Reading

Sea Otter Lesson Plan & Background Information Articles

Objectives/Standards met:

Washington	California	Oregon
• Build vocabulary through reading. • Read fluently, adjusting reading for purpose and material. • Comprehend important ideas and details. • Read to learn new information.	• Read for comprehension (focus on informational materials). • Use word recognition skills for word analysis, fluency and systemic vocabulary.	• Determine meanings of words using contextual and structural clues and other reading strategies. • Extend and deepen comprehension by relating text to other texts, experiences, issues and events. • Analyze and evaluate whether a conclusion is validated by the evidence of the selection.

Materials:

- Sea Otter Background Information Articles 1 - 9, with attached vocabulary lists and reading comprehension check sheets.
- Vocabulary worksheets.
- Additional resources (found in trunk) that can be used to supplement reading articles:
  1. "Keep Sea Otters in the Picture" poster (Sea Otter History, Web of Life, Sea Otter Foraging Behavior, Sea Otter Conservation)
  2. Sea Otters by Glenn VanBlaricom
  3. Sea Otters by Peter Murray
  4. The Monterey Bay Shoreline Guide by Jerry Emory
  5. Saving Sea Otters: Stories of Survival by Elin Kelsey
  6. Sea Otters Zoobook (Vital Statistics, Sea Otter Foraging Behavior, Threats to Sea Otters)
  7. Sea Otters by Marianne Riedman (Sea Otter History, Vital Statistics, Web of Life, Sea Otter Social Structure and Behavior, Sea Otter Foraging Behavior, Threats to Sea Otters)
  8. The Sea Otter by Alvin, Virginia and Robert Silverstein (Sea Otter History, Vital Statistics, Web of Life, Sea Otter Social Structure and Behavior, Sea Otter Foraging Behavior, Threats to Sea Otters, Sea Otter Conservation)
  9. Sea otter puppet (Vital Statistics - adaptations to life in the water)

10. Sea otter tracks and molds (Vital Statistics - adaptations to life in the water)
11. Sea otter skull replica (Vital Statistics)
12. Prey items (Sea Otter Foraging Behavior)

- Websites:
  1. Defenders of Wildlife: http://www.defenders.org/sea-otter/basic-facts
  2. Monterey Bay Aquarium Sea Otter Research and Conservation Program: http://www.montereybayaquarium.org/conservation/research/saving-sea-otters
  3. Marine Wildlife Veterinary Care and Research Center: http://www.dfg.ca.gov/ospr/Science/marine-wildlife-vetcare/

Background:
Students are expected to read for information and based upon the facts given, draw their own conclusions and opinions. Nine articles with vocabulary and reading comprehension checks are provided to help students identify new vocabulary words as well as important information. The articles also provide background information for other lessons in this unit. Use them to generate class discussions.

Procedures:
1. Have the students read an article. (You may want to have all the articles and accompanying vocabulary lists and comprehension checklists copied as a reading packet.)
2. After students have read the article through once, ask them to read it a second time using the vocabulary worksheet which asks them to write down the vocabulary words (bolded text) and use contextual clues to arrive at their own definition. Then look up the word in a dictionary. Some words may not be found in the dictionary. A sample vocabulary sheet is attached with definitions.
3. Have students divide into nine groups and assign each an article. Have students read their assigned article, do further research and present their finding to the class.

Extension:
Invite your students to create their own reading comprehension questions and answers sheet. Have each student exchange it with a partner. Once partners have answered each other's questions, they can "grade" one another by deciding if the answers given are correct.

Have students keep a running list of questions they have about sea otters and research those questions during the technology section of this unit.

Assessment:
Use the reading comprehension checks as a follow-up activity, springboard for discussion questions, homework assignment or a quiz.

Vocabulary Worksheet

Vocabulary word _____

My definition:

_____

Dictionary definition:

_____

Correct: _____

Vocabulary word _____

My definition:

_____

Dictionary definition:

_____

Correct: _____

Vocabulary word _____

My definition:

_____

Dictionary definition:

_____

Correct: _____

Vocabulary word _____

My definition:

_____

Dictionary definition:

_____

Correct: _____

Vocabulary word _____

My definition:

_____

Dictionary definition:

_____

Correct: _____

Total Number correct: _____

1. SEA OTTER HISTORY

Sea otters once ranged from northern Japan to the Alaskan **peninsula** and along the west coast of North America to Baja California in Mexico. Until the 1700s, sea otters were **abundant** throughout the waters of the north Pacific and for centuries native groups, such as the Aleuts, hunted them. During this time, the worldwide sea otter population numbered between 150,000 to 300,000. By the mid-1700s, Russian hunters had **coerced** the Aleuts to exploit sea otters for the fur trade, and the once abundant sea otter population plummeted. The otters that remained were chased down by English, French, Japanese and American traders. By the 1900s, the sea otter was nearly **extinct** with only 1,000 to 2,000 otters left. Only 13 **remnant** sea otter colonies existed from Russia to Mexico when the **International Fur Seal Treaty**, which banned the hunting of sea otters and fur seals was established in 1911.

CALIFORNIA

By the 1930s, a small group of 50 to 300 sea otters, a population now known as southern or California sea otters, remained near Big Sur, California. Under the protection of the International Fur Seal Treaty, this small population began a slow and steady climb from nearly extinct to a fairly stable population. From the mid-1970s to the mid 1980s, the southern sea otter population began to decline once again. About 1,000 sea otters died over a 10 year period due to entrapment in gill nets. When gill net legislation was passed in the late 1980s requiring gill nets to move farther off shore, the sea otter population began to grow again until the mid-1990s. In 1977, the southern sea otter was listed as "**threatened**" under the **Endangered Species Act**.

From 1995 until the present, southern sea otter numbers have seen very little growth. Some of the possible causes include entrapment in fisheries gear, disease, food limitations, and habitat loss and **degradation** due to **contaminants**.

Sea otter protection is a source of ongoing conflict between the California shellfish (abalone, sea urchins, crab, lobster) industries and conservation groups. While fishermen view the shellfish eating sea otter as a threat to their livelihood, conservation groups and scientists see the sea otter as a **keystone species** because their activity is central to the nature of their **ecosystem**. A sea otter's effect on the ecosystem is disproportionate to how many sea otters there are. Very few sea otters can have a large effect.

ALASKA

In the early 1900s, following the near extinction of the sea otter, remnant sea otter colonies held on in the Aleutian Islands of Alaska, other portions of southwest Alaska, the Alaska peninsula and the northern Gulf of Alaska. Perhaps the most dramatic recovery of the sea otter now known as the northern sea otter occurred in the Aleutian archipelago. By the mid-1980s, biologists believed that perhaps as much as half of the world's population of sea otters lived in the Aleutian Islands. Indeed, the entire Alaska sea otter population seemed to be quite abundant until the late 1990s, when sea otters

in southwestern Alaska began to suffer dramatic declines.

OREGON AND WASHINGTON

Northern sea otters from Alaska were transplanted to Oregon and Washington state with the goal of repopulating the sea otters' former range. In 1970 and 1971, 93 sea otters from Amchitka Island in Alaska were reintroduced to Oregon. However, sea otters are not presently found in Oregon. From 1969 to 1970, 59 sea otters were relocated from Amchitka Island to Washington. This population grew at an average annual rate of about 11 percent from 1989 to 1999 and scientists estimate that 500 sea otters currently live in Washington. However, this small population is vulnerable to fisheries conflicts, the continuing threat of oil spills and environmental contaminants.

VOCABULARY

Peninsula: a piece of land jutting out into the water whether with or without a well-defined narrow strip of land connecting the two land masses

Abundant: plentiful

Coerced: to bring about by force or threat

Extinct: no longer existing or living

Remnant: a small surviving group

International Fur Seal Treaty: a treaty established in 1911 banning the hunting of sea otters and fur seals

Threatened: a species present in its home range but in declining numbers and in danger of becoming endangered

Endangered Species Act: Federal act that was established in 1973 that seeks to "provide for the conservation of endangered and threatened species of birds, mammals, fish, invertebrates and plants and their habitat"

Degradation: decline to a low, destitute, or demoralized state

Contaminants: something that pollutes by contact or mixture

Keystone species: an organism whose abundance or activity is central to maintaining the nature of the habitat; they may be important habitat modifiers, pollinators, seed dispersers

Ecosystem: the complex of a community of organisms and its environment functioning as an ecological unit

Check Your Reading Skills
Sea Otter History

1. Why are sea otters a keystone species?

2. What or who caused the near extinction of the sea otter in the mid 1700s?

3. How did the International Fur Treaty help sea otters?

4. Put yourself in the fishermen's place. Why do you not want the sea otter population to rebound?

5. Do you agree/disagree with the fishermen's viewpoint? Why or why not?

Reading Comprehension Check
Answers

1. Sea otters are keystone species because their activity is central to maintaining the nature of the ecosystem. They are beneficial habitat modifiers.

2. Russian, American and English hunters caused the near extinction of the sea otter.

3. The International Fur Treaty helped sea otters by providing sea otters with protection by banning hunting of their fur.

4. Answers will vary.

5. Answers will vary.

2. SEA OTTER DISTRIBUTION

Historically, sea otters were found from the Japanese Archipelago north to the Kuril Islands, the Kamchatka Peninsula and the Commander Islands of Russia. Sea otters were also found on the islands of the Aleutian chain east to the Alaska Peninsula and then south along the coast of North America to Baja California in Mexico. Before sea otters were hunted to near extinction, there were an estimated 150,000 to 300,000 scattered throughout this historical range.

Today, although their numbers are nowhere near their historical populations, sea otters occupy most of their historical range from the Kuril Islands northeast to Prince William Sound, Alaska.

Additionally, on the Pacific coast, **translocated** populations live in southeastern Alaska and in some parts of British Columbia, Canada, and Washington. Sea otters also are found off the coasts of central and southern California.

Sea otter distribution is summarized in the chart below:

Species	Southern or California Sea Otter (*Enhydra lutris nereis*)	Northern Sea Otter (*Enhydra lutris kenyoni)*	Russian Sea Otter (*Enhydra lutris lutris*)
Location	California	Alaska, Canada, and Washington state	Kuril and Commander Islands, Kamchatka Peninsula, Russia; Very few in Hoikkaido, Japan
Current Numbers	Approximately 3,000	Alaska: ~75,000 to 100,000; Canada: ~1,500; Washington: ~500	Approximately 15,000

Gill nets used by fishing operations can be deadly to sea otters, and one oil spill could potentially wipe out an entire sea otter population. The future of the sea otter population depends on resolving conflicts with the fishing and oil industries.

VOCABULARY

Translocated: to move a species from one location to another to increase that species' range or augment numbers in a critical population

Check Your Reading Skills
Sea Otter Distribution

1. If a sea otter population is translocated, what does that mean?

2. Where in California are sea otters found?

3. Where are northern sea otters found?

4. Before sea otters were hunted to near extinction, how many sea otters lived in their historical range?

5. Do you agree or disagree with the following statement:
   The future of the sea otter population is dependent on how conservationists can solve present and future conflicts with the fishing and oil industries.

Reading Comprehension Check
Answers

1. When a sea otter population is translocated, it means that the sea otter population was relocated to another area increase that species' range or augment numbers in a critical population.

2. Sea otters are found off the coasts of central and southern California.

3. Northern sea otters are found in Alaska, Canada and Washington state.

4. Before sea otters were hunted to near extinction, there were an estimated 100,000 to 300,000 sea otters scattered throughout their historical range.

5. Answers will vary.

3. SEA OTTER EVOLUTION

No one knows exactly how sea otters evolved, but it is believed that they arose from primitive, fish-eating otter mammals about 5 to 7 million years ago during the late **Miocene** and early **Pliocene** periods. It is likely that their ancestors were originally land mammals that only later entered the ocean to escape **predators**, seek shelter and find a more abundant food supply. They probably began to **forage** for food along the seashore where the low tide brought in mussels, snails, urchins and limpets, but soon discovered the abundance of food underwater.

Once these otter ancestors entered the oceans, they began adapting to the marine environment and developed permanent characteristics for survival at sea, such as a waterproof coat, webbed hindfeet, flippers, larger lung capacity, the ability to survive without drinking fresh water, and the ability to give birth and raise their young entirely at sea. In fact, even though they may spend some of their time on land, sea otters could spend their entire lives at sea, eating, sleeping, giving birth and rearing their young without ever coming ashore.

The sea otter belongs to the weasel family or Mustelidae*,* which also includes weasels, skunks, badgers, river otters, wolverines and minks. The classification system for sea otters is listed in the chart below. The modern sea otter genus, *Enhydra*, has been confined to the North Pacific since the Pleistocene period, about 1 to 3 million years ago.

The sea otter is in:		**Which includes:**	**And excludes:**
Kingdom	Animalia	All multicellular organisms that lack cell walls and cannot perform photosynthesis	Plants, fungi, bacteria
Phylum	Chordata	All animals that have a backbone or similar internal support	Invertebrates (insects, snails, seastars, etc.)
Class	Mammalia	All chordates that have fur and produce milk	Fish, amphibians, reptiles and birds
Order	Carnivora	All mammals that mostly eat meat	Rodents, deer, primates, etc.
Family	Mustelidae	All carnivores that are weasel-like, with long, slender bodies and scent glands	Lions, tigers, bears, raccoons, whales, wolves, etc.
Genus	*Enhydra*	Sea Otters	River Otters and other otters
Species	*lutris*	Sea Otters	River Otters and other otters
Subspecies	*nereis* *kenyoni* *lutris*	Southern or California sea otter, Northern sea otter, Russian sea otter	Any other otter

VOCABULARY

Miocene: pertaining to an epoch of the Tertiary Period, the period from 25 to 10 million years ago, when grazing mammals became widespread

Pliocene: pertaining to an epoch of the Tertiary Period, which occurred from 10 to 2 million years ago, and characterized by increased size and numbers of mammals, by the growth of mountains, and by global climatic cooling

Predators: organisms that live by preying on other organisms

Forage: to look for food; food for animals especially when taken by browsing or grazing

Check Your Reading Skills
Sea Otter Evolution

1. Provide examples of how sea otters adapted to ocean life.

2. What are some of the reasons why the ancestors of the sea otters entered the ocean?

For questions 3 & 4 refer to the chart.

3. What are the three subspecies of the sea otter?

4. What are some of the characteristics that belong to the family Mustelidae?

5. Do you think that sea otters escaped to the sea for all three reasons or only one? Why or why not?

Reading Comprehension Check
Answers

1. Answers may include: Sea otters developed: a waterproof coat, webbed hindfeet, flippers, larger lung capacity, do not need to drink fresh water, ability to give birth and raise their young at sea.

2. Answers may include: Some reasons why sea otter ancestors entered the ocean were: to escape predators, seek shelter and find a more abundant food supply.

3. The three subspecies of the sea otter are: southern, or California sea otter, northern sea otter and Russian sea otter.

4. The family Mustelidae are all carnivores that are weasel-like, have long, slender bodies, and have scent glands.

5. Answers will vary.

4. VITAL STATISTICS

Sea otters belong to the family Mustelidae, along with weasels, minks, skunks, badgers, wolverines, fishers, martens and about 11 species of otters. Like other members of their family, otters have long, slender bodies, scent glands and high metabolisms, but several distinctions set them apart. The sea otter, *Enhydra lutris*, is not only the second smallest marine mammal and the largest member of the weasel family, but the only member of the family Mustelidae that is a true marine mammal.

Sea otters breed throughout the year. Females give birth to one pup after a gestation period of six to eight months. Southern sea otter pups weigh three to five pounds at birth. Adult males are typically larger than females. Male southern sea otters weigh an average of 65 pounds and adult females weigh an average of 45 pounds. (Northern sea otters can weigh as much as 100 pounds.) The average length of a southern sea otter is four feet. Male sea otters live an average of 10 to 15 years and females live an average of 15 to 20 years.

Pelage color in sea otter adults varies in shades of brown. As they age, their fur can take on a lighter color due to loss of **pigmentation** in the guard hairs, which also gives the fur a grizzled look over the head, chest, neck and forepaws. This lighter hair is most pronounced in older adult males. Newborn pups have a wooly pelage characterized by lighter shades of brown or yellow. This fur is replaced by the adult pelage by 13 weeks of age.

Sea otters have the thickest fur of any mammal. The underfur ranges from 250,000 to one million hairs per square inch. This thick fur is the only protection sea otters have against the cold water in which they live. They do not have insulating blubber like other marine mammals, such as whales, seals and sea lions. Instead, a layer of air is trapped within the fibers of the underfur, providing insulation and buoyancy and enabling the skin to remain dry when immersed. Maintenance of these air pockets is one reason sea otters groom so much, along with the necessary cleaning of their fur to get rid of **debris** and **contaminants**.

A high metabolic rate also helps sea otters stay warm. They are very active in **foraging** for food, since they must consume 20 to 30 percent of their weight in food each day. In fact, they spend about 35 to 50 percent of their day expending energy to find nourishment.

Sea otters often are seen swimming on their backs in a behavior known as sculling. While sculling, **propulsion** is accomplished through the use of their extremely powerful hind legs and by **undulating** motions made by their horizontally flattened tail. The forelegs do not aid in propulsion, but rather are used primarily for grooming and foraging.

Sea otters generally swim at speeds of 0.5 to 1.25 miles per hour (mph). However, speeds of 5.5 mph can be attained for short distances underwater. Although it is not common, sea otters can dive to a maximum depth of 300 feet, but they generally forage at depths of 60 feet or less. Sea otters can hold their breath for almost five minutes, as their lungs are nearly two and a half times larger than the lungs of similar-size mammals.

Sensory organs in sea otters are poorly understood because they are difficult to study. Sea otters seem to have good sight both on land and in water during the day and night. They also seem to have a keen sense of touch. They use their paws to forage for food and their long whiskers are sensitive enough to allow them to detect vibrations. The nose of a sea otter contains many bones that suggests they also have a keen sense of smell. Little is known about their sense of hearing.

These various characteristics of sea otters, from their thick fur to their swimming techniques, make them a unique marine mammal. They also share many other characteristics, such as slender body length, possession of scent glands, and high metabolic rates with other members of the weasel family.

VOCABULARY

Pelage: the coat of a mammal, as distinct from bare skin

Pigmentation: coloration of tissue

Debris: the remains of something broken down or destroyed

Contaminants: something that makes impure or unclean by contact or mixture

Foraging: the act of looking for food

Propulsion: the act of driving forward or onward by, or as if by, means of a force that imparts motion

Undulating: to form or move in waves

Check Your Reading Skills
Vital Statistics

1. What makes the sea otter an unusual member of the Mustelidae family?

2. Why do sea otters have such thick fur?

3. Why do sea otters constantly groom themselves?

4. What enables the sea otter to hold their breath under water for as long as five minutes?

5. What other animals groom themselves? Why do they groom?

Reading Comprehension Check
Answers

1. It is the second smallest marine mammal and the largest member of the weasel family but the only member of the Mustelidae family that is a true marine mammal.

2. Sea otters have the thickest fur of any mammal because it provides protection from the cold water in which they live. Sea otters, unlike all other marine mammals, lack blubber.

3. Sea otters must maintain the air pockets since they do not have blubber to keep warm. They also must rid their fur of debris.

4. Sea otters have lungs that are two and half times larger than the lungs of similar sized mammals.

5. Answers will vary.

5. WEB OF LIFE

Sea otters live in the shallow waters of the Pacific and in various types of habitats that include rocky shores, tidal estuaries, and kelp forests. Kelp forests are a key habitat often associated with sea otters. **Kelp** is an algae that grows in ocean waters. The type of kelp that dominate the kelp forests within the range of the sea otter are the giant kelp (*Macrocystis pyrifera*). These huge plants can reach up to 100 feet in height, commonly grow at a phenomenal rate of 1.5 feet per day, and form forests along the shore. Kelp forests are biologically productive areas that provide a home for countless species including sea urchins, sea stars, abalone, fish and sea otters. Sea otters sometimes wrap themselves in kelp when sleeping. Kelp forests also act as a nursery for young fish as they are able to hide from predators in the kelp. In addition, kelp forests act as a damper against winter storms to protect the coastline from severe damage.

Sea otters are described as a **keystone species** and indicators of nearshore **ecosystem** health. Their importance in shaping the nearshore marine ecosystem is well documented. When sea otters were hunted to near **extinction**, the kelp forests throughout the north Pacific, especially in California, were **decimated** by sea urchins. The sea otter, which is the sea urchin's top **predator**, was not present to keep these rocky reef **invertebrates** in check, and the urchins **proliferated** to unhealthy numbers. As sea otter numbers increased as a result of protections granted to them through the International Fur Seal Treaty of 1911, so did the kelp forests. Maintaining a balance between all inhabitants in the kelp forest ecosystem is imperative to creating a rich, diverse habitat. Kelp forests are important as fish nurseries. They dampen the impact of severe winter storms on the nearshore habitats and their inhabitants, provide shelter for sea otter mothers and their pups and provide foraging areas for many marine species.

With sea otters present, the kelp forests and rocky reef communities they **inhabit** flourish. A sea otter's effect on the ecosystem is disproportionate to how many sea otters there are. Very few sea otters can have a large effect. When sea otters are absent or are in decline, kelp communities are absent and the rocky reef communities become dominated by sea urchins and other **herbivorous** grazers.

Not only are they a keystone species of nearshore marine ecosystems, but sea otters also are linked to the **biodiversity** of these ecosystems as well. A lack of biodiversity in an ecosystem is an indicator that the ecosystem's health may be suffering. Many biologists believe that the occasional decline in the southern sea otter population is a signal that the health of our oceans is at risk. In addition, if sea otters populations decline due to disease and effects from environmental contaminants, then it is likely that the **prey** they consume will suffer as well. Since humans consume a variety of seafood, the health of our oceans is a major factor in the quality and safety of that food source.

The sea otter is an important species to preserve not only for its ecological value but for

economic reasons. Sea otters provide a **profound** economic benefit to coastal areas in the form of tourism. Many coastal areas rely on native wildlife, including the sea otter, to bring tourists to their area. In addition, many people visit zoos and aquariums to observe sea otters.

VOCABULARY

Kelp: collective name for various large, brown algae.

Keystone species: an organism whose abundance or activity is central to maintaining the nature of the habitat; they may be important habitat modifiers, pollinators, seed dispersers

Ecosystem: the complex of a community of organisms and its environment functioning as an ecological unit

Extinction: in the process of being destroyed so that it no longer exists

Decimated: to kill a large number of (something), or to reduce (something) severely

Predator: an organism that lives by preying on other organisms

Invertebrates: an animal that lacks a spinal column

Proliferated: to increase greatly and suddenly in number

Inhabit: to live in (a place)

Herbivorous: an animal that eats grass and other plants

Biodiversity: a term used to describe the number, variety and variability of living organisms.

Prey: a creature that is hunted and killed for food by another animal

Profound: extreme

Check Your Reading Skills
Web of Life

1. What is the growth rate commonly documented for the giant kelp?

2. How are sea otters indicators of nearshore ecosystem health?

3. How does a decline in sea otters relate to human health?

4. How does tourism relate to sea otter preservation?

5. Provide two reasons why preserving sea otters is important.

6. What zoo or aquarium exhibits have you seen that educated you about an endangered species? What did you learn?

Reading Comprehension Check
Answers

1. Approximately 1.5 feet/day.

2. When sea otters are present, the rocky reef and kelp forest communities they inhabit flourish.

3. A decline in sea otter numbers affects human health because humans consume seafood. Sea otters are indicators of nearshore ecosystem health and when otter numbers are low, contamination and pollution could be the cause and may be in the seafood consumed in that area.

4. Many people visit coastal areas to view wildlife including sea otters. Aquariums help to educate tourists and the general public about the importance for preserving this endangered species.

5. Preserving sea otters is important because they are a gauge on which scientists can rely to check the health of our oceans. Also, they help to maintain a healthy balance in the nearshore ecosystem.

6. Answers will vary.

6. SEA OTTER SOCIAL STRUCTURE AND BEHAVIOR

The social structure and behavior of the sea otter is not fully understood. While there have been many studies of tagged otters over long periods of time, how sea otters communicate and interact with one another is not entirely revealed through such studies. However, we do know that sea otters, like many nonhuman animals, have distinct personalities. For example, sea otters differ in their reactions to humans, some otters are **wary**, some brave, and some are very playful in interacting with people.

A common sight along the coast lines sea otters inhabit is sea otters **congregated** in nearshore groups, called rafts. Rafting sea otters are usually in a resting mode. Raft sizes can vary from a dozen to as many as a couple thousand animals, as is often seen in Alaska. While this behavior appears to demonstrate a tendency towards a group social structure, sea otters can also be **solitary** animals. They tend to feed, give birth and mate away from other otters.

Sea otters form specific groups, including mother-pup pairs, juvenile male groups and adult male groups. Male sea otters may exhibit **territoriality**. The establishment and maintenance of territories can occur on a seasonal basis or throughout the year. While male sea otters generally reach sexual maturity at the age of five, they do not begin to establish territories until they are between eight and ten years of age. Territorial males will sometimes be found among female groups.

The mother-pup pair is an extremely important social bond for sea otters because the female is entirely responsible for the care of the pup. The male is not involved in any of the parenting. The female teaches the majority of the behaviors that are essential for the growing pup such as foraging, diving and grooming. By about three and a half months of age, most pups have the ability to swim independently, dive capably and groom themselves without assistance from their mother. At five to six months, sea otter pups can accomplish certain foraging tasks. They are generally weaned at six months to one year.

Unlike whales and other marine mammals, sea otters do not migrate great distances. Territorial males can travel distances 40 to 60 miles on a seasonal basis, but most sea otters stay within a very short distance of their home range.

Communication in sea otters involves both vocalizations and visual behaviors. A common visual behavior is the “head jerk.” This motion is generally observed when an individual otter approaches a raft of sea otters. The approaching otter noses and sniffs the other otters while jerking its head from side to side. This behavior may be either a means of greeting or a way of obtaining information about members of the raft through use of the well-developed **olfactory** sense. When this behavior is performed by an

intruding otter, it often will take on a more aggressive nature through pounces and lunges at members of the raft.

Sea otters have a **repertoire** of vocalizations. One of the most frequently heard sounds when visiting nearshore areas inhabited by sea otters is the high pitched squeals of the sea otter pup. This vocalization keeps the pup in contact with its mother. These squeals enable the mother to find her pup when she returns from foraging for food. Other sea otter vocalizations include coos, whistles, whines, screams, squeaks, grunts, growls and hisses. These sounds are used in a variety of ways. Grunting and cooing are typically observed in otters when they are eating. Mother-pup pairs also sometimes coo. Stressed sea otters can whine, hiss and growl.

Although many facets of sea otter behavior and social structure are yet to be explained, through study and observation, scientists are continually learning more and more about these unique marine mammals.

VOCABULARY

Wary: on guard, watchful

Congregated: to collect into a group or crowd

Solitary: being, living, or going alone or without companions

Territoriality: the pattern of behavior associated with the defense of a territory

Olfactory: of, relating to, or connected with the sense of smell

Repertoire: a list or supply of capabilities

Check Your Reading Skills

Sea Otter Social Structure and Behavior

1. What are rafts?

2. Explain why the mother-pup behavior is an important relationship.

3. Explain the significance of the “head jerk” that sea otters make.

4. Describe some of the common sounds that sea otters make.

5. What sounds do humans make to communicate with each other?

Reading Comprehension Check
Answers

1. Rafts are groups of sea otters congregated nearshore. Otters usually raft when they are in resting mode.

2. The mother-pup relationship is important because it teaches the pup important survival skills. The mother teaches her pup how to forage for food, dive and groom.

3. After a sea otter has entered a group, it will jerk its head from side to side and nose and sniff the other otters. This behavior may be a greeting or a way of obtaining information.

4. Answers may include the following:

- High pitched squeals which allows the pup to keep in contact with its mother.

- Grunting and cooing sounds are made when otters are eating.

- Whining, hissing and growling sounds are made when otters are stressed.

5. Answers will vary.

7. SEA OTTER FORAGING BEHAVIOR

Sea otters are opportunistic hunters, meaning they take **prey** as it becomes available. Although individual sea otters do have food preferences, prey availability and abundance determines what they eat. Sea otters are adept at switching prey when a particular food source becomes scarce. They feed on approximately 40 different types of marine **invertebrates** including turban snails, sea urchins, mussels, crabs, sea stars, abalone and octopus. However, they also occasionally feed on fish (especially in Alaska) and upon the kelp in their resting area. On rare occasions, they eat marine birds.

Sea otters forage in kelp forests and rocky nearshore areas. They also forage on muddy bottoms like those found in Elkhorn Slough, an **estuary** near Moss Landing, California. Sea otters use their incredible **tactile** senses to seek out prey hidden in rock **crevices** and beneath the **substrate**. They also use their highly sensitive vibrissae, or whiskers, to seek out and identify their prey.

When observing sea otters, it is common to witness the unique manner in which they eat their prey. Sea otters bring their prey to the surface along with a tool, usually a hard object. They proceed to crack open the hard-shelled prey with the tool using their chest as a table. As the sea otter ascends to the surface with the prey item in hand, they tuck the tool in an area near their armpit. This area has loose pouches of skin that are used for storage. Tool-use preference in sea otters is a behavior that is passed down from mother to pup. Usually if a mother sea otter prefers a particular tool, the pup will share that same preference. Tool-use in foraging is only practiced by a small number of species in the animal kingdom, including primates, birds, polar bears and some insects.

Food stealing is another common practice among sea otters. This act occurs between pups and their mothers and mothers and male sea otters. In the latter case, the male otter has been known take a pup “hostage” in exchange for food. Only when the mother offers food to the male is the pup released.

VOCABULARY

Prey: an animal that is hunted and killed for food by another animal

Invertebrates: an animal that lacks a spinal column

Estuary: a water passage where the tide meets a river current

Tactile: of or relating to the sense of touch

Crevices: a narrow opening resulting from a split or crack

Substrate: the base on which an organism live

Check Your Reading Skills

Sea Otter Foraging Behavior

1. What does it mean when sea otters are called opportunistic hunters?

2. Where do sea otters keep the tools they use to crack open their prey?

3. What do sea otters use to seek out their prey?

4. Why do you think that tool preference is passed down from mother to pup?

5. How do humans get their food? What tools do humans use to eat their food?

Reading Comprehension Check
Answers

1. Sea otters are opportunistic hunters because they take prey as it becomes available.

2. Sea otters keep their tools tucked in an area near their armpit.

3. Sea otters use their tactile senses and whiskers to seek out prey.

4. Possible answers:

- Pups observe their mothers using the tool.

- That tool is readily available in that area.

5. Answers will vary.

8. THREATS TO SEA OTTERS

Throughout history, humans have posed the greatest threat to sea otters, both directly and indirectly. From the mid-1970s to the mid-1980s, about 1,000 sea otters were caught and killed in gill and trammel nets used by fishermen. These nets are often over a mile long and almost invisible to marine wildlife. Fortunately, laws that regulated gill nets in the 1980s decreased sea otter deaths that resulted from **entanglement** in nets.

Shooting of sea otters is also a problem. Since southern sea otters are protected as a threatened species under the Endangered Species Act, any actions taken to intentionally harm them is considered a federal crime. Between 1968 and 1989, 4.6 percent of recorded sea otter deaths were attributed to known or probable sea otter shootings. Although this number has decreased (only 1.6 percent of sea otter mortalities were attributed to shootings between 1990 and 2000), this crime is still a serious threat to the species. Defenders of Wildlife, along with other conservation groups, has raised reward money to ensure that the **perpetrators** are **prosecuted**.

A certain percentage of sea otter mortality also is attributed to collisions with boats and propellers. As human recreational and fishing activities increase in areas where sea otters reside, this form of mortality is likely to increase.

Oil spills, such as the *Exxon Valdez* spill of March 24, 1989, pose a continued threat to sea otters. Researchers are not sure how many sea otters died as a result of the *Exxon Valdez* spill. Approximately 1,000 oiled sea otters carcasses were found, but since the bodies of oiled sea otters usually sink to the bottom of the ocean, researchers believe these otters were only a small fraction of those that died.

Even small spills have an extremely **detrimental** impact on sea otters. Oil harms sea otters by coating their fur and impairing their ability to remain warm, causing **hypothermia** and ultimately resulting in death. Otters also ingested this oil during the crucial grooming activities. Once oil is ingested it travels into their internal organs, causing **irreparable** damage.

Disease is a source of sea otter mortality that can be attributed to the indirect effects of the environmental **contaminants** we use. Some contaminants in the food web directly impact sea otters. Some harm the immune systems of the sea otters, which increases the risk of disease. Researchers are investigating a new disease now being seen in southern sea otters. They have found a parasite that invades the brain, causing convulsions and ultimately death. This parasite is commonly found in cat litter, leading researchers to believe that cat litter is finding its way into the ocean.

Sea otters also have natural predators. The great white shark is the main predator of the southern sea otter. Orcas may be a major predator of sea otters in Alaska. Other predators include Steller's sea lions, bald eagles, coyotes and brown bears.

VOCABULARY

Entanglement: the act of wrapping or twisting together

Perpetrators: to bring about or carry out (as a crime or deception)

Prosecuted: to bring legal action against for redress or punishment of a crime or violation of law

Detrimental: obviously harmful

Hypothermia: subnormal temperature of the body

Irreparable: not reparable

Contaminants: something that makes impure or unclean by contact or mixture

Check Your Reading Skills

Threats to Sea Otters

1. What are the natural predators of the sea otter?

2. Why is it illegal to intentionally kill or harm a sea otter?

3. Why is a small oil spill harmful to sea otters?

4. Why are sea otter diseases attributed to human activities?

5. Brainstorm some ideas how humans can help save sea otters through individual choices.

Reading Comprehension Check
Answers

1. The great white shark is the main predator of the southern sea otter. Orcas may be a predator of sea otters in Alaska. Other predators include Steller's sea lions, bald eagles, coyotes and brown bears.

2. Sea otters are a protected species under the Endangered Species Act. It is illegal to hunt, harass or harm them.

3. Oil harms sea otters by impairing their ability to remain warm, causing hypothermia and even death. Oil that is ingested also damages the sea otter's internal organs.

4. Humans indirectly cause sea otter disease through the use of environmental contaminants. Some contaminants make their way into the food web and can directly impact sea otters by harming their immune systems.

5. Answers will vary.

9. SEA OTTER CONSERVATION

Only three subspecies of sea otter are found in the world: the southern, or California, sea otter (*Enhydra lutris nereis*), the northern sea otter (*Enhydra lutris kenyoni*) and the Russian sea otter (*Enhydra lutris lutris*). Southern sea otters are found only in California. Northern sea otters are found in Washington, Alaska and Canada. Russian sea otters are found in Russia with a few in Japan.

The southern sea otter is the only sea otter subspecies protected under the federal Endangered Species Act (ESA). It was added to the list of "threatened" species under the ESA in 1977. The southern sea otter is also classified as a "fully protected mammal" under California state law. All sea otters are given additional protection under the Marine Mammal Protection Act (MMPA).

The ESA was passed in 1973 to help preserve America's endangered and threatened species. It is a complex law that requires the addition of imperiled wildlife and plants to a federal list of threatened or endangered species. The ESA also established rules about how existing populations of endangered and threatened animals must be treated. For instance, according to the ESA an endangered species cannot be killed, collected, wounded or harassed. The ESA also makes it illegal to buy, sell or possess any part of endangered species or items made from them. In addition, it also **mandates** that efforts must be made to recover the species, which means creating and implementing a plan for returning them to healthy population levels.

The Marine Mammal Protection Act of 1972 was enacted to protect marine mammals and establish a Marine Mammal Commission. The MMPA acknowledges that: "Certain species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities" and that "there is inadequate knowledge of the ecology and population dynamics of such marine mammals and of the factors which bear upon their ability to reproduce themselves successfully." To address these problems, the MMPA states that "negotiations should be undertaken immediately to encourage the development of international arrangements for research on, and conservation of, all marine mammals."

These and other findings and declarations of policy set forth in the MMPA serve as the guiding force for adopting the most effective conservation activities for all marine mammals in U.S. waters.

THE SOUTHERN SEA OTTER

The southern sea otter population has grown slowly over the past three decades, although there have been some large declines in certain years. Scientists theorize that the lack of significant growth is due to a combination of problems such as high rate of

disease, food limitations (not having enough food in some areas), getting caught in abandoned or lost fishing gear and habitat **degradation**, but more research is needed. Initial conservation efforts involved translocating otters from one place to another. Beginning in 1987, 140 sea otters were translocated from the **parent range** to San Nicolas Island in the Channel Islands off the California coast. Conservationists were hopeful that establishing this second population would guard against the entire southern sea otter population being wiped out by an oil spill or other catastrophic event. The translocations were stopped when it became clear that sea otters were not remaining at San Nicolas Island and that the stress-related mortality rate was higher than expected when translocating sea otters. Some of the otters translocated to San Nicholas Island died, while some swam back to the parent range. More than half of the translocated sea otters disappeared.

A management zone was created in 1986 to reduce conflicts between sea otters and fishermen. The management zone was an area outside the parent range in which sea otters were not allowed. If sea otters moved into the management zone, the U.S. Fish and Wildlife Service (FWS) was required by law to transport these otters back into the parent range.

Initially, the California sea otter population was small and very few migrated into the “no-otter” management zone. Beginning in 1998, however, the number of sea otters moving into this zone began to increase. There was seasonal movement of 100 to 200 sea otters into the management zone in late winter and early spring of each year. The otters would then move back into the parent range by late summer or early fall. Fishermen believed FWS should uphold the law and move the otters back into the parent range. Conservationists argued that sea otters were simply returning to their historical territory and that this movement was necessary for the continued recovery of the southern sea otter. They also pointed out that capturing and transporting sea otters resulted in high levels of **mortality** due to stress.

In 2003, FWS determined that enforcing the translocation program and management zone hurt sea otters’ protection and recovery, and the agency decided that allowing otters to expand to their natural, historical range would be necessary to achieve recovery of the species. In December 2012, FWS officially ended the translocation program and management zone, allowing sea otters to move freely into their historic range along the California coast.

Southern sea otters and other marine animals have been harmed by gill nets used by fishing groups. These animals cannot see the nets in the dark ocean water and become tapped. Gill nets accounted for approximately 1,000 sea otter deaths from 1973 to 1983. To reduce the number of deaths, regulations were established to prevent gill net fishing in ocean water that is less than 110 meters, or about 360 feet, deep. This has made a big difference in ending the death of sea otters from gill nets and very few cases have been reported in recent years.

Other problems facing the southern sea otter include high rate of disease and general

degradation of their habitat through human activities. In addition, southern sea otters may also become entrapped and drown in live fish traps.

THE NORTHERN SEA OTTER

Alaska

Within the state of Alaska, the Southeast and Southcentral stocks are stable. The Southwestern stock, spanning from the western edge of Cook Inlet out into the Aleutian Islands, is listed as “threatened” under the ESA. This population has declined by nearly 70 percent since 1992. Some scientists think that the major reason for this decline is orca **predation**, although exactly why orcas are preying upon sea otters is not entirely understood. One theory attributes otter predation by these large whales to declines in the harbor seals and Steller’s sea lions on which they typically feed. Scientists theorize that such declines in prey may be due to overfishing and/or changes in environmental conditions (**regime shifts**) or other unknown factors.

Washington

The small, **vulnerable** population of sea otters in the state of Washington grew out of sea otter translocation efforts in 1969-1970. Fifty-nine sea otters were moved from Amchitka Island in Alaska to Washington. Today there are about 500 sea otters in the state. As these otters migrate into new areas, conservationists are concerned that conflicts with state and tribal fisheries may arise. These conservationists would like to have this subpopulation of the northern sea otter protected by the ESA or listed as “depleted” under the MMPA.

GLOBAL

While Canada and Russia do not have the kind of sea otter issues that confront California, Alaska and Washington, the overall worldwide conservation strategy for the sea otter is united. Although sea otters once had extensive numbers throughout their range from northern Japan to Baja California, their range is now divided into subpopulations, some of which are experiencing severe problems. As we have seen in the United States, efforts to recover these sea otter populations will require cooperation and coordinated efforts among state and federal agencies, conservation groups, researchers, fishing groups, zoos, aquariums and the public. Only then can there be hope for successfully recovering this remarkable keystone species.

VOCABULARY

Mandate: a formal order from a superior court, official or law

Degradation: decline to a low, destitute, or demoralized state

Parent range: the main area, which includes the northern and southern boundaries, from which the population or subpopulation is found

Mortality: the number of deaths that occur in a particular time or place

Vulnerable: open to attack or damage

Predation: the capture of prey as a means for maintaining life

Regime shift: a pronounced and prolonged change in the characteristic atmosphere-ocean climate of a region

Check Your Reading Skills
Sea Otter Conservation

1. What sea otter subspecies is the only one protected under the Endangered Species Act?

2. Why has the Aleutian sea otter population declined since 1992?

3. What groups play an important role in sea otter recovery?

4. In your own words, explain the Endangered Species Act.

5. Do you agree/disagree with the legally imposed management zone? Why/why not? Support your answer.

Reading Comprehension Check
Answers

1. The southern or California sea otter is the only subspecies protected under the ESA.

2. The predominant theory is that orca predation has caused a decline in the sea otter population.

3. State and federal agencies, conservation groups, researchers, fisheries groups, zoos, aquariums and the public are all key players in sea otter recovery.

4. Answers will vary. The Endangered Species Act (or ESA) is a law passed in 1973 to preserve threatened and endangered species in America. An endangered species cannot be killed, collected, wounded or harassed. It is illegal to buy, sell or possess any part of an endangered species or items made from them. Efforts must be made to recover the species.

5. Answers will vary.