



# Sea Lions, Sea Caves, and Sea Coast

**An Elementary Curriculum Guide with  
Activities**

# For Sea Lion Caves



## Table of Contents

**Introduction**..... 3

**Understanding the Codes for Benchmarks**..... 5

**Section 1 - Field Trip Nuts and Bolts** are important for every teacher planning to bring students to Sea Lion Caves. This section covers essential logistical and fee information..... 6



Section 2 – **Facts about Sea Lion Caves** contains background information sheets on a variety of themes. Teachers should select and utilize the information sheets that correspond with the activities their students will be doing.....10

Section 3 – **History**..... 11

Section 4 – **The Sea Lions at Sea Lion Caves** ..... 14

Section 5 – **Scientific Investigations** ..... 20

Section 6 – **Geology and Activities**..... . 22

Section 7 – **Animals and Activities** .....48

Section 8 – **Plants and Activities** ..... 59

Section 9 – **Sea Lions Caves Tour Reminders and Worksheet**.....64

Section 10 – **References**.....70

# Introduction

## An Unforgettable Experience

The vast cavern with its strikingly colored walls, the imagination-stirring markings in the cave, combined with the roar of the great Steller sea lions, the cries of the wailing birds, and the restless surge of the ocean into the cave below, form an unforgettable experience.

Those who have not visited Sea Lion Caves, who read details of it here for the first time, are encouraged to make the trip. With the elevator, the descent and ascent are now within the physical capacities of almost everyone. A gift shop is maintained for the convenience of those wishing collectable or other articles on Northwest lore and interest.

U.S. Highway 101 both north and south of Sea Lion Caves is generally recognized to be one of the most spectacular scenic highways in the world, because of the grandeur and variety of the Oregon coast. Every kind of accommodation from private and state park campsites, to luxurious motels can be found a few miles from Sea Lion Caves, and excellent highways lead inland to other famous scenic spots in Oregon.

For those who have already visited the grotto; it never appears exactly the same twice, and each succeeding trip will lead to new discoveries and new interest. It must be remembered that Sea Lion Caves is the only place known where wild sea lions make their home on the mainland. All other places, sea lions live on rocky islands located from a few hundred yards to several miles offshore. Had not the area been privately owned, developed, and protected, especially in the early days when the State of Oregon paid a bounty for slaughtered sea lions, the Sea Lion Caves area would undoubtedly be void of sea lions and other marine life, and the natural wonder would probably not exist.

The following text/guide does not attempt to picture Sea Lion Caves, its life and its surrounding completely. It is designed to give students and educators background information prior to touring the Caves to appreciate and benefit from this unique natural resource. With the introduction of cameras placed around the facility this guide can stand alone and students can benefit from the on-line experience from anywhere in the world. In this manner, Sea Lion Caves



becomes a world-wide experience to enjoy and appreciate. Our basic goal is to maintain the resource, keeping it as natural as possible but still making it accessible

**Sea Lions, Sea Caves, and Sea Coast** is based on the Sea Lions Caves fact book. This guide appeals to primary and elementary teachers. However, it can be modified and used at all grade levels. **Sea Lions, Sea Caves, and Sea Coast:**

- is aligned with Oregon State Education's state-wide framework, Content Standards for fifth grade - 2009
- explains field trip basics
- explains reasons for facility rules
- explains the fee paying process
- includes a section with basic information on facility resources
- includes facility activities pre-post, and during visit
- lists content standards

- includes evaluation forms.

# Understanding the Codes for Benchmarks

## Science Numbering Key Example: K.2P.1

**K= Grade**

**2= Core Standard strand** (strands are 1 = structure and function; 2 = interaction and change; 3 = scientific inquiry; 4 = engineering design)

**P=Science Discipline** (disciplines are P = Physical; L = Live; E = Earth and Space; S = Scientific inquiry; D = Engineering Design)

**1 = Number of the content standard for this grade, strand, and discipline**

# Section 1 – Field Trip Nuts and Bolts

## Field Trip Essentials for Educators

- Please call ahead for a reservation and fees applicable at that time. Please mail your check at least one month in advance of your group's visit, unless otherwise arranged.
- Prepare your students through curriculum-based, **pre-visit activities**.
- Stress facility rules with your students and chaperons prior to the field trip. Teach your students the reasons for each rule.
- Make sure all adults and students in your group participate in the activities during the visit. Students may be asked to recall facility rules and reasons for them while visiting. Students will also be asked to share what they learned in the course of their **pre-visit activities**.
- To ensure the comfort and safety of everyone visiting the Sea Lion Caves,;
  1. Encourage shoes with good soles – flip/flops can be a problem on the trails
  2. Coats or sweatshirts are recommended – rain gear is suggested (large trash bags work in a pinch)
  3. Cameras

4. Long pants, as it can get very breezy and chilly at times.
5. Binoculars are a good idea
6. There is really no place for students to eat their lunch, but one mile down the road is the Heceta Lighthouse Park with lots of picnic tables and bathroom facilities.

## Important Field Trip Notices

- Tours, times and fees are subject to change, without notice.
- Field trips dates should coincide with classroom studies, if possible. Most schools schedule field trips in September and October and then again in April and May. September through May is usually more conducive to learning, as the Cave is less crowded and more available for students to take their time, learn and enjoy the environment.
- Sea Lions are wild animals and come and go as they please. We are not a zoo. There are times when the sea lions are not in the Cave. Usually speaking, sea lions are landed in the Cave or rocky ledges from December through September. The fall is the time to enjoy the geology of the area and Cave without sea lions being present. Spring is mating season and lots of activity is occurring in the Cave and on the rocky ledges.

## Group Rules and Safety Matters

- Students must stay with adult sponsors at all times. We recommend 1 adult for every 5 or 6 students. Each adult is responsible for a specific group of students and must maintain control at all times. On trails (cave or surface) the sponsor should lead the group. Fences are for your protection not for climbing on.
- Remain on hard-surface trails because hillsides are delicate and can be hazardous.
- Talk quietly to allow yourself and others to enjoy the Cave's wonders.



- Do not throw anything away along trails or in the Cave. Foreign materials introduce new bacteria and native bacteria may not be able to compete with the foreign bacteria, and thus eliminated. Animals can be fooled and take some litter as food and become ill from the material. Whatever you bring in, please take out or use litter cans found along the trails and in the Cave.
- Tobacco use of any kind is permitted only in the parking-lot at the Caves.
- Do not collect anything natural at the facility. Some species are rare and will not be able to reproduce. Allow others to enjoy the natural beauty.
- In case of injury or illness, notify a staff person immediately.
- No running, pushing, or shoving on trails or in the cave as walkways can be slippery and uneven. Be safe, not sorry.
- Bathrooms are inside main building and located to the right of the stairs outside building.
- A water fountain is located downstairs near bathroom in main building.
- Always dress for cold and wet weather. The Oregon coast weather is always unpredictable.
- Trails to and from the Cave are not handicap/wheelchair friendly. There are stairs down to the trails and in the Cave. Trails are uphill and downhill and sometimes uneven. Handicapped/wheelchair students and adults should safely remain in main building.
- Caps/hats should be worn backward as the wind does use them as kites occasionally. Caps can be blown so far toward the cliff that they are not retrievable.
- Using a camera flash in the Cave is prohibited. It scares the animals and as the Cave is so large the flash has little effect on any picture taken within.
- Wearing shoes with good soles are recommended. Flip/flops can cause falls and are not recommended.



- Drinks (soft drinks, Snapple, orange juice, bottled water) are available for purchase. Snacks include popcorn, fudge, and taffy and can be purchased. Other than a drinking fountain no other food or drinks are available without purchase.
- After parking the bus in our designated area, the students must cross a busy Hwy 101 to reach the main building. Adults must monitor their groups for a safe crossing. It is much safer to cross in groups rather than individuals crossing singly. Please be careful!

## **Fee Application Process**

Schools are provided with a substantial discounted student entry fee. Please call and check applicable current fees rates. Teachers, chaperons and bus driver(s) are admitted free. Please mail your check at least one month in advance of your group's visit, unless otherwise arranged. Only organized tours or outings conducted for educational or scientific objectives are eligible for the discount. To apply, please send or fax the following:

1. A letter on your school's letterhead stating the purpose of your visit, name and phone number of sponsoring teacher, the number of students, number of adult supervisors, date of visit, and approximate time of arrival.
2. Return a signed copy of the Group Visitation Rules to ensure that the rules have been discussed with all group participants prior to the visit.
3. Mail your check one month in advance to your group's visit along with the above information.

**a. Mail or fax your request to:**

Sea Lion Caves

91560 Hwy. 101

Florence, OR. 97439

U.S.A

Phone -541-547-3111



Fax – 541-547-3545

**Hours of Operation** – Sea Lion Caves is closed Thanksgiving and Christmas day. Hours of operation are subject to change without notice.

**9:00 A.M. – 5:00 P.M. September 1 through May 31**

**8:00 A. M. – 6:00 P.M. June 1 through August 31**

## **Tours**

### **Self- Guided Tours – Least Restrictive**

- 37 steps down from main facility to trails
- Both trails are paved and approximately 100 yards long
- Bathroom provided in main building and at start of trails
- Bronze statue of sea lions
- Binocular viewing machines available for usage for 25 cents.
- 200 ft elevator decent into the depths of the Cave
- Approximately 60 minutes for tour; walking, viewing and exploring
- Not recommended to people using wheelchairs
- Not recommended for those with health or walking problems
- Appropriate for all academic levels ( adult supervision is required)
- Upper level of Cave has several stairs and landings which need to be accomplished to view Heceta Lighthouse and old entrance

## **Who to Contact**

**Call Duane “Boomer” Wright at Sea Lion Caves at 541-547-3111 if you wish to:**

- Ask questions of a general nature
- Check status of your request
- There are no dumb questions – please call

## **Section 2 – Cave Facts**

### **The Significance of the Sea Lion Caves**

These statements explain why the Caves are important to our natural and cultural heritage:

- The Sea Lion Caves is the largest sea cave in the world as identified by the Guinness Book of World Records.
- It is the year round home of the Steller Sea Lion.
- As of 2009, the Sea Lion Caves area is one of the few places along the west coast where the population of the Steller Sea Lion is increasing.
- The Cave vicinity is home to several other animals other than Steller sea lions including bats, pigeon guillemots, cormorants, gulls, orcas, gray whales, humpback whales, harbor seals, California sea lions, bald eagles, mountain lions, black bear, elk, deer, chipmunks, gray squirrels, owls, common murre, tufted puffin, marbled murrelet, black oystercatcher,

anklets, sandpiper, dunlin, whimbrel, snowy plover, osprey, killdeer, and numerous ducks and geese. Many seabird species are endemic and found nowhere else, except along the Oregon Coast. [5]

- The Central Coast, which extends from Lincoln City to Florence, while similar to the North Coast, possesses fewer sandy beaches, more sea cliffs and terraces, and a greater number of bays. [4]
- Average temp runs from 45 F. to 62 F. with approximately 70 inches of precipitation per year. [12]
- Because of the Oregon Coast's physical complexity, many different species of plant and animal can be found in the region, both terrestrial and marine in nature. However, past human interaction has caused a decline in several species of animal along the coast, such as the sea otter. Strict regulations as well as modern human aid have seen a return of some species in recent years. The Oregon Coast is also the location of the Oregon Coast National Wildlife Refuge Complex, which consists of six wildlife refuges, covering 371 acres (1.50 km<sup>2</sup>), spread over a distance of 320 miles (510 km).<sup>[5]</sup>
- Sea Lion Caves is located 11 miles north of Florence, Oregon on U.S. Highway 101, about midpoint on the 400 mile Oregon coast.
- Highway 101 follows a steep and wild sea cape 300 feet above sea level and provides access to the gift shop and office headquarters building through which the Cave is reached. [3]
- The cave system is at sea level and the ocean continually washes into the main cavern. This room has a floor area of about two acres and a vaulted rock dome about 125 feet high.
- Southward from the main chamber a low passage runs 1,000 feet into a sea level opening. This corridor is flooded at high tide and free of water a low tide. [3]
- Elevator has a capacity of 23 passengers, a descent of 208 feet, and a travel-rate of 250 feet per minute

## Section #3

# Sea Lion Caves History 1880 – 2007

**1880** – Sea Lion Caves was discovered by a local seaman, William Cox, who entered the grotto through the western channel in a small boat on a calm day.

He reportedly returned to explore the caves a number of times and on one occasion was marooned for several days because of stormy weather and rough ocean. During this time he supposedly sustained himself by shooting a young sea lion and eating the meat of its flippers.

**1887** – Regardless of the incident’s authenticity, it is established that Captain Cox purchased the land containing the sea lion Caves from the State of Oregon.

**1926** – William Cox and his family owned the property until 1926

**1927** – There were no roads in the area that that time. The slopes of the rocky headlands were used for sheep pasture. Access to the caves from the hillside above was not even considered until after the land was acquired by R.E. Clanton in 1927, with the specific intention of opening the Caves as a business.

**1930** – When it became probably that U.S. Highway 101 would be completed, Clanton was joined by J.G. Houghton and J.E. Jacobson. These three partners decided to risk all that they owned and could borrow to build a safe access to the cave. A trail 1500 feet long was excavated by the hand into the face of the cliff and at its lower termination a 135 stair–step wooden tower was extended down to the north entrance of the caves.

**1932** – Despite the difficulty and danger of the construction, the trail and stairs provided safe access for visitors and Seal Lion Caves was opened to the public by this route in August 1932.

**1934** – Traffic was light at first. The highway was only graveled until 1934. Clanton withdrew from the partnership and R.A. Saubert was admitted a part owner. The

**1937** – Until 1937 there were just five ferry crossing within 100 miles.

**1942** – Word of the amazing phenomenon spread and the number people visiting Sea Lion Caves slowly grew until 1942, when virtually all such travel was halted by World War II. Since 1942 the same three families have since operated Sea Lion Caves as a private responsibility with ownership passing to the partners’ sons after World War II.

**1958** – Elevator shaft was started in April.

**1961** – Since the inception of the Caves in the 1930's word of this unique attraction has been widely spread, The Cave is frequently visited by students of geology, ornithology, marine biology and natural history. The sharpest rise in admissions was experienced in 1961, following the completion of an elevator to carry customers to the cave.

**1982** – In September of 1982 The Caves celebrated its 50 year anniversary with the addition of a bronze statue of a family of sea lions sculpted by Ken Scott.

**2007** – In September of 2007 The Caves celebrated its 75<sup>th</sup> year anniversary with the addition of a Caves Totem Pole.

Sea Lion Caves is located 11 miles north of Florence, Oregon, on U.S. Highway 101, about midpoint on the 400 mile Oregon coast. In this area, Highway 101 follows a steep and wild sea cape 300 feet above sea level and provides access to the gift shop and office headquarters building through which the cave is reached.

The Cave system is at sea level and the ocean continually washes into the main cavern. This room has a floor area of about two acres and a vaulted rock dome about 125 feet high. Southward from the main chamber a low passage runs 1,000 feet to a sea level opening. This corridor is flooded at high and free of water a low tide. The western entrance is a short, high passage flooded at high tide and free of water at low tide. From the north, a third entrance opens into the main cave, about fifty feet above the ocean. This entrance serves as an elevated observation area from which one may view the entire underground cave system and its wildlife.

Lichens, algae, and mineral stains paint the cavern walls with greens, pinks, purples, buffs, and reds, forming on the rough surfaces such easily distinguishable figures as Lincoln's Head, the Indian Maiden, and Goddess of Liberty.

The sea level portion of this cave and the sea cliff rocks just outside the cave have become, over the centuries, the only know mainland rookery (breeding area) and hauling area (wintering home) of the Steller sea lion, and to lesser extent, the California sea lion. The high vault is a natural resting place for fascinating sea birds. Sea Lion Caves is the largest sea grotto in the world;

comparable both in size and coloration to the famed Blue Grotto of Capri in the Mediterranean; and it is nature's entertaining and educational exhibit of a wide variety of marine life.

Originally the cave was entered by a trail and stairs. The quarter mile of steep trail and the 250 stairs were often a formidable climb for many visitors and impossibility for some. The decision to install the elevator was almost public obligation although the construction promised to be an expensive, difficult, and lengthy task.

The job was started in April of 1958. A ten by ten, 70 foot drift tunnel was blasted in the cave wall and then an eight by fifteen foot vertical shaft was excavated, ascending 215 feet. The blasting necessary to drive these two intersection shafts was confined to spring months when the sea lions were out of the caves. The engineers and construction workers used every possible precaution to insure that the wildlife would not be disturbed.

The drift tunnel and elevator shaft could not be finished the first year before the sea lions returned to the caves so the remaining excavation was delayed and finished in the spring 1959. During the fall and winter of 1959, deep foundations were laid, and the shaft and drift tunnel were lined with Gunitite, a mixture of sand, cement, and water, applied with compressed air.

But a unique problem was encountered; the entire shaft was subject to water seepage. The water could not be controlled until the Gunitite lining was installed, and the lining could not be installed until the seepage was controlled. What seemed to be a classic paradox was finally solved by an intricate system of small catch basins which collected the water to be carried away in pipes.

Finally it was possible to finish the shaft lining and to install the ring beams every thirteen feet upon which the elevator guide rails would be fastened. During the fall and winter of 1960-61, the elevator building and the emergency staircase inside the shaft were completed, By June of 1961; the new method of reaching Sea Lion Caves was opened for public use.

The elevator has a capacity of twenty-three passengers, a decent of 208 feet, and a travel rate of 250 feet per minute. It will accommodate about 400 people per hour. Many of its parts and fittings were specifically fabricated to resist the



corrosion of salt air and moisture, and in the years since its completion the elevator has proved to be almost trouble free.

## Section #4

# The Sea Lions of Sea Lion Caves

**Family and Species.** The variety of sea lion which normally lives at Sea Lion Caves is commonly called the Northern, or Steller, sea lion (*Eumetopias jubatus*). The sea lion is named after George Wilhelm Steller, an eminent German naturalist who accompanied the Danish explorer Vitus Bering in 1741 on his second Alaskan expedition. Seller was the first qualified observer to study and classify these animals

The Steller sea lion is a member of the Otariidae family, or eared seal. It is characterized by an external ear which can be closed when entering water and by hind feet or flippers that point backward. Also belonging to the Otariidae family is the California sea lion and the Alaska fur seal.

The Alaska fur seal (*Callorhinus alascanus*), is not found at Sea Lion Caves. The California sea lion (*Zalophus californianus*) is seen all along the Pacific Coast and is generally found a Sea Lion Caves from late fall to early spring. It readily adapts to captivity and is trained for circus acts.

The largest of the eared seal family and the principal tenant of Sea Lion Caves is the Steller sea lion. This animal is also considered non-migratory because there is no mass movement to summer or winter grounds, although individuals or small groups may travel hundreds of miles in search of food. It is found from the central California coast, north to the Bering Sea and back south to northern Japanese waters.

Over the past 30 years an alarming decline has occurred in the number of Steller sea lions throughout most of this range. Sea lion declines of more than 90 percent have been observed at some rookeries and haulouts in the western Gulf of Alaska, the eastern Aleutian Islands, and Russia. The extent of the decline led the National Marine Fisheries Service to list the Steller sea lion as threatened under the Endangered Species Act.

The causes of the decline are uncertain but, some possible contributing factors may include lack of prey due to commercial fishing or climatic change, human disturbance of rookeries and haulouts, incidental taking and deliberate shooting, and subsistence harvests.

The Steller sea lion population estimates in Northern California, Oregon, and Washington are stable. The number of Steller sea lions in the Sea Lion Caves area varies from season to season and from year to year with the heard averaging about 200 animals. A recent survey indicates a worldwide population of about 80,000 Steller sea lions. According to the researchers who frequent the Cave and keep track of the sea lions, their health, and population, the Cave is one of the few areas along the west coast that Steller populations are actually increasing.

Although, the Sea Lion Caves is the year round home of the Steller sea lion, along with the rocky ledges nearby, there are times of the year when the sea lions are neither in the Cave nor on the rocky ledges. The Sea Lion Caves is not a zoo, but an environmentally friendly habitat where these wild animals can come and go as they please, as they have for thousands of years. The management of the Caves is a private enterprise dedicated to preserving the habitat of the variety of animals using the Cave and surrounding area, not controlling their lifestyle.

**Physical Characteristics.** Sea Lions are mammals, or warm blooded animals which give birth, nurse their offspring, and must breathe air. Sea Lions are also Pinnipeds -- literally, feather-footed -- meaning they have finlike members for propulsion. Their pelvic bone structure allows independent use of their rear flippers, and therefore, they can walk on their four web-like flippers which contain the same bony structure as the legs of land animals. In water, the Steller swims by using a breast stroke and may reach a top speed of about 17 miles per hour. In contrast, other marine animals, such as the gray whale, depend on fishlike body action to move through the water. The true fur seals folds its front flippers and swims by the force of its trailing rear flippers.

Young sea lions called pups seem to be immune to most diseases as long as they are nursing. As they mature, pups become susceptible to internal parasites

such as round worms and tape worms which are a deterrent to both growth and longevity. Population increases are also somewhat checked by adult sea lions trampling their young and also by accidental drowning of the newly born which have not yet learned how to swim.

**Diet.** Sea lions are carnivorous – they eat meat. Their skulls are similar to those of bears and their jaws contain sharp teeth much like those found in dogs, cats, and other flesh eaters. They feed exclusively on fish they catch themselves; their diet varying with whatever is abundant in the area. In the vicinity of Sea Lion Caves, they appear to subsist chiefly on bottom fish such as skate, small sharks, squid and various species of rock fish. Sea lions may descend in search of food to a depth of 80 to 100 fathoms (one fathom equals 6 ft.), and normally remain submerged no longer than four or five minutes.

Possible sea lion predation on commercially valuable fish has been of some concern. Because of the animal's remote and rugged habitat, and because collecting specimens at sea is difficult, much is unknown about its diet habits. However, recent scientific studies indicate that valuable fish such as salmon constitute a very minute part of the sea lion diet. Although sea lions are good swimmers, they are opportunists; they find it much easier to capture more sluggish victims than game fish.

If unprovoked, the Steller sea lion would not deliberately attack a human; however, a descent by man into the midst of a harem during the mating season would be foolish. Precautions are taken at Sea Lion Caves to prevent this from happening.

**Family Life.** Sea Lions breed and bear young in the spring, usually in May and June, although some breeding occurs as late as July or even August. The coincidence of breeding and bearing young was once thought possible because female sea lions have a twin uterus, a characteristic of all Pinnipeds. Also, it was assumed that the Steller sea lion bore a pup each year like its close relative the Alaska fur seal.

However, through close observation, it has been concluded that the females generally bear every other year, as half-grown pups have been seen nursing at the mothers retractable dug well past bearing time. This variation from the Otariidae family pattern may well have developed to give the young sea lions a better diet and a better chance of survival. Gestation has been timed at nine months. There is apparently some system of delayed impregnation which makes bearing time conform to the mating season. Cows that lose their pups soon after birth probably breed again immediately and bear the following season.

Until late in August, when mating season finally ends, the heard bulls keep constant vigil over their females. Occasionally a young, strong bachelor succeeds in besting an older bull, thereby acquiring the herd. The heard bulls do not leave their harems even for food for perhaps three months. Only the largest ocean waves can drive them for the ledge into the sea. Females display no loyalty and when a harem is broken by a storm, the bull may never recover all of his chosen mates. Therefore, much of his work involves keeping his “wives” from slipping away in search for food or because of big waves and rough ocean. Naturally, the bulls have lost weight and are exhausted by the end of the breeding season and they generally spend the remainder of the summer by themselves, resting and regaining their strength.

**Size, Growth, and Color.** Sea lion pups are about four feet long at birth and weigh from 40 to 50 pounds. They are slate gray in color for about six months, turn dark brown until approximately two years, and then begin to assume the lighter tan color of the adult. They remain with their mothers well over the year and grow rapidly, averaging about six feet long at the end of their first year. The pups continue to grow, perhaps all of their lives, but the growth rate decreases each year. Mature cows are identifiable by their size and long slender shape. They average about eight or nine feet in length and weight from six to seven hundred pounds. The bulls are much larger and have massive shoulders. They average twelve feet in length and weigh around 1500 pounds. Many extremely large bulls have been known to weigh well over a ton. The average life span of these animals is believed to be about 20 years.

**Commercial Value.** The Steller sea lion has not fur, but instead is covered with coarse, short hair about one inch long on its body, and the mature bull has slightly longer hair resembling a mane around his neck. Therefore, the Steller is not of commercial value except that some natives in remote northern parts of Alaska occasionally take the animal for food or for the skin which is used in boat making.

**An Interesting Enigma.** For some reason, experts have found that the stomachs of many adult sea lions contain stones! These stones vary in number and size from pebbles to three inches in diameter. No one knows whether the stones serve some useful function to the sea lion or whether they might have been swallowed accidentally, possibly in play.

**Sea Lion Dangers and Protections.** The only natural enemy of the sea lion is the killer whale. Sea lions can easily escape the whale’s pursuit by scrambling out of the water onto rocky ledges. Throughout the years, man has probably been the greatest threat to sea lion safety, but from the beginning, the management of Sea Lion Caves has taken the utmost care to avoid

disturbing the animals of the caves' area. For example, the distance between observation points and the wildlife is designed so that the public can enjoy a reasonably close inspection without endangering and disrupting the natural life sequence of the animals. Also, maintenance and improvement is considered an undertaken only when there is no chance of disturbing the wildlife. Consequently, sea lions have continued to use Sea Lion Caves area as a home and a refuge from danger.

The sea lion is protected by Oregon law and it is never legally hunted either for trophy or sport. In December of 1972, landmark legislation was enacted by the federal government, prohibiting the killing, harassment, or even capturing alive of any marine mammal. With these protective laws, hopefully marine mammals, including the sea lion, will maintain their numbers which have slowly diminished over the past thirty years.

All in all, the sea lion is a remarkable animal that deserves our respect and protection. The Sea Lion Caves family takes this responsibility seriously and strives to provide and maintain the best environment possible for the sea lion, while providing the public with the opportunity to view these magnificent animals in their natural habitat. This is truly one of the most remarkable nature experiences anyone is likely to encounter anywhere. At Sea Lion Caves you see these amazing creatures in their natural home. Everyone can experience and enjoy the sea lions where they have chosen to live. Everyone has the opportunity to share their world, and it's a "must see" for nature lovers of all ages.

**The Difference Between Sea Lions and Seals.** They may look very much alike, but are seals and sea lions related? What are the differences?

Seals and sea lions both belong to the scientific order Pinnipedia. The name literally means "fin-footed." There are 33 living species of pinnipeds. They are all warm-blooded mammals that have a streamlined torpedo body, enabling them to swim and dive gracefully. Both seals and sea lions have flippers that act as rudders, helping them to steer in the water. However, although they are very suited to the marine environment, pinnipeds spend part of their life in the water and part on land, which sets them apart from the other marine mammals (whales). Some live a nomadic lifestyle, spending months out at sea and then returning to land to rest. Scientists have divided the pinnipeds into three families: earless seals (Phocidae), eared seals (Otariidae), and walruses (Odobenidae).

The earless **seals** are the phocids. They are what you would think of as a seal. They are called earless because they lack ear flaps. However, this does not

mean they are deaf. Seals have tiny openings, which are called pinnae, that serve as ears. There are eighteen species of seals.

The most distinguished feature of the seal is the flipper. This sets the seal apart from other pinnipeds. They have short foreflippers with a claw on each toe. The hind flippers are also clawed. The flippers have a thin webbing of skin, enabling them to move through the water with grace. Seals can flex their toes to groom themselves or haul themselves out of water. The hind flippers angle toward the rear and cannot be rotated forward. This is a hindrance for seals. For a seal to move across dry land, it must balance its weight on to the fore flippers and crawl along using their bellies. Seals have more girth than most of the other pinnipeds. They are not as sleek and can even appear chubby. Even though they are disadvantaged on land, they move swiftly through the water. The front flippers serve as rudders for steering. The hind flippers allow the animal to thrust along in the water. It is with these combined adaptations that seals can move along through the water at speeds of 14 to 24 miles an hour.

The **sea lion** is the pinniped that most individuals know, because they are frequently used in water shows at theme parks. Sea lions make up several of the fourteen species that make up the family Otariidae. The sea lion differs from the seal in that its pinnae are covered by external ear flaps. This is why they are known as the “eared seals.” Sea lions also have longer necks than seals. The body of the sea lion is much sleeker than that of the seal, even though sea lions are generally larger than most seals: a male sea lion of certain species can tip the scales at over six hundred pounds, compared to less than four hundred for a large seal.

Another very different adaptation of the sea lions is the flipper. Sea lions’ front flippers have only a partial fur covering, unlike the seal, whose flippers are covered entirely by fur. Sea lions’ first toes are longer than the other toes. Their hind flippers are extremely flexible, and can actually rotate forward and beneath the body. This enables sea lions to move around on land with ease, unlike the seal. They are very dexterous creatures and thus have been the stars in many movies as well as marine aquarium shows.

Behaviorally, sea lions are usually more vocal than seals. Sea lions are called “sea dogs” due to their unique barking noise, whereas seals tend to make much quieter grunting noises. Sea lions also tend to be more social than other pinnipeds.

Both seals and sea lions have some similarities, such as adaptations that make them extremely effective oceanic animals. Both species are adept at diving and can reach to depths beyond a thousand feet, the record-holder being the

elephant seal, which can descend to 4,125 feet. In fact, only the sperm whale and the beluga whale are capable of making deeper dives.

In the wild, both seals and sea lions are hunted by the killer whale. In the past both were also hunted by humans for their pelts and blubber, the fatty insulating layer both groups have beneath their skins.

Seals and sea lions actually have more in common than they have different. The differences are mostly physical as described previously. However, you are more likely to see a sea lion than you are a seal: if you have ever been to the Sea Lion Caves, you have probably witnessed some Steller Sea Lions piling on top of each other on the rocks in the Cave.

### **Avoid Disturbing Wildlife**

Public use at the Oregon Coast Refuges is restricted to limit disturbance to wildlife and their habitats. ALL COASTAL ROCKS AND ISLANDS ARE CLOSED TO PUBLIC ACCESS AND ALL WATERCRAFT SHOULD STAY AT LEAST 500 FEET AWAY.

### **Caution**

Coastal areas, with their steep cliffs, strong currents, and heavy surf, can be extremely dangerous. Exercise caution during your visit. Stay away from cliff edges, and observe posted warnings. Avoid climbing on drift logs as they can roll in the surf at any time. Consult weather forecast and tidal charts before boating, canoeing, or kayaking.

## Section #5

### **A Good Scientific Investigation** (5.3S.1, 5.3S.2, 5.3S.3)

A good scientific investigation is not just one experiment. It is a long-term series of related experiments. A good investigation will be characterized by the following:

- It is as specific as possible.
- All factors are held constant except for the one factor being tested.
- It has control. The control proves that the factor being tested actually caused the result being observed. It is a basis for comparison.
- It is extensive, continuing for a period of time and testing a large population.
- The student doing the investigation records each phase of work in a journal. The journal includes the thought processes the student followed, the work that led up to his/her experiment, the investigative techniques that were used, the results of each test, the problems that were encountered, and the solutions to the problems. Charts are also included in the journal to help organize the data collected.
- The results are measurable or countable.
- Its experiments are repeated several times and the results are averaged.
- Its results are compared to known data.



- Its results are presented in charts and graphs. A good graph is neatly drawn, is large enough to be clearly seen, uses color or texture to clearly show a difference among items being graphed together, has limited items to prevent confusion, includes a key to explain colors or symbols, has a title and tells a purpose, and has labels for each axis to indicate what they represent and what measuring units are used. Explain the reasons why similar investigations may have different results.

### **Any science fair exhibit should contain the following:**

- problem
- purpose
- hypothesis
- data
- results
- conclusions
- materials
- variable
- procedures

### **The six steps to the scientific method:**

- State the problem
- Gather information
- Formulate a hypothesis
- Test the hypothesis, limiting the number of variables to one
- Record and analyze any changes
- State the conclusion

When all is said and done, sometimes more is said than done. However, regardless of that fact, scientists do sometimes disagree. Even when utilizing

the data collected from the same study, scientists may draw different conclusions. Yet, as non-scientists, we often feel we must accept whatever the experts write or say – not true. But when they disagree, whom do we believe? How do we draw our own conclusions from the research? How do we know what is fact and what is really theory?

**Below are a few questions that a non-scientist may attempt to answer to decide for him/herself if something is fact or theory:**

- Was the idea or fact tested through observation and experimentation?
- Is the idea or fact based on an assumption?
- Is the idea or fact consistent with other scientific laws; such as the law of biogenesis, the law of heredity, the laws of logic, the laws of probability, the 1<sup>st</sup> law of thermodynamics; the 2<sup>nd</sup> law of thermodynamics?
- Was the idea or fact tested in such a manner that all things were considered – the actual structure of what was being tested and its chemical nature, etc.?
- Does circular reasoning or scientific reasoning support the idea or fact?
- Does the idea or fact sound sensible or does it conflict with what you are able to observe in nature.

**If you read or hear something that just does not make sense to you, investigate. It may be nonsense.** [13] ( pages 9 and 10 were taken almost entirely from “About Bats, Caves & Deserts” a Carlsbad Cavern National Park Elementary Curriculum guide with permission – <http://www.nps.gov/cave/forteachers/curriculummaterials.htm>)

## Section #6

# Geology

### Types of Caves

Cave and cavern are different words for the same thing. Caves are underground cavities formed by nature. Mines are manmade. There are more than 40,000 known caves in the United States.

Caves harbor rare animal life, fragile mineral formations and irreplaceable archaeological objects. Most caves are wild caves. Only explorers who have special permits may enter them. Show caves such as Sea Lion Caves are open to the public. Like Sea Lions Caves, they may have lights, stairs, railings and benches.

Mammoth Cave in Kentucky in the worlds' largest cave with 355 miles of passageways explored. Lechuquilla Cave in Carlsbad Caverns National Park is the deepest limestone cave in the United States with thus far with more than 100 miles of surveyed passageways. The world's deepest cave is Jean Bernard Cave in France at 5, 256 feet deep. The world's largest cave chamber is Sarawak Cavern in Sarawak, Borneo. The chamber is 2,300 feet long. The largest room in North America is Carlsbad Cavern's Big Room. Sea Lion Caves is the world's largest sea cave.

### **Caves are formed in various ways...**

- **Solutional caves** are formed by weak, natural acid dissolving soluble rocks such as limestone, dolomite, gypsum and marble. Carlsbad Cavern is a solutional cave.
- **Lava tubes** form during the cooling of lava flows. First, rust forms on the lava as it begins to cool. A break in this crust allows some of the molten lava to flow through the crack leaving long, tunnel-like passages.
- **Sea Caves** form from wave action. The waves force water into the cracks in the rock, breaking off the rock or wearing it down. Sea Lion Caves is a sea cave.
- **Wind Caves** form from wind erosion or cliffs or hills. They are almost always small caves that seldom penetrate into total darkness.
- **Talus caves** form from huge rocks that have fallen from cliffs.
- **Glacier caves** form from by melting waters moving through glaciers.

- **Soil caves** form when flash floods move through the soils and transport earth with them. They are found in desert areas.
- **Tectonic caves** form by the action of earthquakes.

## The Geology of the Sea Lion Caves

**25 Million Years Ago** – The land mass which now underlies the Pacific Coast emerged in the Devonian Period before mammalian life was established on land. In its birth, the Oregon coast may have risen and subsided a number of times before finally stabilizing about 25 million years ago in the Miocene Period of the Cenozoic Era.

This was a time of intense volcanic activity in the Pacific Northwest, when vast lava eruptions flowed thousands of feet deep across the land and into the sea. This floating igneous rock, basalt, formed towering headlands and steep coastal cliffs, and blanketed the lighter sedimentary sandstone and igneous granites of the earth's crust.

During the Cenozoic Era the coastline was rising as it is presently, but the action was considerably more rapid. The flat crescent of sand dune beach south of the Sea Lion Caves is believed to have emerged from the water at a later period than the land on either side.

Ages may have intervened between lava flows during which time layers of ash and sediment formed on what was then the earth's surface. Often eruptions followed, covering sediment with more basalt. This layering effect can easily be seen in the cave.

As the heaving and growth of the earth subsided, the coast was subjected to the eroding action of the sea, through many centuries the waves engraved their record into the Pacific shorelines, grinding softer rock to fine sand and carving out great capes and offshore islands.

At Sea Lion Caves, geologists believe that a combination of earth faults and a stratum of soft, vulnerable rock may have opened the way for the ocean to work, thus carving the enormous cavern that now exists. In any event, the vast Sea Lion Caves with its odd formations and many colored walls was uniquely accepted by the huge sea lions as a safe and attractive home.

## Geology: Our Rockin' Earth

### Overview 4.2 (4.2P.1, 4.2P.2, 4.2P.3)

The earth is constantly changing and evolving. The changes occur through natural process such as plate tectonics, weathering, and erosion, while other changes are caused by human action. By studying Earth's dynamic geologic makeup and rock cycle, students will understand the forces and processes that create Earth's various landforms and develop and appreciation for the importance of geology in people's lives. As human and environmental impacts are evaluated, stewardship behaviors that support a healthy world will be explored and practiced.

### Objectives

Following the Caves experience and classroom activities, the students will be able to

1. Name the three major rock categories and explain the rock cycle;
2. Describe the theory of the geologic processes that created the Coast Range Mountains;
3. Identify examples of weathering and erosion and describe the impacts on landforms;
4. Determine relationships between area geology and living organisms, including people;
5. Describe how Sea Lion Caves protects geologic resources and list three ways people can help protect and conserve resources.

## Background Information

There are four main layers of the earth – the crust, mantle, outer core, and inner core. The crust is Earth's outer layer composed of solid, rocky material. If the Earth were compared with an apple, the crust would be as thin as the apple's skin. The mantle is the middle layer made of soft, solid material (like butter left out on the dinner table). The mantle is very hot and under tremendous pressure. The outer core, which begins more than 1,800 miles beneath the surface, is hot molten liquid. Scientists think this is rich in iron and nickel. The movement of this liquid probably causes Earth's magnetic field. The inner core, also mostly iron and nickel, is squeezed solid due to extreme high pressure.

Scientists believe that the Earth is approximately 4.6 billion years old. Its geology is constantly changing, being restructured and reformed through natural phenomena and also by human impact. The modern theory of plate tectonics (formerly called continental drift) states that the Earth's outer crust of the earth is separated into several "plates" some containing continents, which move slowly, but continually. The constant movement of the mantle layer causes the overlying plates to crack and move. Geologists generally agree that there are 6–8 large plates and a number of smaller ones.

Adapted from  
Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

There are three main types of plate boundaries: convergent, divergent, and transform. Tectonic activity, such as earthquakes and volcanoes, often occurs along these boundaries.

A convergent boundary occurs when plates move towards one another. Their collision (convergence) causes folding and uplifting of rocks. The Oregon Coast Range Mountain range could have formed through subduction as one plate slid beneath the other or by uplift of the plate boundaries at the collision area. Volcanoes can form when the subducted plate melts deep in the Earth and the molten rock rises as magma to the surface.

A divergent boundary occurs when plates pull apart (diverge) from each other. A rift zone is formed causing the Earth's crust to thin and form a rift valley. If the plates continue to pull apart, magma will rise through the rift forming new crust.

A transform boundary occurs when plates slide laterally past one another. Friction from this movement along plate boundaries can create earthquakes. As the plates move relative to one another, the crust is stretched, compressed, or sheared along the boundaries. A tremendous amount of strain builds up. When the strain finally reaches the breaking point and is suddenly released, the crust breaks, the rocks are displaced, and violent shaking of the earth occurs.

The Earth is undergoing continuous change through the formation, weathering, erosion, and reformation of rock. This process is called the rock cycle. There are three main types of rocks; igneous, sedimentary, and metamorphic.

Rock deep within the earth encounters temperatures high enough to make it melt. This liquid stage is called magma. Igneous rock is formed when the magma cools and solidifies. Magma forms volcanic rock when it is forced to the surface and cools. Magma forms granitic rock when it cools beneath the Earth's surface.

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

As rocks are weathered (broken down into smaller pieces) and eroded (moved to new locations), the rock fragments (sediments) build up in layers. The combined weights of the layers along with other pressures within the Earth cause the layers to compact. The tiny spaces between rock fragments fill with natural cementing agents. Mineral grains in the rock may grow and interlock. Thus, sedimentary rock has been formed. Sedimentary rock is also formed under water when shells and skeletons of sea creatures accumulate on the ocean floor. Over a long period of time, these sediments compact and harden to form rock. Fossils are most often found in sedimentary rock.

Sedimentary and igneous rocks can be altered by the tremendous pressures and high temperatures associated with the movement and collision of tectonic plates. Metamorphic rock is formed under these extreme conditions. Ultimately,

any of the rock types may again return to a hot, molten state deep in the Earth, thus completing the rock cycle.

Studying geology helps people to understand how today's geological formations were created and to predict future changes. Geologists often take a "core sample" by drilling into a rock formation and pulling out a layered specimen of the rocks to determine a timeline of geologic events for that area. The consequences of natural events and human activity can be better analyzed with knowledge of the underlying rock formations. Through this understanding, a student may develop a new sense of respect for our environment and a new commitment for the responsible, caring, and protective behaviors of good citizenship and environmental stewardship.

### **Visiting Sea Lion Caves**

The mission of the Sea Lion Caves is to preserve and protect the natural resources of the Caves for all people to enjoy. It is important for visitors to practice good stewardship ethics and behaviors in order to pass these unique natural treasures on to future generations in an unimpaired condition.

We recommend following Leave No Trace (LNT) principles when visiting Sea Lion Caves. There are six LNT principles:

- Plan ahead and prepare
- Travel on durable surfaces only
- Dispose of waste properly
- Leave what you find

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

- Be considerate of other visitors
- Respect wildlife

Following these principles and Cave rules will help make your visit safe, successful learning experience while also caring for the natural resources.

### **Vocabulary**



- **basalt** – rock formed from solidified lava
- **compression** – a force that squeezes or pushed together the Earth's crust
- **convergent boundary** – occurs when plates move towards one another
- **crust** – thin, rocky, outer layer of the Earth
- **divergent boundary** – occurs when plates pull apart (diverge) from each other
- **erosion** – the movement of rocks by processes such as gravity, running water, waves, moving ice, and wind.
- **earthquake** – a shaking or trembling of the crust of the Earth
- **fault** – a crack in the Earth's crust along which the rocks on either side have moved
- **fold mountains** – mountains made of crumpled and folded layers of rock
- **geology** – the science dealing with the physical and historic nature of the Earth
- **igneous rock** – rock formed when melted rock material cools and hardens
- **inner core** – a layer of the Earth, mostly iron and nickel, that is squeezed solid due to extreme high pressure.
- **lava** – magma that reaches Earth's surface and cools
- **magma** – hot molten rock deep below Earth's surface
- **mantle** – the layer of the Earth's interior immediately below the crust
- **metamorphic rock** – rock formed under heat and pressure by changing a pre-existing rock.
- **minerals** – solid material of Earth's crust with a definite chemical composition

- **outer core** – a layer of the Earth which begins more than 1,800 miles beneath the surface and is hot molten liquid
- **plate tectonics** – a scientific theory that Earth's crust is made of moving plates
- **rift** – an elongated opening or split in the crust of the Earth located where the earth is pulling apart by tension (divergence)
- **rock** – a naturally formed solid in the crust made up of one or more minerals
- **rock cycle** – rocks changing from one into another in a never-ending process
- **sedimentary rock** – rock made of bits of matter joined together

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

- **shear** – a force that twists, tears, or pushes one part of the crust past another
- **subduction** – one plate sliding beneath the other
- **tension** – a force that stretches or pulls apart the Earth's crust
- **transform boundary** – occurs when plates slide laterally past one another
- **uplift** – a raising of land above the surrounding area
- **volcano** – a vent in the Earth's crust through which molten rock (lava), rock fragments, gases, and ash, are ejected from the earth's interior.
- **weathering** – breaking down rocks into smaller pieces by mechanical and chemical processes such as ice wedging, root wedging, acid rain

## Pre-Visit Activities

Prior to beginning the Geology unity study, have the students take the Geology Pre-Visit Assessment. Record the class scores on the Pre-Visit/Post-Visit Score Sheet. Begin the unit study. Incorporate as many of the following pre-visit

activities as possible into your lesson plan to prepare the students for the visit. For more fun geology activities see Good Steward: Caring for the World Around Us at [http://www.nps.gov/shen/forteachers/upload/edu\\_steward\\_geology\\_rocks.pdf](http://www.nps.gov/shen/forteachers/upload/edu_steward_geology_rocks.pdf)

## Materials

Collection of pocket-sized rocks (enough for 1 per student), pipe-cleaners, plastic eyes, paints, hard-boiled eggs, poster board, paper, pencils, permanent markers, glue, clay, dough, or wooden blocks, bread (white, wheat, and grain), peanut butter, raisins, nuts, honey, marshmallows, jelly, candy worms, large, clear plastic straw or sections of plastic PVC tubes, class-size number of chocolate cream-filled cookies.

### 1. Motivational Activity

Bring to school a collection of pocket-sized, interesting rocks – at least one for each student. Have each choose one he/she likes or is drawn to, hold it, and get comfortable with it. Ask students to share what it is about the chosen rock that tells

- how it is unique,
- why it was chosen, and
- how it reminds the student of himself–herself, i.e., it is colorful, smooth, has a happy feeling, is jagged, light–weight, tough, sparkly, etc..

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

Brainstorm why rocks are important in our lives. What are some things we use them for? Have students start a journal by first drawing their “special rock,” naming it, and writing about it using personification techniques. This rock could be carried back and forth between home and school and be a pretend “friend” in future journal entries. For example: “Rocko had a difficult beginning – he/she was formed by....., We went to the football game yesterday.....”, etc..

At the end of the unit, these personal rocks might be decorated with paint, glitter, plastic eyes, pipe-cleaner legs, and used either as a present for a parent, a paperweight, or as a “pet” and decorative reminder of the unit of study.

## 2. Vocabulary Activity Suggestions

- a. Play the bingo-like game called “Rocks” Bingo (game card and teacher page attached). Make copies of game cards and have each student randomly write in the vocabulary words to fill in each box. When everyone has a game card ready, begin calling out vocabulary terms. As each term is called, players should cover the correct term on his/her card from a supply of pebbles or small stones. Play until someone achieves “Rocks.”
- b. Write a short list of vocabulary words on the blackboard. Have students close their eyes while you or a selected student erases one. Then see who can correctly identify, spell, and write the missing word. You might ask for the definition before allowing the word to be written. This is good for a 5–19 minute time-filler.
- c. Have students work in groups to act out a term from the vocabulary list while their peers try to identify and spell the word (charades or password game).
- d. Play “I’m Thinking of a Word” (variation of “Twenty Questions”). Student leader should provide “yes” and “no” answers until the word is guessed correctly.

## 3. Read and Discuss

The Magic School Bus – Inside the Earth and The Magic School Bus Blows Its Top!

## 4. Use A Hard-Boiled Egg To Illustrate The Layers Of The Earth

First, gently tap the egg on a hard surface to create several cracks in the shell. Using a marker, outline enough of the cracks so that there are eight large “plates.” Carefully cut the egg in half lengthwise and make a dot in

the center of the yolk with the marker. The shell represents the Earth's crust, the outlined cracks the tectonic plates, the egg white the mantle, the yolk the outer cores, and the dot the inner core. Discuss the fact that the real tectonic plates on the Earth's crust actually move, causing geological phenomena such as earthquakes and volcanoes.

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## 5. Rock Cycle

Have the students create a diagram or poster illustrating and correctly labeling the parts of the rock cycle. Post on bulletin board or around the classroom.

## 6. Discuss Weathering and Erosion and the effect Geology has on plants, animals, and people

- a. Take a brief walk around the school to observe and discuss weathering (rocks that have changed in place as a result of mild-flowing water, lichen, acid rain, ice or root wedging) and erosion (rocks that have been moved by machines, people, animals, fast-flowing water).
- b. Ask "Do plants and animals depend on geology for anything?" (Rocks weather and erode and become part of the soil, providing plants with necessary minerals. Rocks provide homes for animals. Rocks can prevent slow down erosion and provide protection).
- c. Discuss "Do people depend on geology for any resources?" (People depend on fossil fuels – oil, coal, and natural gas. Rocks weather and erode, adding minerals and nutrients to enrich soil for farming. People use many metals such as aluminum, iron, copper, and gold. Many types of rock are used as construction and building materials.)

## 7. Leave No Trace Principals: Suggested Activities for "Travel on Durable Surfaces: and "Be Considerate of Other Visitors."

To prepare for your visit, share with your students the mission of The Sea Lion Caves. Explain that the mission is to protect and preserve the natural resource for the present and future visitors to enjoy. Lead them to understand that they can help protect the beauty and natural resources of Sea Lion Caves by using good environmental stewardship practices.

- a. Introduce the Leave No Trace principal of “Travel on Durable Surfaces.” Take the students outside and walk on the sidewalk or through the playground and ask if they can tell where their footsteps were. Next, have them walk through a grassy area and ask if they can tell where they had walked.

Next, divide the class into teams of 3–4 students and give each team a short loop of rope tied into a circle. Each team should have a leader, a recorder with paper and pen, and “explorers.” Establish boundaries and have the teams find a natural area and place their loop of rope on the ground.

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

The teams should explore the area inside their loop of rope, counting and identifying the number of living organisms they can find. Picture may be drawn and each unique plant or animal can be tailed and counted.

Gather the teams to share their finding. Ask them what would happen to the living things they found if something travels over the area. Students should understand that every place on earth contains living organisms and that they should walk on trails and durable surfaces whenever possible.

- b. Introduce the Leave No Trace principle of “Be Considerate of Other Visitors.” As you read an interesting, captivating story, have one student (or another teacher) rudely interrupt

conversation by walking in and loudly talking on their cell phone, blatantly ignoring any stares from the offended parties and flaunting loud colors and rude behaviors. Later, ask the student how they felt about their behavior and whether they think it would intrude on a quiet walk in the woods or trying to study.

Have the students brainstorm a list of rules and behaviors to follow on the trip to The Sea Lion Caves that is considerate of other visitors and helps keep plants, animals, and themselves safe. The students could create and perform short skits to demonstrate and discuss good and bad behavior. By following these Leave No Trace principles, they can help preserve both the integrity of the Caves resources and the great experience visitors might have.

8. Begin final preparation and planning for the class field trip to Sea Lion Caves. Review appropriate dress and practice proper field trip behavior and exploration skills with students. Have students write letters to their parents informing them about the time and date, appropriate dress, personal needs, and behaviors expected for the field trip.

## Sea Lion Caves Field Trip

The visit will generally take a minimum of 60 minutes. For adequate learning experience, please remember the following:

- Bring enough competent chaperones to assist on the visit. We recommend 1 adult for every 5–6 students

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

- Review appropriate dress and behavior for the field trip and remind student they will be in school while at the Caves. Warm clothes and sturdy shoes are important due to uneven trails, blustery wind, and rain squalls making trails slippery.

- Before arriving at the Caves, have the students divided into groups of 5–6 and assign chaperones to groups. Provide nametags for all participants, including adults.
- Cross Highway 101 in a group as it is a very busy highway. Do not allow students to dangerously cross on their own.
- Use bathroom facilities upon arrival, if necessary. There are bathrooms in the main building and at ground level near the bronze statue.
- A drinking fountain is located bottom of stairs near bathrooms in main building.
- There are six zones to distribute students if necessary; Totem Pole outside, Main Building, Bronze Statue of Sea Lion Family, Over-look, Elevator entrance, and Cave. Five minutes at each station and 10 minutes in the Cave, plus walking, time will run over 45 minutes. Another 15 minutes for bathroom, drinks, and bus unloading and loading make the visiting time run over 60 minutes.
- Plan for lunch. There are no facilities for lunch at the Caves. However, one mile north of the Caves is Heceta Head Lighthouse Park with benches, tables, and restroom facilities, but no shelters. There are shelters at the Caves for inclement weather, but the two – 100 yard long trails are not covered. There are benches along the trails, a shelter at the overlook and at the entrance to the elevator. Each shelter can hold about 15 individuals.

## Post-Visit Activities

Following your visit to Sea Lion Caves, incorporate as many of the following post-visit activities as possible into your lesson plans to conclude the unit of study. Give the students the Geology **Post-Visit Assessment**. Record the class scores on the **Pre-Visit/Post-Visit Score Sheet**. Complete the **Program Evaluation Form**. Return the program evaluation, pre/post-visit score sheet, and any other student work to:

**Sea Lion Caves**

**91560 Hwy. 101**



Florence, OR. 97439

Attention: Boomer Wright

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## 1. Simulate Plate Tectonics

- a. Students can use clay, dough, or wood block models to simulate typical tectonic plate movement and the resulting landforms: uplift – plates crash into one another (converge) creating mountains; subduction – one plate slips under another causing folding of the upper layers; divergent – plates drift apart (diverge) and separate causing rifts; and transform fault – plates slip laterally past each other causing earthquakes.
- b. A fun option is to use chocolate, cream-filled cookies to simulate the three types of tectonic plate boundaries. The upper chocolate cookie represents the tectonic plate while the creamy filling represents the buttery consistency of the upper mantle. Have students remove the upper chocolate cookie and break it into two pieces, then replace the broken pieces on top of the creamy filling.

With the upper cookie pieces still resting on the filling, have students follow these steps:

- Pull the broken pieces apart to simulate a divergent plate boundary. This is caused by tension.
- Slide the pieces laterally to simulate a transform (sliding) plate boundary. This is caused by a shear force which causes the two sides of the crust to tear, twist, or push past each other.
- Push the pieces together to simulate a convergent plate boundary. This is caused by compression, and might result in the rising up of the upper cookie pieces (simulation the crumpling and folding formation of a mountain range) or one plate subducting beneath the other into the creamy filled mantle. The heat and pressure caused by this convergent collision would cause some degree of metamorphism of existing rock.
- Allow the students to eat their “geologic formations.”

## 2. Create A “Sedimentary Rock Sandwich” And core Sample Of Earth Layers.

See “Peanut Butter and Jelly Geology” at [http://www.aimsedu.org/aims\\_store/Peanut-Butter-and-Jelly-Geology-p-4350.html](http://www.aimsedu.org/aims_store/Peanut-Butter-and-Jelly-Geology-p-4350.html)

Have several sets of materials available and covering for individual desks. Read the following story sequence and have students simulate the history of various geological formations by building layered sandwiches.

- **First Layer** – white bread

White sand erodes from upper rocks and is transported by rain, melting snow, and gravity into a flowing stream at the foot of a mountain. The sand is carried along the stream into a river that eventually widens, causing the flow of the water to slow down. This allows the white sand to drift slowly to the bottom. Over many years, this sand becomes cemented together forming a layer of white sandstone.

Adapted from Shenandoah National Park Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

- **Second Layer** – chunky peanut butter, chocolate chip chunks, raisins

A hurricane passes through the area, bringing torrential rains and wind. Trees, rocks, dirt, and gravel erode into the water and cover the white sandstone.

- **Third Layer** – wheat bread

Over many years, the river erodes brown silt particles from the land and carries them downstream. Again, the velocity of the water slows as the river widens and the silt gradually drops to the bottom. This eventually forms a sedimentary rock called shale.

- **Fourth Layer** – jelly

Meanwhile, glaciers are melting on the Earth causing the ocean to rise and cover the area. Millions of tiny marine organisms and shells line the ocean floor. After many years, the ocean recedes and shells have cemented together forming a layer of rock called limestone. Many fossils can be found in this layer.

- **Fifth Layer** – candy worms or fish as the fossilized animals
- **Sixth Layer** – dark bread
- Finally, a layer of brown sand is blown over the entire area. There has been a severe drought and mighty winds have sandblasted large, brown boulders with small bits of rocks. In time, this layer will become brown sandstone.

The geology sandwich is now complete! Have students pretend to be geologists and use a clear plastic straw or a section of small-diameter plastic pipe to take a “core sample” of the layers. Have the students examine the core and identify the layers. Relate this to real core samples that help determine the composition and historical sequence of the Earth’s formation.

Review the concept of plate tectonics. Have students cut or break their sedimentary sandwich in half and simulate two plates colliding (convergent boundary). Relate this crumpling and folding to the formation of mountains (such as the Coast Range). The heat and pressure resulting from the collision cause the rocks to change through metamorphism. Encourage student to also simulate divergent and transform boundaries with their sandwich halves.

Ask students to visualize the interior layers of mountains, describing how the order of layers can change. They may take a core sample after each “geological event” and compare the results. Conclude by having the students illustrate, label, and explain the new concepts learned in their journals before eating their geological formations.

### 3. Slow Down Erosion!

Erosion by water can wind can cause damage to natural features and human communities. There are ways to slow down erosion and your class can help! Have students locate an area at school or in the city that is barren of vegetation. After getting approval to work the site, have students’ plant grass, trees, or flowers in that area.

Adapted from Shenandoah National Park Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

For a hillside, build rock-lined terraces with raised rows of dirt to help slow run off from the rain. Trees will slow the speed of the wind; rocks and plant roots will help anchor the dirt. Students’ might clear a trail an

use pebbles to create a walkway through what will become a new green space for visitors to use.

#### 4. Class Discussion

- a. Remind the students that the Earth is constantly changing and evolving. Geological change can occur very slowly, as in the formation of sedimentary rock or the weathering of exposed rocks. Change can also occur suddenly, as in landslide or an erupting volcano. Review how animals, plants, and people use and depend on geologic resources. Ask the students how geologic change can affect living things. How important is geology to living things?
- b. Ask “Now that you realize how important geology is to living things, can you imagine life without geology?” We all live on land that is made of rocks and geologic features and depend on many geologic resources. Ask the students if they think human actions can affect the land and geology. Examples include the mining of metals and coal; drilling for oil and natural gas; farming; using geologic materials for construction; moving earth and rock for the development of homes, stores, and cities; and damming rivers. Remind the student that geologists think it took millions of years to create these resources. Are these resources that we depend on replaceable? If not, how long before the resources are used up? At Sea Lion Caves, what would happen to the sea lions if the Cave was not their home anymore?
- c. Ask the students if people should care about geologic resources. Have the students brainstorm ways people can help conserve and protect resources for the future, while maintaining jobs and leisure time for humans. Examples include recycling aluminum and other metals to reduce mining (are there good mining practices?); using energy-efficient transportation and machines to reduce oil, gas, and coal consumption (are there good driving practices?); following good farming practices to reduce erosion and soil loss; and reducing waste to conserve resources. Introduce the term stewardship and have students discuss the reasons why there is such a heated national discussion about environmental concerns vs. preserving jobs. Example of a compromise that is successful is the Alaska Pipeline.

#### 5. Portfolio Activity

Use the attached Geology Portfolio Page for an end-of-the-unit portfolio activity. You may use this as a unit final evaluation, confirmation of student learning, or portfolio page. Below is a suggested rubric. Provide each

student with a copy of the worksheet and encourage creative writing and thoughtful input. If possible, send copies of completed worksheets, artwork, and writing to the Sea Lion Caves. We would love to have them and put them on display.

Adapted from Shenandoah National Park Education, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

Number		Points Possible	Student Totals
#1 - 2 (20 points each)	Facts and Knowledge - with explanations	40	
#3 - 4 (20 points each)	Expression of Behaviors	40	
#5	Environmental writing	20	
		100	

## Unit Assessment

1. Observe and document student interaction, discussion, behavior changes, skits, and written work.
2. Evaluate dioramas, posters, journals, and involvement based on effort and correct number of pre-determined and posted criteria.
3. Assess the attached Geology Unit pre-and post-tests.
4. Utilize the portfolio rubric to evaluate concluding journal activity.

## Going Further

1. Have the students research the timeline of major geological events leading to the earth's features of today. This should include scientific data regarding plate tectonics and the creation and causes of local (or worldwide) land formations. Assign posters, dioramas, or a large bulletin board for display. Have the students conduct research to find facts about each rock type and their formation and label them accordingly.

2. Using plaster of Paris, have students create fossils and display them on a table for all to see. They might use leaves, bones, or tools. Spray the plaster of Paris with cooking oil before you place the “fossil.” Have students write creative stories about their fossil and how it was “formed in history.”
3. Have students act out the rock cycle. Divide the class into 3 groups: igneous, metamorphic, and sedimentary. Students can act out the formation of the different rock types. Costumes can be created to represent rock types or conditions such as red flame-type material for magma. One student in each group can act as the “radio announcer” or “story teller” to describe the conditions and changes taking place in their sequence. Groups might create a “rap” or song to accompany their drama and the sequence could be performed for other grade levels. Option: present the musical play “Geology Rocks!” See <http://www.badwolfpress.com/geology.htm>.

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

4. Have students organize a recycling program in the school. Use the proceeds to create a rock garden in the school courtyard or in a local park that has been trampled down or misused. Display a variety of rock types and have students label them for all to enjoy. Plant a variety of bushes to attract wildlife and beautify the area. Create a cascade of water flowing over hard rocks. Have students simulate the creation of a waterfall or mountain spring.

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Geology Pre-Visit Activity “ROCKS” Bingo

Directions: Write a geology term from the vocabulary list in each blank space. Cover the work when it is called (as you would in BINGO). You have won “ROCKS” if you cover the squares in the format pre-established by the teacher (line down, line across, diagonal, all 4 squares covered in any corner, 4 corners, or full board).

Name \_\_\_\_\_

R	O	C	K	S

		<b>FREE PEBBLE</b>		

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Geology Pre-Visit Activity “ROCKS” Bingo – Teacher Page

Use this table as a master copy of vocabulary words to call. Mark off each word then it is used. Have students prove their winning format by calling their list back.

<b>R</b>	<b>O</b>	<b>C</b>	<b>K</b>	<b>S</b>
basalt	basalt	basalt	basalt	basalt
compression	compression	compression	compression	compression
convergent boundary	convergent boundary	convergent boundary	convergent boundary	convergent boundary
crust	crust	crust	crust	crust
divergent boundary	divergent boundary	divergent boundary	divergent boundary	divergent boundary



erosion	erosion	erosion	erosion	erosion
earthquake	earthquake	earthquake	earthquake	earthquake
fault	fault	fault	fault	fault
fold mountains	fold mountains	fold mountains	fold mountains	fold mountains
geology	geology	geology	geology	geology
igneous rock	igneous rock	igneous rock	igneous rock	igneous rock
inner core	inner core	inner core	inner core	inner core
lava	lava	lava	lava	lava
magma	magma	magma	magma	magma
mantle	mantle	mantle	mantle	mantle
metamorphic rock	metamorphic rock	metamorphic rock	metamorphic rock	metamorphic rock
minerals	minerals	minerals	minerals	minerals
outer core	outer core	outer core	outer core	outer core
plate tectonics	plate tectonics	plate tectonics	plate tectonics	plate tectonics
rift	rift	rift	rift	rift
rock	rock	rock	rock	rock
rock cycle	rock cycle	rock cycle	rock cycle	rock cycle
sedimentary rock	sedimentary rock	sedimentary rock	sedimentary rock	sedimentary rock
shear	shear	shear	shear	shear
subduction	subduction	subduction	subduction	subduction
tension	tension	tension	tension	tension
transform boundary	transform boundary	transform boundary	transform boundary	transform boundary
uplift	uplift	uplift	uplift	uplift
volcano	volcano	volcano	volcano	volcano
weathering	weathering	weathering	weathering	weathering

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Post Visit Activity – Geology Portfolio Page

Name \_\_\_\_\_ Date \_\_\_\_\_

School \_\_\_\_\_

Teacher \_\_\_\_\_

**#1 – 2 Facts And Knowledge:** Identify 2 new facts you learned in this unit of study and tell why you think each is important.

1)
2)

**#3 – 4 Behaviors:** List 2 behaviors you learned in this unit that can help protect Sea Lion Caves, while allowing human access, and/or preserve the natural resources of our world, while allowing for human needs .

3)

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

4)

**#5 Environmental Writing:** Write a paragraph, creative story, poem, essay, rap, song, etc. about these stewardship behaviors. You might tell how using them could change your life and your future world. Try to balance environmental needs (plants, animals, water, soil, ocean, the earth, etc.) with human needs (jobs, growing food, water, housing, energy, etc.). If you have time, create a picture to go along with your writing. If you need more room for writing or drawing a picture please just add another sheet(s)

5)


Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Geology: Our Changing Earth Pre/Post Visit Assessment

Name \_\_\_\_\_

Date \_\_\_\_\_

**Instructions: Read each question carefully and choose the one best answer. Circle the letter of your choice.**

1. The Earth changes;
  - a. Fast
  - b. Slow
  - c. Fast and slow
  - d. The Earth doesn't change
  
2. What causes the Earth to change?
  - a. Water and acid
  - b. People and plants
  - c. Earthquakes and volcanoes
  - d. All of the above.
  
3. \_\_\_\_\_ occurs when rocks or soil are carried away from one place to another.
  - a. Intrusion

- b. Weathering
  - c. Erosion
  - d. Hardening
4. Rocks are broken up into three major:
- a. Magma, metamorphic, and minerals
  - b. Igneous, metamorphic, and sedimentary
  - c. Sedimentary, sand, and igneous
  - d. Sand, mud, and silt
5. The rock that makes up Sea Lion Caves is primarily basalt, an igneous rock. This rock was formed by \_\_\_\_\_.
- a. Rivers and streams
  - b. Lava flows
  - c. Earthquakes
  - d. Chemicals and weathering

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

6. Some rock in the Sea Lion Caves is made of layers of sea creatures, sand, and silt. Through pressure it was turned into a soft rock deposit. Which rock is it?
- a. Igneous
  - b. Metamorphic
  - c. Sedimentary
  - d. Pebbles
7. Rocks are important because they are used for \_\_\_\_\_?

- a. Tools
  - b. Building
  - c. Habitats
  - d. All of the above
8. Rocks from heat such as lava erupting from a volcano and then cooling is an example of what type of rock?
- a. Igneous
  - b. Metamorphic
  - c. Sedimentary
  - d. Shale
9. Which action can be used to protect soil and prevent erosion?
- a. Grazing cattle on a steep hillside
  - b. Planting trees and grass
  - c. Cutting trees
  - d. Trampling side hills off trails
10. How does the Sea Lion Caves protect geological resources?
- a. By teaching preservations and protection of natural resources.
  - b. By participating in and encouraging depositing all litter in recycling cans.
  - c. By requiring people to leave rocks, plants and animals where they are found.
  - d. All of the above.

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Geology: Pre-Visit/Post Visit Assessment

### Answer Key

1. The Earth changes;  
**c. Fast and slow**
2. What causes the Earth to change?  
**d. All of the above.**
3. \_\_\_\_\_ occurs when rocks or soil are carried away from one place to another.  
**c.Erosion**
4. Rocks are broken up into three major:  
**b.Igneous, metamorphic, and sedimentary**
5. The rock that makes up Sea Lion Caves is primarily basalt, an igneous rock. This rock was formed by \_\_\_\_\_.  
**b.Lava flows**

6. Some rock in the Sea Lion Caves is made of layers of sea creatures, sand, and silt. Through pressure it was turned into a soft rock deposit. Which rock is it?

**b.Sedimentary**

7. Rocks are important because they are used for \_\_\_\_\_?

**d.All of the above**

8. Rocks from heat such as lava erupting from a volcano and then cooling is an example of what type of rock?

**a.Igneous**

9. Which action can be used to protect soil and prevent erosion?

**b.Planting trees and grass**

- 10.How does the Sea Lion Caves protect geological resources?

**d.All of the above.**

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## **Sea Lion Caves Geology Education Program Evaluation Form**

The Pre-Visit/Post-Visit Assessment is an important tool used to help measure the program's effectiveness in meeting the learning objectives.

**Insturctions:** Administer a Pre-Visit Assessment at the very beginning of the unit of study. Record the result in the chart below. Continue the unit with the pre-visit activities, educational field trip, and Post-Visit activities. At the conclusion of your unit, administer a Post-Visit Assessment. Record the results.





Return the completed score sheet and Program Evaluation in a pre-addressed, stamped envelope.

Teacher Name \_\_\_\_\_

Date \_\_\_\_\_

School Name \_\_\_\_\_

Grade \_\_\_\_\_

# Students \_\_\_\_\_

Score	Pre-Visit	Post-Visit
# of correct answers	# number of students with score	# number of students with score
10		
9		
8		
7		
6		
5		
4		
3		
2		
1		
0		

Was there a specific question that gave students difficulty on the post-assessment?

If so, why do you think this happened?

Do you have any suggestions to improve the assessment?

Do you have any suggestions to improve the geology program or your visit to Sea Lion Caves?

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Geology References and Additional Activities

1. AIMS Earth Science activities – Virginia Aims Activities Integrating Math and Science, AIMS Education Foundation, VA, 2005  
Finding Faults with Food, 37, 38, 39, 40  
[http://www.aimsedu.org/aims\\_store/VA-5th-Grade-EArth-Science\\_STudent-Activity-Book-p-1760.html](http://www.aimsedu.org/aims_store/VA-5th-Grade-EArth-Science_STudent-Activity-Book-p-1760.html)
2. Badger, Robert A. Geology Along Skyline Drive. Montana: Falcon Publishing, Inc. 1999
3. Cole, Joanna. The Magic School Bus: Inside the Earth. NY: Scholastic Inc. 1987
4. Cole, Joanna. The Magic School Bus Blows Its Top: A Book About Volcanoes. NY: Scholastic Inc. 1996
5. Delta Science Module II: Earth Science – Earth Movements. Delta Education. [www.delta-education.com/index.html](http://www.delta-education.com/index.html)
6. Exploring Earth Science in Shenandoah National Park: An Integrated Curriculum for Grades 7–12. Shenandoah National Park. 2000
7. Ford, Brent. Project Earth Science: Geology. VA: National Science Teachers Association 1996  
Rock Around the Clock 139–147  
All Cracked Up. 34–37  
Plate Tectonics. 171–178  
<http://www.te-mat.org?Reviews/ViewProduct.aspx?ProductID=17463>
8. Geology Rocks! Musical school play. Bad Wolf Press. 1995–2008  
<http://www.badwolfpress.com/geology.htm>
9. Good Character, Good Stewards, Caring for the World Around Us, Shenandoah National Park. 2005

[http://www.nps.gov/shen/forteachers/upload/edu\\_steward\\_geology\\_rocks.pdf](http://www.nps.gov/shen/forteachers/upload/edu_steward_geology_rocks.pdf)

10. Overhead and Underfoot. CA" AIMS Education Foundation. 1994

Peanut Butter and Jelly Geology 78–83

[http://www.aimsedu.org/aims\\_store/Peanut-Butter-and-Jelly-Geology-p-4350.html](http://www.aimsedu.org/aims_store/Peanut-Butter-and-Jelly-Geology-p-4350.html)

11. Project Underground. VA: Richmond Area Speleological Society, Project Underground, Inc. 1993

<http://www.dcr.virginia.gov/underground.shtml>

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

12. Ranger Rick's Nature Scope. Geology: The Active Earth Model. DC: National Wildlife Federation. 1988

13. Silver, Donald M. and Patricia J. Wynne. The Amazing Earth Model Book: Easy-to-Make hands-on Models That Teach. U.S.A: Scholastic Inc. 1997

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Section #7

# The Wildlife of the Sea Lion Caves (5.2P.

1)

Members of the animal kingdom are classified according to body structure. The two general groups of animals are vertebrates (animals with backbones) and invertebrates (animals without backbones) Vertebrates, making up less than one tenth of the entire animal population, include: birds, mammals, reptiles, amphibians and fish. The majority of animals are invertebrates. Invertebrates are divided into three general groups ---those with jointed feet, those with unusual bodies and those with one-celled bodies.

**Native Species.** This list is not meant to be a complete list of all wild life living in and around the Cave, just those periodically observed.

### Cave Species.



**Steller Sea Lions** – Steller Sea Lions (*Eumetopias jubatus*) – Steller or northern sea lions are found in the Pacific Ocean from Japan to southern California. Stellers, named after Wilhelm Steller, a German naturalist, tend to remain offshore

or haulout in unpopulated areas. Stellers roar rather than bark and are much larger and lighter in color than California sea lions. Steller males weigh up to 2,200 pounds and can be 8 – 11 feet long. Females are smaller, weighing 600 to 800 pounds and growing 6 – 8 feet long. Adult males do not have a visible sagittal crest (the bump on the top of their heads) as the adult male California sea lions do. Stellers have a thick neck resembling a lion's mane. They breed in Oregon during the months of June and July. Breeding grounds occur along the North Pacific Rim from Nuevo Island in central California to the Kuril Islands north of Japan, with the greatest concentration in the Gulf of Alaska and the Aleutian Islands. The main haulout areas in Oregon are Rogue Reef, Three Arch Rocks, and Shell Island. Steller sea lions are a federally threatened species in Oregon and in the Aleutian Islands of Alaska--their main concentration. [15]

**California Sea Lions** – California Sea Lions (*Zalophus californianus*) – California sea lions are found in near shore waters along the Pacific coast from Vancouver Island British Columbia to Baja Mexico. North of southern California, the hauling out grounds are occupied by males only, who migrate north for the winter. The females and their pups remain in California all year. Males may often reach 850 pounds, and seven feet in length. California sea lions can be heard making a barking sound. Males develop a bony bump on top of their skull called a sagittal crest. Females can grow to 220 pounds and up to six feet in length and are lighter in color than the males. They can be seen breeding in areas of California and Mexico. Most pups are born in June or July. California sea lions are very social animals and rest together in tightly packed groups on haulout sites. The main haulout areas along the Oregon coast are in the Columbia River near Astoria, Newport's Historic Bayfront, and Shell Island of Simpson Reef. [15]



© Ram Papish

**Harbor Seal** – Harbor Seals (*Pusa vitulina*) – Harbor seals can be found in both the Pacific and the Atlantic Oceans north of the equator. In the Pacific they range from Alaska to Baja Mexico and often can be seen in near shore coastal waters, bays, estuaries, and on sandy beaches and mudflats. Harbor seals are true seals having no external ear flaps. They have small flippers and can only move on land by flopping along on their bellies, called gallupping. Harbor seals have spotted coats in a variety of colors ranging from silver to dark brown or black. Males are slightly larger than females. They can be 5 – 6 feet in length and weigh up to 300 pounds. In California, pups are born in March and April and in parts of Oregon they are born in April and May. Unlike elephant seals, harbor seal pups can swim at birth. Harbor seals will spend half their time on land and half in the water, sometimes sleeping in the water. Harbor seals are year-round



© Ram Papish

residents on the Oregon coast and can be seen at Shell Island of Simpson Reef, Salishan Spit in Lincoln City, Alsea Bay in Waldport, Strawberry Point State Park, and Nehalem Bay. [15]

**Bats.** Little Brown Bat – The most common bat in Oregon. Their scientific name is *Myotis lucifungus*. The group of bats in the genus *Myotis* are called the “mouse-eared” bats. For more information about the Brown Bat – Oregon State University Extension Service EC 1584 September 2006 , “Little Brown Bat” *Myotis lucifungus* by L. Schumacher and N. Allen <http://extension.oregonstate.edu/catalog/pdf/ec/ec1584.pdf>

**Surface Species.** Black Tail Deer are plentiful. Large animal predators include coyote, mountain lion, elk, black bear, squirrels, brown bats, porcupines, raccoons, badgers, rabbits, skunks, weasels, and mice. Surface birds include; grouse and quail.

Bird species include; Birds of prey – Peregrine falcon, hawks, ospreys, vultures, owls, bald eagle. Shorebirds and waterfowl include; herons, geese, common murre, tufted puffin, marbled murrelet, black oystercatcher anklets, sandpiper, dunlin whimbrel, snowy plover, killdeer, cave swallows, and ducks. Check out this website – <http://www.fws.gov/oregoncoast/wildlife/seabird.htm>

Sea Lion Caves is almost as well known as a bird rookery as it is for the sea lions, Gulls, cormorants, and an unusual bird called pigeon guillemot can be seen in the area during their nesting season.

**Pigeon guillemot** – The Pigeon Guillemot (*Ceppus Columba*), a migratory bird, usually appears at Sea Lions Caves in early April when it’s mating season begins. It is similar in species to the murre of the East Coast, and is called “dovekie” by sailor, who often encounter it far out to sea.

The pigeon guillemot is black with white patches and markings on the wings. It has bright orangish–red feet which trail in flight, looking like a scarlet tail. Its voice, a shrill, hissing whistle, sounds much like a canary. The murre family of seabirds is fairly numerous

throughout the Northern Hemisphere, but the particular variety found Sea Lion Cave is rather rare.

The pigeon guillemot builds its nest of seaweed or grass on the ledges inside the caves, and lays a clutch of one to two eggs. The parents feed small fish to their young until they mature and are able to care for themselves.

This unique bird seems to spend its winter's miles from land, living right on the ocean, and comes to shore only to nest. In fact, early sailors often believed that the pigeon guillemot bore its young alive because the sailors only encountered the birds far out to sea where not nest could possibly be build.

**Cormorants** – Cormorants are found throughout the world, Brandt's cormorant (*Phalacrocorax penicillatus*), the most common cormorant seen in the Sea Lion Caves area, ranges from Baja California to Southern British Columbia. The Brandt's cormorant begins nesting in the spring, laying a clutch of three to six eggs. The young are dark brown at birth, but as the mature thy turn almost black. Occasionally the pelagic and double crested cormorants are seen nesting with the Brandt's on the rocky ledges outside the cave.

Cormorants are excellent swimmers because of their web feet. In some parts of the world a ring is placed snugly around the bird's neck so that I cannot swallow its catch, and is actually taught to bring fish back to its trainer for a reward.

**Gulls** – Gulls are also found throughout the world, three varieties the herring gull, the California gull, and the western gull are seen in the Sea Lion Caves vicinity. The western gull (*Larus occidentalis*) is the most common gull seen near the Caves. The adult has a wing span of 24 to 27 inches, and is buff and olive colored, mottled with white or shades of brown. It generally nests on the rocky ledges above the cormorants and lays two to three eggs.

The herring gull (*Larus argentatus*) is approximately the same size as the western gull but it has a somewhat lighter mantle. It lays a

many as four eggs and sometimes nests in trees instead of the rocky cliffs.

The California gull is seen only on rare occasions near the Caves. It is considerably smaller than the western and the herring gull, its color is more brown and it prefers inland waters, particularly for nesting.

All three types of gulls feed on refuse and fish and become quite tame in the presence of humans. But it is interesting to note that if a predator such as an eagle or hawk enters the nesting area, the gulls will immediately attack in forces of 100 or more, chasing the intruder away often forcing it into the water to drown.

The elevation of the shop and offices above the Sea Lion Caves permits a seaward view of approximately 20 miles. Because of this vantage, Sea Lion Caves has become a favored post from which to watch birds, sea lions and whales.

**Amphibians and Reptiles.** These include garter snakes, turtles, frogs, lizards.

- 1. Ocean Species.** Whales – California gray humpback whales (Long white flippers, bumps on top of the head, very strong angle of the back when diving. Short dorsal fin), sperm whale (Square-shaped head, blows at a 40-degree angle from front of head, often seen in groups, ridges along tail stalk. Wrinkled-looking skin). On a side note, Check out this website – TheExplodingWhale.com". <http://www.theexplodingwhale.com/>. Retrieved 2009-03-14.

**Killer Whale** – The killer whale (*Orcinus orca*) is not a frequent visitor to the Sea Lion Caves area; however, as one of the few predators of the sea lion, it is of considerable interest. The black and white mammal which travels in small groups or pods, and have been seen eating sea lions in the vicinity during the late spring and early fall. The orca has a tall dorsal fin, very distinct black and white pattern.

The orca is a resident the Washington coast. The male attains a length of about 27 feet and weights an estimated 9 tons. A newborn calf is about 8 feet long and weighs 400 pounds.



**Gray Whale** – The gray whale (*Eschrichtius robustus*) passes Sea Lion Caves usually close to shore in March on its northward journey because it has just rounded Cape Blanco, the westernmost extension of the United States' mainland. It is seen for several months as individual timestables seem to vary in the whale's migration pattern. Small groups sometimes end their trip north and spend the summer in the immediate vicinity of Sea Lion Caves, feeding very close to shore.

The gray whale is a mammal. It must breathe air and surfaces frequently to inhale and expel its condensed breath through the hole in the top of its head. It rarely swims more than 2,000 feet before surfacing to breathe and its spout is visible for a considerable distance.

The mature gray whale 30 to 50 feet long weights 16 to 45 tons. It feeds off the bottom in relatively shallow water by plowing up the soft sandy sediments to obtain its main food; amphipods. Amphipods are crustaceans one-third to one inch long and are related to the common sand flea. The gray whale has no teeth to use for protection, and except for its size and endurance, is defenseless against attacker such as the killer whale.

Dr. Raymond Gilmore, research curator of marine mammals at the Sand Diego Museum, believes that the gray whale actually remembers the contour of the coast it passes, and he speculates that from time to time the whale will lift from the water to take a bearing from prominent headlands. Heceta Head Light Station, just north of Sea Lion Caves, has been used for navigation by seamen since it was built in 1894. Since the gray whale travels at night, it is just possible that it follows coastal shipping routes and navigates partially by observing the 1 million candlepower white light that flashes every ten second with visibility for 21 miles at sea.

**Others** – Sharks, salmon, steelhead, skate, various varieties of bottom fish, sea anemones, star fish, mussels, clams, kelp worms, china hats, several types of crabs, to name just a few.

## How About Those Sea Lions?

### Pre-Visit or Post-Visit Activity

#### Elementary Level

**Objective(s)** Students will understand the realities about sealions.

**Method.** By reviewing background information and drawing pictures of sea lions, students learn more about these unique animals.

**Materials.** Graph with three columns, light colored construction paper, white constructions paper, and scissors.

**Key Vocabulary.** anatomy, haulouts, Otariidae, Endangered Species Act

**Background.** Steller sea lions are unique mammals. They have an external ear which can be closed when entering water and by hind feet or flippers that point backward. It is the largest of the eared seal family and principal tenant of Sea Lion Caves. It is non-migratory and found from central California coast, north to the Bering Sea and back south to northern Japanese waters. It belongs to the Otariidae family which includes the California sea lion and Alaska fur seal.

Their pelvic bone structure allows independent use of their rear flippers, and therefore, they can walk on their four web-like flippers which contain the same bony structure as legs of land animals. They eat meat. Their skulls are similar to those of bears and their jaws contain sharp teeth much like those found in dogs, cats, and other flesh eaters. They feed exclusively on fish they catch themselves; usually bottom fish such as skate, small sharks, squid and various species of rock fish. A recent survey indicates a worldwide population of about

80,000 Steller sea lions. After declines at some rookeries and haulouts in the western Gulf of Alaska, the eastern Aleutian Islands, and Russia has led to the National Marine Fisheries Service to list the Steller sea lion as Threatened under the Endangered Species Act.

See “The Sea Lions of Sea Lion Caves” in Section #4 for more information.

### **Suggested Procedure**

1. Create a large graph that the entire class can see. You may want to use the blackboard. The graph should contain three columns: “I know a lot about sea lions” and “I don’t know much about sea lions” and “I am not sure.”
2. Ask, “What do you know about sea lions?” Give each student a 3” x 5” piece of white construction paper. Ask each student to draw a picture of a sea lion and list some of the things they know about them. When they have completed their pictures and what they know about sea lions, allow them to place their pictures on the graph in the appropriate column.
3. After placing the pictures on the graph, ask students to state three things that are true about the graph. Discuss findings. Ask them to observe the details in the pictures and knowledge about sea lions. Encourage students to notice the similarities and differences in the illustrations and knowledge levels.
4. Have each student fold a 9” x 12” piece of the construction paper in half, lengthwise. Instruct students to fold the long slender rectangle in half and in half again.
5. Have students open the paper to the original fold. Place the fold away from you and open the flap. Cut along the other three fold lines up to the original fold.
6. Have students write a question about sea lions on the top of each of the flaps. When they have written their questions, have them open the flap and write information they may know about the question inside top of the flap.

7. At this time, do not have students write anything on the lower interior part. Collect the booklets for later use.
8. After the class has studied sea lions and possibly visit Sea Lion Caves, have students write the answers to their questions on the inside of their booklets.

## Comparing Sea Lions and Seals

### Pre-Visit or Post-Visit Activity

### Elementary and Intermediate Level

**Objective(s).** Students will compare and contrast sea lions and seals.

**Method.** Students complete a chart deciding which animal has the characteristic listed.

**Materials.** Copies of “Comparing Sea Lions and Seals” student worksheet, pencils, illustrations and/or models of sea lions and seals.

**Key Vocabulary.** compare, contrast

**Background.** See “The Difference Between Sea Lions and Seals” Section #4

**Suggested Procedure**

1. Have students complete their student worksheets, with what they believe to be the characteristics of sea lions and seals.
2. Facilitate a class discussion comparing and contrasting the two animals, making a classroom master chart.
3. Use illustrations or models of sea lions and bats for emphasis the characteristics.

# Comparing Sea Lions and Seals

## Pre-Visit/Post-Visit Assessment

### Student Worksheet

**Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Directions:** Place an X for the statements that are true for sea lions, seals, both or for none.

<b>Characteristics</b>	<b>Sea Lion</b>	<b>Seal</b>
The animal has an inside skeleton		
This animal has fur		
This animal has external ear flaps		
This animal has teeth		
This animal gives birth to live babies		
This animal has flippers completely covered with fur		
This animal can rotate hind flipper forward beneath body		
This male animal can weigh over 600 pounds		
This animal eats fish		
This animal has clawed flippers		
This animal barks		
This animal is frequently used in water shows		
This animal has trouble moving around on land		
This animal is very social		
This animal is normally found at Sea Lion Caves		
This animal has a short neck		
This animal breathes air		
This animal lays eggs		

### Student Worksheet Key

<b>Characteristics</b>	<b>Sea Lion</b>	<b>Seal</b>
The animal has an inside skeleton	X	X
This animal has fur	X	X
This animal has external ear flaps	X	

This animal has teeth	X	X
This animal gives birth to live babies	X	X
This animal has flippers completely covered with fur		X
This animal can rotate hind flipper forward beneath body	X	
This male animal can weigh over 600 pounds	X	
This animal eats fish	X	X
This animal has clawed flippers		X
This animal barks	X	
This animal is frequently used in water shows	X	
This animal has trouble moving around on land		X
This animal is very social	X	
This animal is normally found at Sea Lion Caves	X	
This animal has a short neck		X
This animal breathes air	X	X
This animal lays eggs		

## Pre-Visit/Post-Visit Assessment

The Pre-Visit/Post-Visit Assessment is an important tool used to help measure the program's effectiveness in meeting the learning objectives.

**Instructions:** Administer a Pre-Visit Assessment at the very beginning of the unit of study. Record the result in the chart below. Continue the unit with the pre-visit activities, educational field trip, and Post-Visit activities. At the conclusion of your unit, administer a Post-Visit Assessment. Record the results. Return the completed score sheet and Program Evaluation in a pre-addressed, stamped envelope.

Teacher Name \_\_\_\_\_

Date \_\_\_\_\_

School Name \_\_\_\_\_

Grade \_\_\_\_\_

# Students \_\_\_\_\_

Score	Pre-Visit	Post-Visit
# of correct answers	# number of students with score	# number of students with score
18		
17		
16		
15		
14		
13		
12		
11		
10		
9		
0 - 8		

Was there a specific question that gave students difficulty on the post-assessment?

If so, why do you think this happened?

Do you have any suggestions to improve the assessment?

Do you have any suggestions to improve the animal program or your visit to Sea Lion Caves?



Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Section #8

# The Vegetation of Sea Lion Caves and Oregon Coastal Vicinity 2.1L.1

Extending from the seashore to the foothills of the coast range, the Oregon coast encompasses a wide variety of plant communities. Windswept bluffs and exposed sandy beaches, sand dunes and grasslands, make way for dense forests. The moderate year round climate is influenced by the nearly constant temperatures of the Pacific Ocean, while northwesterly winds bring cool air to the coast in the summer months and southwesterly winds bring warm air in the winter. The resulting cool summers and mild winters make for a long flowering season.

The coastal climate varies from north to south, as temperate conditions gradually shift to a more Mediterranean climate. In the north dense forests and undergrowth predominate, giving way to more California plant species as one reaches the southern Oregon coast. Where mild summer temperatures and fog retain moisture further north, summer on the southern coast is warmer and drier. Here, riparian areas provide the only habitats for plants requiring more moisture.

Conditions of soil and topography also vary along the coast and combine with changes in temperature to create different habitats. Plants found on the beach and among dunes will differ from those found in coastal forests, while grasslands will support a different community of plants from those found in wetlands. A generally useful distinction includes beaches and dunes, grasslands, wetlands, and forests.

**Beaches and dunes** host plants with deep taproots and stout stems, which can withstand constantly shifting sand. Sturdy evening primrose, farewell-to-spring (*Clarkia amoena*), and coast buckwheat may be found here or along the edges of dunes and beaches. Vegetative reproduction gives coastal strawberry and Pacific silverweed an advantage over plants that rely on seeds for reproduction, as seeds are easily buried too deep or exposed to salt air and wind.

**Grasslands** are supported by a thin layer of soil over basalt. Rocky forested headlands fall into the sea, their southern slopes carpeted with grasses and wildflowers. Spring and early summer moisture bring stonecrop, columbine,

and larkspur. Later in the summer selfheal, pearly everlasting and goldenrod appear. As one travels south in Oregon, forested shorelines give way to open grassy slopes.

Both saltwater and freshwater **wetlands** support important coastal habitats. Swales, lakes and marshes dot the entire coastline. Where exposure carves sand away to below the water table, deflation plains support unique plant communities and migrating waterfowl. Normally on the lee side or at the base of dunes, they are frequently covered with water in the winter and damp in summer.

**Forests** along the Oregon coast support stands of shore pine (*Pinus contorta*), tolerant of wind, salt spray, and mineral soils, and often growing just above high tide. Sitka spruce (*Picea sitchensis*) is found only near the coast, forming dense forests and becoming "shaped and gnarled by the salt spray and wind"<sup>1</sup> on coastal bluffs. Western hemlock and Douglas fir form the dominant species in lowland forests of the coast range.

**Brushfields** are formed where forest and grassland meet. Openings like meadows and pastures are slowly overtaken with young trees and shrubs. Here, the azalea, rhododendron, and currant provide a riot of color along the coast come spring.

Many of our natives can be found in a variety of habitats. For example, Tiger Lily (*Lilium columbianum*) grows on hillsides with shrubs and blackberry, on exposed headlands and in partial shade. Salal forms thick hedges along coastal bluffs and thrives in the understory of a coastal forest. [16] The vegetation section take in its entirety from Bosky Del Natives of West Linn, Oregon website.

**Trees at the Caves** are may include; Vine maple, big-leaf maple, red alder, madrone, port orford cedar, Oregon ash, western crabapple, Sitka spruce, shore pine, cottonwood, Douglas fir, cascara, western red cedar, and western hemlock.

**Shrubs** may include kinnikinnik, goatsbeard, coyote bush, blue bush, silk-tassel, salal, oceanspray, black twinberry, tall Oregon grape, dull cascade Oregon grape, pacific wax myrtle, Indian plum, devils club, evergreen blackberry, cascara, pacific rhododendron, western azalea, nootka rose, thimble berry, coast willow, western spirea, salmonberry, snowberry, evergreen huckleberry, red huckleberry, red elderberry, and gorse

**Ground Covers and Flowers** may include; common yarrow, vanilla leaf, nodding onion, pearly everlasting, kinnikinnik, goatsbeard, pacific aster, coast boykinia, great camas, common camas, Indian paintbrush, farewell to spring, candy flower, beadlily, foxglove, beach daisy, coast buckwheat, Oregon sunshine, trout lily, California poppy, coastal strawberry, wood's strawberry, large-leaved avens, cow parsnip, Oregon iris, tiger lily, large-leaved lupine, skunk cabbage false lily of the valley, yellow monkeyflower, evening primrose, beach knotweed, self-heal, cascade

penstemon, coltsfoot, pacific silverweed, fairybell, blue-eyed grass, goldenrod, fincecups, youth-on-age, piggy-back plant, wake robin, early blue violet.

**Ferns** may include; deerfern, licorice fern, sward fern, and western bracken fern.

**Grasses, Sedges and Rushes** may include; sough sedge, tufted hairgrass, creeping spike-rush, bolander's rush, American dunegrass [16] The above list of plants taken entirely from Bosky Del Natives of West Linn, Oregon website.

## Giving Trees Activity

### Pre-Visit, Field-Trip and Post-Visit Activities

#### Elementary Level

**Objectives(s).** Students will explain the benefits of trees in the natural environment Students will develop a biography of a chosen tree in a natural environment.

**Method.** During their field trip/visit each student claims a tree. As a post-visit activity, students research their trees and write tree biographies.

**Materials.** The Giving Tree by Shel Silverstein, copies of the student worksheet, crayons or colored pencils.

**Key Vocabulary.** tree, bark, leaf, biography

**Background.** Living trees create shades and serve as homes for insets and small animals. Threes clean the air by removing carbon dioxide and releasing oxygen. They also return nutrients ot the soil through their fallen leaves. Dead trees are hosts to fungi (which also decompose them), small animals and insects. Dead trees replenish the soil with nutrients for new growth. Trees also provide building materials for homes and businesses which create jobs. Trees are a renewable resource. Healthy trees are essential for our environment.

#### Suggested Pre-Visit Procedure

1. The day before the field trip, read The Giving Tree to your students under a large shade tree, if possible.
2. Discuss how the tree in the story gave of itself. Ask Students how trees are essential to a healthy natural environment.

3. Instruct students to claim a tree at the Caves or on the way during the field trip/visit.

### **Suggested Post-Visit Procedure**

1. After returning from the field trip, distribute copies of the student worksheet. Review each section of the worksheet with your students.
2. Have students use their worksheets to write biographies about the trees they selected on their field trip/visit. Give students' time to research their trees with reference materials available in the school library. Encourage students to be accurate and creative.
3. Have students share their biographies with each other. Place special emphasis on the contributions each individual tree has made to its environment. Ask students why they choose the tree they did.

## **Biography of a Tree Student Worksheet**

Identification (name of your tree)

Birth Place (Siuslaw National Forrest, Sea Lion Caves, or whatever)

Age (young, middle-aged, old, deceased)

Characteristics (List characteristics and draw pictures of the bark, leaf and seed of your tree)

<b>Bark</b>	<b>Leaf</b>	<b>Seed</b>
-------------	-------------	-------------

--	--	--

Special Adaptations

Contributions to its Environment

Why I chose this Tree

Illustration (Draw a picture of your tree on back of this page.)

## Pre-Visit/Post-Visit Evaluation

The Pre-Visit/Post-Visit Assessment is an important tool used to help measure the program's effectiveness in meeting the learning objectives.

**Instructions:** Administer a Pre-Visit Assessment at the very beginning of the unit of study. Record the result below. Continue the unit with the pre-visit activities, educational field trip, and Post-Visit activities. At the conclusion of your unit, administer a Post-Visit Assessment. Record the results. Return the completed evaluation sheet in a pre-addressed, stamped envelope.

Teacher Name \_\_\_\_\_

Date \_\_\_\_\_

School Name \_\_\_\_\_

Grade \_\_\_\_\_

# Students \_\_\_\_\_



What did you like about the Giving Trees Activity?

Was there a specific part of the Giving Trees Activity that gave students difficulty?

If so, why do you think this happened?

Do you have any suggestions to improve the Giving Trees Activity, plant program or your visit to Sea Lion Caves?

Adapted from Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006

## Sea Lion Caves Worksheet

Welcome to the Sea Lion Caves. We are glad you are here and know you will enjoy the visit. Just as a reminder; talk in quiet voices, don't run, stay on paved trails, be courteous, place all litter in trashcans, and have fun! Remember, if you have trouble with the answers to any of the following questions, any Sea Lion Cave employee will be glad to help you.

### Zone #1 – Totem Pole



1. List the animals carved or painted on the totem pole. When was it erected? Why?

2. What famous building is just one mile north of Sea Lion Caves? You can see it to the North.

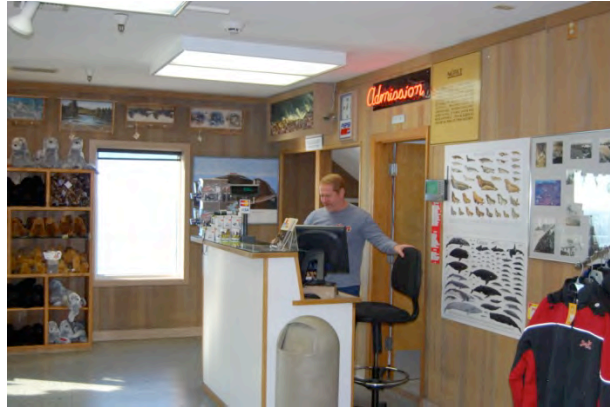
3. Looking south, you can see in the far distance at the mouth of the river, a line of rocks. What do they call that line of the rocks lining the mouth of the river and what is the name of the river running through Florence?

4. How many cars are in the parking lot and list the names of the states they are from represented by the license plates.

5. What type of roofing material is on the roof of the Gift Shop? Why do you think this type of material is a good idea for the Oregon coast?

6. Describe what the weather is like today.

## **Zone #2 – The Gift Shop**



6. What is the name of the person taking tickets?
7. There are two posters behind the ticket desk. What do the two posters show?
8. From the posters, what is the largest Whale? What is the largest Pinniped?
9. What is the name of the sea lion that usually resides at Sea Lion Caves most of the year round?
10. What are the names of the other people in the gift shop; Cashier and at Fudge Counter?
11. How many steps are there down to the lower level to Zone #3?
12. Describe what you see out the windows toward the west? How far do you think you can see to the horizon in miles from the Gift Shop?



### Zone #3 – Seal Lion Family Statue



13. When was the statue erected. What does it celebrate? Who crafted the statue?

14. Describe the ocean; What colors do you see, estimate how high the swells are, estimate how tall the waves are today. Do you know what causes the wave action? Explain.

15. Do you see any birds? If so, what kind are they? If you don't know, describe them.

16. From the sign on the Whale Watching Deck, what information does it give about the whales that visit the Caves?

17. Do you notice the foam on the ocean? What do you think may cause the ocean to foam?

18. Before Hwy 101 was built in the 1930s, how do you think people got to the Cave and the Heceta Lighthouse?

## Zone 4 - The Overlook



19. Estimate how many sea lions are on the rock ledge?

20. As you look to the south, toward Florence, describe what you see.

21. The rock ledge you observe below the Outlook is where the mother sea lions have their pups. Why do you think the mothers pick this very spot along the coast to have their pups? Explain.

22. Do you know the name of any of the plants on the hillsides and along the trails? Name two or three of the plants you see. If not, describe two or three of the plants that are most abundant as you walk the trails.

### Zone 5 & 6 – The Cave



This is the elevator entrance to the Cave.

23. Describe what you see from the elevator deck. Explain.



This is the inside of the Cave. To the left is the lower viewing area and to the right is the video/information area. Straight ahead are the stairs to the old entrance viewpoint.

24. Do you experience an odor? Why do you think causes that odor? I suggest you breathe through your mouth until you get used to the smell.

25. How many seal lions are in the Cave? Estimate.

26. Notice the center rock. How many sea lions are on the center rock? Does watching the actions of the sea lions on the center rock remind you of the game "King of the Hill? Explain.

27. Describe the fossil located on the lower viewing area behind the fence? How long has it been there?

28. What images can you see on the far rock wall and close to the lower viewing area? Hint - read the bulletin board just to the right of the lower viewing area.

28. What information did you hear that you did not know before your visit concerning the sea lions, the birds, or the other animals at the Caves from the video or from the bulletin boards? Just list two or three.

29. How many steps are there up to the old entrance viewing area? What do you see (a white building) out the old entrance viewing area. Makes a great picture and I hope you have a camera.

30. How did people get down to the Cave before the elevator was installed?

31. The elevator descends how many feet into the Cave? How long did it take to be built and why did it take so long to build?

31. What did you enjoy most about visiting the Sea Lion Caves? Please come back!

## Section #10

### References

- 1 "City Data Newport Oregon". <http://www.city-data.com/city/Newport-Oregon.html>. Retrieved 2009-03-19.
9. [http://en.wikipedia.org/wiki/Oregon\\_Coast](http://en.wikipedia.org/wiki/Oregon_Coast)
10. Sea Lion Caves – Worlds Largest Sea Cave Guide
11. Orr, William N. and Elizabeth L. (2006). Geology of the Pacific Northwest, 2nd. Ed.. Long Grove, Illinois: Waveland Press, Inc. pp. 260-297. ISBN 978-1-57766-480-2.

12. "Oregon Coast National Wildlife Refuge Complex". US Fish and Wildlife Service. <http://www.fws.gov/oregoncoast/wildlife>. Retrieved 2006-03-18
13. "Rare sea otter confirmed at Depoe Bay". Oregonlive. February 20, 2009. [http://blog.oregonlive.com/terryrichard/2009/02/rare\\_sea\\_otter\\_confirmed\\_at\\_de.html#more](http://blog.oregonlive.com/terryrichard/2009/02/rare_sea_otter_confirmed_at_de.html#more). Retrieved 2009-02-27
14. "Dozens of frozen squid appear on beaches". KATU. December 11, 2009. <http://www.katu.com/outdoors/featured/79083817.html>. Retrieved 2009-12-11
15. "Whale Watching in the Winchester Bay Area Winchester Bay Merchants' Association". URL accessed on March 18, 2006
16. "TheExplodingWhale.com". <http://www.theexplodingwhale.com/>. Retrieved 2009-03-14.
17. "Oregon Coast Tidepools". Fort Hays State University. URL accessed on March 18, 2006
18. Dunaway, Vic (2004). *Sport Fish of the Pacific*. Stuart, Florida: Florida Sportsman. ISBN 0-936240-28-8. <http://www.floridasportsman.com/>.
19. <http://www.city-data.com/city/Florence-Oregon.html>
20. "About Bats , Caves, & Deserts – Carlsbad Cavern National Park Elementary Curriculum Guide – <http://www.nps.gov/cave/forteachers/curriculummaterials.htm>
21. Oregon State University Extension Service EC 1584 September 2006 , "Little Brown Bat" *Myotis lucifungus* by L. Schumacher and N. Allen <http://extension.oregonstate.edu/catalog/pdf/ec/ec1584.pdf>
22. <http://www.fws.gov/oregoncoast/wildlife/pinniped.htm>
23. <http://www.boskydellnatives.com/coast.htm>
24. Shenandoah National Park Education Program, Education Program, [http://www.nps.gov/shen/forteachers/upload/geology\\_unit.pdf](http://www.nps.gov/shen/forteachers/upload/geology_unit.pdf) 2006