and educational use of most of the privately-owned Santa Cruz.

Finally, in 1980, Congress declared the four northern islands, Santa Barbara Island, and the waters for one nautical mile around each as our 40th national park. The park was selected as an "Inventory and Monitoring" park. Park Rangers monitor species of plants and animals, air and water quality, soils, visitors, and weather to determine the present and future health of the park. Also in 1980, the ocean six miles out around each park island was declared a National Marine Sanctuary.

Suggested Activities

Geography/Mapping

• On a bulletin board, prepare a large map of the coastline from approximately Point Conception to Port Hueneme. Identify
longitude and latitude markings. Show where your school is located. Include any other identifying cities and locations on the mainland that will personalize the map for the students.

- Use the activity maps following the resource list to make either cutouts or scaled drawings of the islands. Place them in the correct position on the bulletin board. Label each island and the Santa Barbara Channel. As your study progresses, add symbols to the map.

- Using the maps, have each student cut out each island and place on construction paper in the proper positions.

Art / Salt Dough Maps

Do the same activity as above, but create salt dough maps of the islands and surrounding areas.

Language Arts

Make copies of the "Island Booklet" for each student. Use these during reading time or assign as home reading. Have the students write about their reading in their daily writing journals or in a special writing book about the Channel Islands.

On-Site Activities

After studying the island exhibits in the breezeway at Channel Islands National Park, walk across to Harbor Cove Beach and create the Channel Islands chain in the sand. Have groups of five to six students each work on building one sand island. Encourage students to make the islands as realistic as possible and be sure to build the islands in the correct relationship to each other.

Resources

Books:


*Howorth, Peter C. 1982. Channel Islands, the Story Behind the Scenery. KC Publications. ISBN 0-916122-75-1

Picture Books:


Coloring Books:


Videos:

*A Treasure in the Sea: Channel Islands. 1982. Harpers Ferry Historical Association, Inc.

Curriculum Guide:

*Indicates resources available for purchase at the Southwest Parks & Monuments Association Bookstore located in the Channel Islands National Park Visitor Center, 1901 Spinnaker Drive, Ventura.
Lesson 2: Marine Mammals

The waters of Channel Islands National Park are home to more kinds of marine mammals than any other body of water of comparable size. The diversity of marine mammals includes six species of pinnipeds and more than 27 species of cetaceans (whales, dolphins, and porpoises) which occur in the Channel Islands area.

All mammals are grouped together by the following characteristics:
- They have hair or fur (some marine mammals have only whiskery hairs on their chins or heads).
- They breathe air into lungs.
- (In most cases) their young are born alive.
- They feed their newborns milk.
- They are warm-blooded.

The bodies of marine mammals are well-adapted for life in the sea. Most are streamlined, making it easier for them to move through the water. Whales have horizontal tails, an adaptation which enables them to dive and surface easily. Whales can withstand cold ocean water temperatures due to their insulating thick layer of blubber (fat) which also provides buoyancy and a source of energy when food is scarce. Seals and sea lions have both a layer of fat and a layer of hair to keep them warm.

In 1972, the United States passed the Marine Mammal Protection Act, making it illegal to kill, harm, or capture any kind of marine mammal without a permit.

Pinnipeds

By definition, a pinniped is a mammal that has webbed feet called "flippers," which look similar to the wings of birds. The animals use their flippers to move through the water. Besides having flippers, pinnipeds have some other adaptations for living their lives in the water. Pinniped eyes have special hard coverings to help them see underwater. This aids them in catching fish. Their noses have special muscles to open and close the nostrils in order to keep the water out.
Six species of pinnipeds - sea lions and seals - breed and live on the Channel Islands. Two families are represented in the region, the eared seals (Otariidae) and the true seals (Phocidae). Eared seals include the California sea lion, the northern fur seal, the Guadelupe fur seal and the Stellar or northern sea lion. The Stellar sea lion has not bred on the Channel Islands recently, and its numbers are declining for undetermined reasons. The true seals that live here are the harbor seal and the elephant seal. Nearly all species of pinnipeds have been hunted at one time or another, some nearly to extinction, for their meat, oil, ivory, or fur.

There are differences between the sea lion family and the true seal family. One difference is that sea lions can walk on all four flippers, pulling their back flippers underneath their bodies. True seals cannot do that and must get around on land by pulling themselves along with their front flippers. Sea lions swim using their long front flippers to paddle. Sea lions steer with their back flippers. When seals swim, they paddle with their rear flippers and steer with their short front flippers. Sea lions have external ear flaps. True seals do not have ear flaps that we can see.

Thousands of pinnipeds live in the waters around the Channel Islands. They live there for several reasons. The kelp forests provide plenty of food, and not many people are around to disturb the pinnipeds when they come ashore to rest or raise their young. When a seal or sea lion crawls up onto the beach to "haul out," they are there to dry off in the sun and rest. They spend much of their time lying on the beach, returning to the water to catch food. Pinnipeds move much faster in the water than they do on land.

Many of the pinnipeds in Southern California are found on San Miguel Island. Over 10,000 pinnipeds representing six different kinds or species haul out there. More species of pinnipeds are sighted at the remote spot of Point Bennett on San Miguel Island than anywhere else on the planet. The diversity of seals and sea lions at Point Bennett is an excellent example of the biological diversity found in the Santa Barbara Channel. Stellar's sea lions visiting from the cold waters of the north, Guadelupe fur seals traveling in the warm waters from the south, elephant seals eating the huge variety of fish available in the Channel are all examples of animals getting what they need to survive in the diversity of the area.
These animals are protected by spending at least part of their lives in a national park—or, are they? Some threats to these animals know no boundaries. Threats made by water pollution, plastics and debris in the ocean, oil spills, overharvesting of fisheries, toxins, and pesticides affect even isolated areas like Point Bennett. People can make sure that the pinnipeds of Channel Islands National Park survive into the future. Simple things like recycling plastics can make a difference to a curious young sea lion looking for something to play with. That plaything need not be a piece of plastic webbing or a soda six-pack ring which may strangle it.

Cetaceans

The Santa Barbara Channel is one of the best places in the world for whale watching. Over 27 species of cetaceans, which includes whales, dolphins, and porpoises, can be found here. Cetaceans are classified into two groups, baleen whales (Mysticeti) and toothed whales (Odontoceti).

Of the baleen whales, migrating gray whales are the most frequently sighted near the Channel Islands. They may be seen in the area between the months of December through April. Although less frequently, the fin whale is also seen. In recent years, sightings of blue whales, minke whales, and humpback whales have become more numerous.

The baleen whales do not have teeth. They have baleen plates made of a substance similar to human fingernails. These plates act like a sieve through which plankton, small fish and shrimp are strained. Unlike the toothed whales, which have only one, all baleen whales have paired blowholes.
Although they spend only a brief time along our coast, the gray whale is the species of great whale most often encountered in and near Channel Islands National Park. These enormous mammals—they may reach lengths of up to 50 feet and can weigh up to 38 tons—swim an annual marathon of 10,000 to 12,000 miles round-trip, migrating from their summer feeding grounds in the Bering Sea and West Arctic Ocean to their winter haven in Baja California. Their annual journey is the longest known migration conducted by a mammal.

Gray whales travel a well-established route. Leaving the cold Arctic waters in the fall, they travel alone or in pods of three to 12 whales. The whales swim up to 100 miles a day and usually arrive at Point Conception between early December and January. Six to eight weeks after beginning their journey, the whales will arrive in the warm Mexican waters. Here the cows will give birth and then begin to head back northward. Northbound whales can be spotted in the Santa Barbara Channel from February through April. Solitary whales and mothers with calves may pause in the kelp beds near the Channel Islands to rest and feed.

Among the toothed whales that are found in the waters near the Channel Islands are killer whales, pilot whales, sperm whales, and several species of dolphins and porpoises. The most frequently observed cetacean in the Channel is the common dolphin. Other residents of the area are Dall's porpoise, Risso's dolphin, the northern right-whale dolphin, and the Pacific white-sided dolphin. The toothed whales feed mostly on fish, squid, octopi, and occasionally on other marine mammals.

Whales can stay underwater for extended periods of time. These marine mammals have developed a special diving reflex. They load up on oxygen before a dive, and then slowly release it throughout their body during the dive. Gray whales can stay underwater for up to 20 minutes. When they surface and exhale through their paired blowholes, they produce a visible vapor cloud several feet high.
Suggested Activities

Math

Activity 1
Use either a 100-foot rope or measure on the playground the lengths that represent the different kinds of whales. If rope is used, mark off each whale length with a different colored piece of yarn or tape. Unroll the rope and at each marker discuss something about that particular whale. The same idea can be used on the playground, marking the ground with chalk. If students have done research on the whales, they could be the narrators as the different lengths are reached.

<table>
<thead>
<tr>
<th>Type of whale</th>
<th>Length to measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dall’s porpoise</td>
<td>7 feet</td>
</tr>
<tr>
<td>Common dolphin</td>
<td>8 feet</td>
</tr>
<tr>
<td>Bottlenose dolphin</td>
<td>14 feet</td>
</tr>
<tr>
<td>Pilot whale</td>
<td>28 feet</td>
</tr>
<tr>
<td>Killer whale</td>
<td>32 feet</td>
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<tr>
<td>Gray whale</td>
<td>50 feet</td>
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<tr>
<td>Humpback whale</td>
<td>62 feet</td>
</tr>
<tr>
<td>Sperm whale</td>
<td>69 feet</td>
</tr>
<tr>
<td>Blue whale</td>
<td>102 feet</td>
</tr>
</tbody>
</table>
**Science**

**Baleen Demonstration**

*Mysticeti*, commonly called baleen whales, have no teeth in their mouths. They have rows of baleen hanging from their upper jaw that act as a large filter. Baleen is made of keratin, a substance similar to human fingernail. The baleen has a smooth outer edge and a fringed inner edge for trapping food. The food caught by *Mysticeti* whales is very small compared to the size of the whale. Some of these whales eat small fish, but others eat only small crustaceans, such as krill. Krill are considered plankton because they cannot swim against a current. Baleen whales are often considered plankton feeders which leads people to believe that they eat only microscopic plants and animals. Not all plankton is microscopic. Krill can be over two inches long. Krill are found in huge swarms in colder oceans. It is amazing that the largest creatures on earth (whales) eat some of the smallest.

Depending on the type of whale, the rows of baleen can be very large. In the bowhead and right whales, the baleen rows can be about 15 feet long. This is one reason these whales were hunted nearly to extinction. Baleen was used in a variety of products—corsets, umbrella staves, venetian blinds, window gratings, riding crops, furniture springing and even portable sheep pens.

This demonstration will give students an idea of how baleen works. Materials: four large inexpensive hair combs, two square plastic dish tubs (about 9"x 12"), one small jar of parsley flakes (you may use dill weed, or even grass clippings), water, and two bath towels.

Procedure:

1. Fill tubs about half full with water.
2. Place tubs on towels on tables or a counter.
3. Add about two tablespoons of parsley flakes, stir to wet the flakes.
4. Now, let the students try to catch the "plankton" with the combs. Have them move the teeth of the combs through the water to see how much they can catch. Remind them that whales have many, many rows of baleen and also that they have the task of locating plankton in a very large ocean.
Note: Humans are now krill catchers, too. Many tons of these creatures are netted from the sea each year for food and fertilizer.

**Insulation Investigation - "Blubber Bags"**

Marine mammals, like all mammals, are warm-blooded and must maintain a constant internal body temperature. Because they live in water, the temperature of their environment is often lower than that of land animals. Besides being colder, water has a much greater capacity to sap body heat and to do it more quickly than air. Marine mammals face particular difficulties in keeping warm. Many land animals have behaviors that help them conserve body heat, such as: curling up, building nests, huddling together or seeking shelter. Marine mammals cannot do these things.

Marine mammals have a layer of fat or blubber found just beneath their skin. This keeps these animals from losing too much body heat (Sea otters are the exception to this. Their dense fur keeps them warm, as they do not have any blubber.). The thickness of the blubber layer is not the same in all marine mammals. In many species of seals, the blubber may only be a few inches thick. The blubber layer in many whales can be more than foot thick.

The following experiment shows how blubber works. It allows students to actually feel the difference a layer of fat can make in very cold water.

**Materials for six blubber bags:** twelve one quart size ziploc freezer bags, a bucket, crushed ice/ice cubes, water, thermometers, one three-pound can of vegetable shortening.

**Procedure:**

1. Place about 1-1/2 cups shortening into a ziploc bag. Try to keep the shortening from getting around the upper edge of the bag.
2. Turn a ziploc bag inside-out and put over your hand. Push hand with bag down into the other bag with shortening. Make sure the sealing strips at the top of the bags match up so they will seal when pressed.
3. With hand still in the inner bag, press shortening around in the bag. Try to keep shortening about 1-1/2 inches below the sealing strip.

4. Seal the bags together.

5. Fill a bucket with ice water. Measure and record the water temperature.

6. Select a student volunteer. Have the volunteer place a blubber bag over one hand. Have the volunteer put both hands into the ice water. Instruct them to remove their hands when it becomes uncomfortable. Repeat several times with other students.

7. Discuss which hand could stay in the water longer. Why was the shortening able to insulate their hand? Discuss how the whales and pinnipeds have blubber as protection against the cold water.

Ears That See

The following experiments will give students opportunities to attempt to locate people and objects within their environment by the use of sound.

1. Blindfold a student (be sure to use a clean blindfold on each student). The teacher creates a sound (bouncing ball, dropping pencil) and the blindfolded student shows where the sound is by pointing or walking towards the sound. Or, students may be stationed around the room, each with a noise-maker. The teacher points to students to make sounds one after another. The blindfolded student indicates where the sounds are coming from.

2. Repeat activity #1 while a tape, possibly of whale sounds, is playing in the background.

3. Students secretly draw numbers. One student is blindfolded in the center of the room. Students take a number and scatter around the room, the gym, or outdoors. The blindfolded student calls out a number and the person with that number "echoes" the number. The blindfolded student then tries to locate, by pointing, the position of the echoing student.
The following will aid students in developing understanding that echolocation allows the marine mammals to discriminate difference in size and composition of various objects.

Tape several materials of varying properties to the wall or chalkboard. Blindfold a student and have him/her throw a small rubber ball toward the object taped to the wall. Have the student try to determine the property of the object by the sound it makes when it is hit by the rubber ball. It is suggested that the student stand within close range of the object to increase the accuracy of his/her throw.

Language Arts

Marine Mammal Dictionary

Have students create their own marine mammal dictionary. First, have them cut out the following definitions. Then, have them paste them into a book or onto construction paper. Next, have them illustrate each definition.

Baleen - Fringed plates of keratin (material much like our fingernails) growing from the upper jaw instead of teeth. Baleen is used for filtering food.
Blowhole - A whale's nostrils on the top of its head. Baleen whales have two blowholes. Toothed whales have only one.
Blubber - The layer of fat on the body of most marine mammals. Blubber keeps the whale warm.
Breaching - The act of a whale leaping out of the water.
Cetacea - The order of marine mammals that includes whales, dolphins, and porpoises.
Flukes - The two wing-shapes on the end of the whale's tail.
Krill - Small shrimp-like creatures which are eaten by baleen whales.
Migration - The journey from one place to another. The gray whale makes the longest migration of any mammal.
Pinniped - Marine mammals with finned feet called flippers.
Plankton - Floating or drifting animal plant life.
Pod - a number of whales traveling or gathered together.
Ranger Program: Pinniped Parade

Objective

Through a dress-up program, students will learn about pinnipeds living in Channel Islands National Park.

Vocabulary

Adaptation - a characteristic that helps a plant or animal to survive.
Marine - of the sea.
Pinniped - a marine mammal with finned feet called flippers.
Seals and sea lions are two examples of pinnipeds.

Background

By definition, a pinniped is a mammal that has webbed feet called "flippers," which look similar to the wings of birds. Six species of pinnipeds - sea lions and seals - live and breed on the Channel Islands. Two families are represented in the region, the eared seals (Otaridae) and the true seals (Phocidae). Eared seals include the California sea lion, the northern fur seal, the Guadalupe fur seal and the Stellar or northern sea lion. The true seals that live here are the harbor seal and the elephant seal.

Nearly all pinnipeds have been hunted at one time or another, some nearly to extinction, for their meat, oil, ivory or fur. Pinnipeds, as well as all marine mammals, are protected by law in the United States. The Marine Mammal Protection Act was passed in 1972, making it illegal to kill, harm, or capture any kind of marine mammal without a permit.
Lesson 3: Tides

Objective

The students will be able to define high and low tides and identify the forces that cause changes in tides.

Vocabulary

Gravitational attraction - the tendency of things on earth to be attracted toward the ground.
Neap tide - tides with a small range between high and low tide. Neap tides occur during the first and last quarter moon.
Spring tide - tides with a large range between high and low tide. Spring tides occur during the full and new moon.
Tide - the daily rise and fall of sea level along a shore.

Background

Every day the water of the ocean washes up higher and higher onto the shore until it reaches a certain high point; then, it begins to recede, until it reaches a certain low point. These high and low points occur about six hours apart. The tides are the steady rising and falling of the water level each day.

Tides are caused by the gravitational pull of the earth, moon, and sun upon each other. The moon has a greater effect on the tides than the sun because the moon is closer to the earth. As a result of this gravitational attraction between the earth and the moon, the side of the earth facing the moon is pulled towards it. Solid objects like the ground and buildings are not distorted as much as liquids like the oceans. A bulge of water occurs on the side of the earth facing the moon. As the earth rotates, centrifugal force causes an equal bulge on the opposite side of the earth. This creation of the bulges leaves a depression in the oceans in between. The bulges become the high tides, and the depressions become the low tides.
When the sun and the moon are in line with the earth, the tides reach their highest highs and their lowest lows. This occurs at the times of the full and new moon. These tides are called spring tides. This has nothing to do with the season we call spring. It means to leap or jump and occurs twice each month.

During the times of the first quarter and last quarter moon, the moon and sun are at right angles to the earth, and their gravitational pulls balance each other. High tides aren’t as high, and low tides aren’t as low as during spring tides. These tides are called neap tides.

**Suggested Activities**

- Use a cotton ball and a rubber band to demonstrate the pull of the moon’s gravity on the earth.

Place a rubber band around a cotton ball. The rubber band should be just tight enough to fit, but not so tight that it destroys the round shape of the cotton ball. On opposite sides of the cotton ball, pull the rubber band and a little of the cotton between the thumb and index finger of each hand. Look at the shape of the resulting ball. This is somewhat like the pull of the moon’s gravity on the earth.

- Another way to demonstrate the bulging effect on the oceans caused by the gravitational attraction between the earth and the moon uses a water balloon. As the earth spins, the ocean bulges outward from the earth’s surface. Fill a heavy grade water balloon with water until it is the size of a softball. Place it on a smooth, wet surface and spin it with a twist of your wrist. Centrifugal force will cause the outer side of the balloon to bulge out.

- As a class activity, or for homework, consult a tide table (yearly tide books are available at fishing tackle shops, surf shops, dive shops, and boat landings) or collect tidal information from the local newspaper to record the tide levels for several days. Graph the daily high and low tides. Calculate the time difference between each high tide. Graph the results. Do the same with low tides. Compare and look for patterns.
• Invite a local fisher to the class to discuss the role tidal cycles play in the fishing industry.
Lesson 4: Intertidal Zones / Tidepools

Objectives

The students will be able to describe the different intertidal zones and identify animals that live in the different zones.

Vocabulary

Adaptation - a characteristic that helps a plant or animal to survive.
Ecosystem - all the organisms living in a place as an interdependent and separate unit.
Intertidal - the area of shore between the highest and lowest tide levels.
Invertebrates - animals without a backbone.

Background

The area between the land and sea is not distinct, but is a zone of transition. This area may be covered with water during the high tide or exposed to sunlight during low tide. Life in this intertidal region must be the hardiest within the marine environment, able to withstand hours of exposure and the incessant pounding of the energy-filled surf.

Intertidal life has adapted to the sea and the land. When looking at a tidepool area, notice how the plants and animals may be found in certain areas and not in others. Some parts of the beach are higher than others, and some rocks are higher than others. This means that the water reaches some parts during the high tides, but not others; and some parts may be below the water except during minus tides (a tide is minus when it is so low that it is below the zero tide level). This creates four zones, or regions of the beaches or rocks that are affected by the water in different ways. These zones are called intertidal zones.
Zone 1 of the intertidal is the splash zone. It is above the reach of high tide. This zone gets wet only from the spray of the waves and is wet only one-quarter of the time. Those organisms living in the splash zone are tolerant to sunlight, heat and water loss, and have either a means in which to shelter themselves or the ability to move into an area of greater moisture. Animals living in the splash zone have hard shells. Buckshot barnacles, periwinkle snails and rock louse are examples of animals that inhabit the splash zone of the intertidal.

The second zone is the high tide zone. This area is submerged during high tides and exposed during low tides. This region is dry about half of the time. This high tide zone is the highest level at which seaweeds are found. Animals that live in this zone can withstand exposure to air. Examples are striped shore crabs, barnacles, limpets, mussels, and periwinkles.

The middle tide zone is exposed only during the lowest low tides and is submerged three-quarters of the time. Although this area is often called the "mussel zone," it is also home to sea stars, anemones, chitons, limpets, and rock, shore and hermit crabs.

The low tide zone is closest to the water. It is the largest zone and is exposed to air only during minus tides. Plant life is abundant in the low tide zone and it is sometimes referred to as the "seagrass zone." Animal life in this region is abundant and varied. Residents of the low tide zone include kelp snails, sea hares, kelp crabs, sea stars, anemones, snails, sea urchins, sponges, and abalone.

Space is a limiting factor in the intertidal. This creates competition between organisms. Many plants and animals are found in a small area; some may live on each other or use an old shell as a surface on which to live. This is one important reason why collecting is not permitted; you may be taking away a home.

Although hardy against the forces of nature, the plants and animals of the intertidal cannot entirely endure the impact of people. Since individuals interact with one another, minute changes in this area could disrupt the entire community. While exploring tidepools and the intertidal, keep in mind the following tips.
• Watch your step! The rocks can be very slippery and you have to be careful not to step on the small animals on the rocks.

• Keep an eye on the waves.

• Take your time and look carefully. Tidepool organisms are often small and camouflaged.

• Do not collect anything! Most tidepool life in California is protected by law.

• If you pick up an animal to observe it more closely, please place it back where it was found. That particular spot is its home territory.

• Although you may not know the animal by name, through observation, a great deal of information can be learned. Consider, for example, what keeps the animal from drying out? Why doesn’t it get swept out to sea? Does it search for food or wait for food to come to it?

Tidepool Life
The following is a list and description of some of the plants and animals commonly found in the intertidal zone.

Sea Lettuce (Ulva sp.). This bright green alga loses its moisture during low tide and although it becomes crispy, it remains alive. When the tide rises, it re-absorbs moisture.

Sea Sac (Halosaccion glandiforme). This appropriately named red alga is often found in large patches. Sea water is held inside to keep it from drying out.

Articulated Coralline Alga (Corallina sp.). The pink color and articulation (or joints) is noticeable in this alga. The plant secretes calcium carbonate, making a tough crust to help prevent grazing by animals.
Solitary Green Anemone (*Anthopleura xanthogrammica*). This flower-like animal has tentacles equipped with stinging cells. Objects touching the tentacles are penetrated with poison and deposited into the central mouth. The bright green color is due to the presence of an algae living within the anemone.

Ochre Star (*Pisaster ochraceus*). The sea star’s body surrounds its centrally located mouth. When feeding, food is not placed within the mouth, but instead the stomach is pushed from the mouth and food is then digested externally. Tube feet act as suction tubes and are used for moving and clinging.

Purple Sea Urchin (*Stronglyocentrotus purpuratus*). The bright blue-purple body along with numerous spines make this invertebrate noticeable. Algae is chewed using the five-toothed jaw located on its underside. Both the red and the purple sea urchin are commercially harvested for the eggs, which are considered a delicacy.

Black Abalone (*Haliotis cracherodii*). The black to deep blue shell helps protect the large muscular foot of this snail. To feed, small rows of hooked and sharp teeth cut through algae which is then swept into the mouth. Water and waste leave the abalone through the 5 to 9 open holes.

Limpet. This snail’s shell is a simple shield. To prevent it from drying out, the large muscular foot fits tightly to the surface on which it lives. All are plant eaters and graze on algae, using the foot for locomotion.

Periwinkle (*Littorina sp.*). This very tiny snail is commonly found clinging to rocks in the upper splash zone. At low tide, the body is withdrawn into the shell. Holding to the rock with a bit of mucus, the periwinkle is able to hold water within and can survive for weeks exposed to air.

Chiton. The jointed shell consisting of eight overlapping plates allow the chiton to conform its body to the irregular rocky surface. Food is scraped from surfaces as it creeps along.
Buckshot Barnacle (*Balanus* sp.). Adult barnacles lead sedentary lives on hard surfaces, usually rock, in the upper splash zone. During low tide, the shell is closed to keep moisture within, but when covered with water it opens and sweeps food into its mouth.

**Suggested Activities**

- Create a tidal zone bulletin board. Label the various zones and have students create intertidal plants and animals and place them in the correct zone.

- After studying life in the intertidal, create a class graph of favorite tide pool animals. Title the graph "Which intertidal animal is your favorite?" Offer several choices such as sea star, chiton, anemone, hermit crab, and sea urchin.

- Either as group projects, with older student buddies, or as homework have students research an intertidal animal. They can gather information from encyclopedias, magazines, books, at the Visitor Center at Channel Islands National Park, and by visiting a tidepool.

Research topics could include:

**Looks:** size (height, length, weight), color, unusual characteristics.

**Living Habits:** locomotion, food, offspring (eggs, live birth, how many?), does the animal live alone or in groups?

**Habitat:** which intertidal zone, other oceans and areas.

**Art**

- **Fingerprint Tidepools**

Materials: various colors of stamp pads, ink cleanser, paper towels, drawing paper, crayons, markers

- Brainstorm the types of animals found in the intertidal. Think of the shapes of most of these animals. What shapes do they have in common? (ovals and circles) Show students how a fingerprint provides the perfect base for drawing the animals of the tidepools. Instruct students to use all of their fingertips to create a variety of sizes to create their tide pool
animals. Have students use crayons and markers to finish their rocky intertidal scenes.

• **Sea Urchins**

Materials: clay, toothpicks

Have students form a round shape with the clay. Then, they insert the toothpicks into the clay to make the round shapes into sea urchins.

• **Make intertidal puppets**

Use only old materials or scraps to create puppets of intertidal creatures. Socks, popsicle sticks, material scraps, paper scraps, empty clean containers and boxes and an imagination is all that is needed to create puppets. Have students make up their own puppet shows with partners, in small groups or as a whole class.

**Cooking**

Another fun way to make a sea urchin!

Materials: long, thin pretzels, apple half per student

Stick pretzels into half an apple to resemble a sea urchin. A marshmallow may be substituted for the apple half.
Lesson 5: Kelp Forests

Background

The waters surrounding the Channel Islands contain large beds of giant kelp. Feather-boa kelp (*Egregia sp.*) is also seen nearer the shores. Under the surface of the water, these beds of kelp are like dense forests. Kelp "forests" function much the same as forests on land. They provide shelter, food, and habitat for hundreds of animals.

Giant kelp (*Macrosystis sp.*) grows in large patches, or beds. Sometimes growing at a rate of two feet per day, this species of marine alga is one of the fastest growing plants on earth. It is also the largest marine plant in the world.

Like a forest on land, kelp forests can be divided into layers. Different animals live in the different layers. At the bottom of the kelp forest, brittle stars, sea urchins, and many young marine animals live in the caverns and hiding places formed by the kelp plants' intertwining attachment called the "holdfast." In the middle of the forest, snails and other animals crawl around on the blades and stipes. Many kinds of fish swim among the fronds.

Instead of having root systems like trees, kelp plants are held firmly to rocks on the ocean floor by a mass of tangled strands called a holdfast. The holdfast is just an anchor for the plant. It does not absorb nutrients like tree roots do. Flexible leaves, called blades, are attached to the long, sturdy stems of the kelp plant. These stems are called stipes, and they reach gracefully up the the surface of the water. At the water's surface, the intertwined kelp fronds form a thick canopy. The kelp fronds are held afloat by small, gas-filled bubbles, called bladders.

Several types of kelp are harvested. To do this, the top few feet of the plants are cut off periodically, processed, and used as a binding agent in many paints, cosmetics, medicines, and foods. Kelp meal is also used as a diet supplement and as a filler in animal feed.
Marine plants provide about 70% of the world’s oxygen. Many of these marine plants are algae. Kelp is a type of algae. The three major divisions of algae are classified according to their pigments. All algae contain chlorophyll, a green pigment used for photosynthesis. Through photosynthesis, the algae use carbon dioxide, water, and energy from the sun to create its own food. Algae also have accessory pigments that blend with the chlorophyll to color the plants. Red algae grow at lower levels of the ocean than the other algae because they can still photosynthesize in weak light. No algae grow deeper than 100 meters because absolutely no light reaches beyond that level. Red and brown algae have additional pigments that match their names, while green algae has one type that is yellowish-orange. However, the sun’s bleaching and drying, as well as repeated rubbing from the sand, often make it difficult to tell which algae belong to which division by just looking at them.

The hundreds of species of marine algae have adapted to living in a harsh environment. They get their nutrients directly from the sea water. If a fresh water plant was placed in sea water, all of the water in its cells would soon diffuse out of the plant, and it would shrivel up and die. Marine algae have specialized cell walls that allow them to tolerate high concentrations of salt.

**Suggested Activities**

**Science / Art**

Create a walk-through kelp forest right in your classroom. Have students cut hundreds of life-size kelp blades and floats (bladders) from flattened brown paper bags or brown construction paper. Then, make paper stipes the length between the ceiling and the floor. Attach the blades and floats to the stipes. Hang these fronds from the ceiling. Pipe cleaners can become the holdfasts. Populate the kelp forest with models of its inhabitants.

**Cooking**

Have a sushi party. Invite a sushi chef to come to class to prepare sushi and discuss with the class the types of seaweed used.
Kelp Cookies
(Recipe by Ernie Mae Campodonico, Nipomo, California)

1 cup shortening 1 tsp almond flavoring
1 cup white sugar 1 tsp soda
1 cup brown sugar 1 tsp salt
2 eggs *1 tsp powdered kelp
3 cups flour 1 tsp vanilla

*Purchase Par-Kelp in a health food store.
Combine shortening, sugar, eggs, vanilla, and almond flavoring.
Blend well. Add dry ingredients. Mix well. Bake at 400 degrees
for 8 minutes. The cookies will turn out chewy and will stay fresh
for several days if kept in an airtight container.

Drama

Pass out imaginary diving masks and have the children pretend to
put them on and dive under the water in a kelp forest. What do
they see? Have the children name different things they might see
underwater in a kelp forest. Examples might be: fish, sharks,
pinnipeds, whales, octopi, snails, crabs, urchins and abalone.
Have some of the children pretend to be giant kelp swaying back
and forth while the other children pretend to be different ocean
animals moving around in the kelp forest.
Lesson 6: Resource Protectors

Objective

Students learn of the organizations and the task each has in the enormous job of protecting the Channel Islands and the surrounding waters.

Vocabulary

- **Generation** - a period of about thirty years, or the time between the birth of parents and the birth of their children.
- **Environment** - the surroundings in which a plant or animal lives.
- **Violator** - a person who breaks or acts against a rule or law.
- **Preserve** - to protect; keep in safety.
- **Biologist** - a scientist who studies living things.
- **Sanctuary** - an area where animals and birds live and are protected.
- **Nautical** - having to do with ships, sailors or navigation.
- **Atmospheric** - of, in or from the air around the earth.
- **Administration** - the people who manage an organization.
- **Artifacts** - human-made objects.
- **Oil development** - the act of searching and drilling for oil.
- **Federal** - run by the federal government rather than the states.
- **Monitor** - to keep watch over.
- **Endangered species** - animals or plants that are in danger of disappearing from the earth.
- **Warden** - a person having care or charge of something.
- **Regulations** - a law or set of rules by which something is controlled.
- **Conservancy** - a group that takes measure to keep resources in good condition.
- **Cetacean** - a group of marine mammals that include whales, dolphins and porpoises.
- **Cousteau Society** - an organization that helps to protect oceans through education.
- **Advising** - to offer an opinion about what to do.
- **Issues** - subjects being discussed.
Suggested Activities

Writing / Job Opportunity Ad

Teacher makes transparency of several job opportunity ads from the newspaper.

Students and teacher identify parts and discuss ad.

Students list resource protectors mentioned in text and their jobs.

Students write job opportunity ads. Completed ads may be typed ad size on word processors, grouped and displayed as a wall newspaper page.

Writing / Acrostic

Teacher provides large white drawing paper for each student or group. Students choose the name of a resource protector and prints the name in upper case letters vertically on the drawing paper. Block lettering will allow for coloring or illustrations within the letters.

Students generate a word or phrase for each letter of the name, printing it horizontally.

R
A
National Parks
Guides
Encourages care with resources
Runs information center

Language Arts

Make copies of the "Who Protects the Channel Islands?" booklet for each student. Use these during reading time or assign as home reading. Have the students write about their reading in their daily writing journals or in a special writing book about the Channel Islands.
Art / Diorama

Teacher and students discuss resource protectors and typical setting you might find each working in.

Students, individual or partner groups, create shoebox diorama of resource protector using paper, cardboard, natural materials and if available, "Plasticine" (oil base clay).

Art / Logo Design

Students discuss logo designs illustrated in the student handout. Students design a logo that represents themselves or their group.

Resources

Books:


Coloring Books:


* Indicates resources available for purchase at the Southwest Parks & Monuments Association Bookstore, located in the Channel Islands National Park Visitor Center, 1901 Spinnaker Drive, Ventura.
Lesson 7: Putting It All Together

The following projects are designed to allow students to synthesize their learning and produce an authentic assessment product. The projects vary in level of difficulty and complexity and each can be modified to meet the needs of your class. Each project may be assigned individually or to a pair of students.

Gameboard

Objective
The student will create a game and gameboard which will reflect their understanding of "The Channel Islands, Exploring the Islands."

Preparation
Teacher and students can bring in and share a variety of different board games. Discussion of each component part of the games will allow students to see a wide variety of options when they begin to design their own game.

Design Specifications

Gameboard
- Track or path (20+ spaces).
- Illustrations - appropriate to topic.
- Consequences or directions - may be related to topic
  - go back ____ spaces
  - loose a turn
  - go ahead ____ spaces
  - take another turn
  - take a card.
- Start and finish.
- Options
  - questions on board or cards
-short cuts or chutes; leading back or ahead on path.

Markers - to move each player
- Use from an old game.
- Make from recycled materials: marking pen tops, buttons, etc.
- Make from cardboard, may reflect character, animal or object from topic.

Method of Movement; How far to move (choose one)
- Dice (1 or 2).
- Spinner.
- Cards.
- Colored coded path and cards.

Rules
- Research rules from other games.
- Rewrite them to fit your game.
- Include objective of game, order of play, materials needed, number of players, and starting and playing directions.

Lettering Specifications
- Use template or block lettering for all titles or headings.

Step Book

Objective
The student will create a folded construction paper book which will reflect their understanding of "The Channel Islands: Exploring the Islands."

Preparation
Teachers may wish to guide students through each portion of the text by having them, as a group, outline or web their ideas for each topic prior to writing.
Design Specifications

Construction:
Use three different colored sheets of 9"x12" construction paper. Use cardboard templates to ensure even folds. Each section will contain written text and illustrations related to the text.

• Cover: title and student name.
• Step One: Island Geography - map of one or all of the Channel Islands.
• Step Two: Marine Mammals - illustrate and write about your favorite marine mammal of the Channel Islands.
• Step Three: Tides - illustrate and write about what causes tides.
• Step Four: Intertidal/Tidepools - illustrate and write about at least three organisms from the intertidal.
• Step Five: Kelp Forest - illustrate and write about kelp or some features of the kelp forest.

Lettering Specifications
• Use a template or blocklettering for all titles or headings.
• Lightly draw guide lines to help keep lettering straight.
• Lettering should first be done in pencil, checked for accuracy, and finally traced over in pen.
• All pencil lettering and guide lines should be completely erased.
The Important Book

Objective
The student will create a book highlighting the important things about historical cultural groups of the Channel Islands.

Preparation
Margaret Wise Brown's The Important Book offers a good paragraph model for students when writing about the historical culture groups of the Channel Islands.

Procedure
• Read the book and have students see if they can pick out what is special about the way it is written. Lead them to see the pattern and identify its parts. Help them notice that the illustrations cover the entire page with the text becoming part of the illustration.

• Chart the paragraph frame with the help of the class.
  The important thing about ________ is ___________.
  It is _____________________________________________.
  It _____________________________________________.
  And it _____________________________________________.
  But the important thing about ________ is ___________.

• Generate a list of "Important Things About the Channel Islands."

• From this list, choose one and have the class write a page for your "Important Book."

• Assign or have students choose from the list, an important thing to write about and illustrate for their page.

• Combine all pages into a book and bind.
References


Engleson, D. C. (1985). *A guide to curriculum planning in environmental education*. Wisconsin Department of Public Instruction: Milwaukee, WI.


