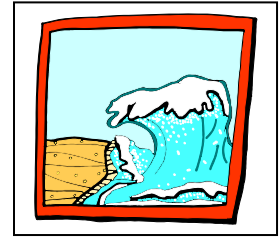


# Girl Scouts of Chesapeake Bay Beaches Patch



Explore the beach environment - bayside or seaside of the Chesapeake Bay Girl Scout Council area.

Beaches are one of the most unstable marine environments, better thought of as rivers of sand than static features of the landscape. Sandy beaches are products of erosion, sediment transport and deposition. Every grain of sand has a history and is a tiny world in itself. It started its evolution as something other than a grain of sand, somewhere other than the beach where you see it today. White sand beaches might be made up of crushed coral or coralline algae. Black sand beaches are made up of crushed volcanic rock. There might be many different multi-colored minerals on the beach if the sand originally came from mineral-rich granite. Pieces of bone, shell, and feathers are also mixed in with the sand on many beaches. – from Surfrider Foundation

Patches may be purchased from the Bay Shop. Contact Mary Russel at 302-456-7176 or [mrussel@cbgsc.org](mailto:mrussel@cbgsc.org).

## Patch Requirements:

Daisy Girl Scouts: Beach Log; 1 geology activity and 1 more for a total of 3 activities.

Brownie Girl Scouts: Beach Log; 1 geology activity; and 2 more for a total of 4 activities.

Junior Girl Scouts: Beach Log; at least 1 geology activity and 3 more for a total of 6 activities.

Teen Girl Scouts: Beach Log; at least 1 geology activity and 6 more for a total of 8 activities.

## Beach Log

1. Create a Field Book or Beach Log. You may use a blank journal or notebook. Younger troops may choose to create a troop log. You may wish to create journal notes for a troop or individual scrap book instead. In your beach log keep a record of what you see at the beach and notes from the patch activities below.

After girls have completed each activity and made notes in their Field Books, ask girls to think about two or three of the following questions and then hold a group discussion:

- a. How did you decide what to put in your field book?
- b. Was there anything special you did to help you remember what you learned?
- c. Are you proud of your book? Could you improve it?
- d. Do you think this book will help you to remember what you learned?

Explain to girls that scientists and explorers often use written notes accompanied by maps and drawings that they make to record their observations at study sites. They make these notes and drawings in pocket-sized books, called 'field books', so that they can later refer to their notes, and retain information in far greater detail than simple recollection would allow. The use of field books is a very old practice, first used by scientists and explorers who lived in times before photography was invented. It is a time honored practice, and still very much used to this day.

## Geology Activities

### 2. Compare Sand Grain Sizes

- Materials: Small containers for sand, magnifying glass, ruler for fine measurements, masking tape for labeling, pencils.
- Procedure: Collect samples of sand from these different beach locations: 1) edge of water 2) high tide line 3) back of beach 4) top of sand dune 5) bottom of sand dune. Label each sample with beach name location and date.

- Activity: Pick 15 grains from a sample, put them on paper and examine with a magnifying glass. Use the ruler to measure the grains. Calculate the average size of the 15 grains and record the size on a paper. Repeat with each sample. Compare sample averages and discuss reasons why your sand samples maybe of different sized grains.

### 3. Sand Grain Shapes & Sounds – Effects of Erosion

- Materials: Small containers, magnifying glass, masking tape for labels, pencil, paper
- Procedure: Use samples from previous activity or collect samples as directed in requirement #2 above.
- Activity: Take a few grains of sand from a sample, hold them near your ear and grind them together with your fingers. Rough and angular grains sound scratchy; smoother grains sound softer. Record on paper how each sample sounds.
- Activity: Take 5 grains of sand. Using the magnifying glass examine the shapes of the grains. Draw what you see. Repeat for each sample.
- Activity: Compare sound samples to sketches of samples. Do scratchiest sounds coincide with sketches of most angular looking grains?
- Think and Discuss: Wind and water action make sand grains angular. Chemical actions of ions in solution in water make grains smoother, rounder and more polished. Can you guess which erosion force has most recently been at work with each sand sample?

### 4. Sand Mineral Sorting

- Materials: Magnifying glass, sand samples, pencil, sorting page in Beach Log booklet.
- Procedure: Use samples from previous activity or collect samples as directed in requirement #2 above.
- Activity: 1) Sprinkle about 30 grains of sand in the center of a blank page.
- 2) Using the magnifying glass and a pencil sort the grains into the following categories:
  - a. Clear and Glassy in texture with uneven fractures (probably quartz)
  - b. Milky grains of red, pink and white hues with flat cleavage planes (probably feldspar)
  - c. Flakes, not rounded grains, of clearish white or black shades (probably mica)
  - d. Dark Minerals (probably hornblende family)
  - e. Others (the commonest are jasper, garnet, amethyst, hematite, and glauconite)

### 5. Magnetized Sand

- Materials: small cups, magnifying glass, 5x7 picture frame without glass, blank white cardstock cut to fit back of frame, masking tape, magnet.
- Preparation: Tape the cardstock to the back of the picture frame. Using small cups, collect and label dry sand from different areas of the beach. Look for and collect a sample of sand with a purplish hue.
- Activity: Take a small amount of sand and carefully sprinkle a very thin layer over the white paper in the frame. Place your magnet under the frame, touching the paper lightly and gently move the magnet back and forth in circular motions. Observe what happens. Try this with other beach samples. Black grains are often magnetite. Magnetite is attracted to the magnet and will move around the paper frame.

6. **Learn How a Grain of Sand is Formed** - Read the story “Roxie’s Rough Ride” (supplemental attachment). Complete one of the activities listed following the story.

## Tides, Dunes, Walks and Architecture

## 7. Make a Wave Machine

- Materials: 16 – 20 ounce washed plastic soda bottle with lid, water, mineral oil, blue food coloring.
- Preparation: Fill plastic bottle 2/3 full with water. Add a few drops of blue food coloring. Fill to the top with mineral oil. Twist the lid on tightly.
- Activity: Turn your bottle sideways and tip it back and forth to create waves.

## 8. Shifting Shores: Waves, Wind and Currents

- Preparation: Mark off an area of the beach by drawing lines in the sand. Be sure to include an area that has wet and dry sand.
- Activity: Create a grid in your Beach Log to record everything you see in your section of the beach. Record the time of day. After one or two hours, record your area again. Record changes and answer survey questions.

## 9. How Dunes are Formed –

### Background Information:

Plants do not survive on the shoreline because of the periodic erosion caused by waves. Above the wave line, sand can begin to form dunes.

Rocks, logs and plants in the path will reduce the speed of the sand and the sand will drop around the object blocking it. This small pile of sand forms the basis of a sand dune. As other mounds merge a hillock is formed with a ridge that has one sloping windward side and a very steep leeward side. With steady winds, dunes will continue to grow up to a few feet per year. If the dune does not become stabilized, the sand will bury everything in its path. Dunes become stabilized by the natural growth of plants. The sand is moved inland by the wind until it hits plant coverage, which binds the sand and anchors the dune. Beach grass is the primary dune building plant. It reduces the velocity of the wind so the sand grains deposit around the plants. Once a dune becomes stabilized the dune no longer moves.

The constant shifting of the sand makes it hard for plants to survive. Beach grass has adapted to survive in shifting sands by having stems that will grow horizontally. As the sand builds up around the plant, the stem grows longer where the leaves stay above ground. As the plant continues to grow the extensive root system anchors the dune.

Sand dune soils provide poor mineral nutrients. What nutrients the sand does have are found on the surface of microscopic soil particles called micelles. Sand is a relatively coarse texture soil with little decomposing organic matter and few mineral-holding micelles. Therefore, the main source of mineral nutrients comes from the spray from waves during heavy storms and rainfall. Plants depend on the small film of water around the soil. In the summer temperatures of the sand can reach as high as 115 degrees of higher. This dries out the surface layers. Plants have a root system that penetrates below the hot dry surface. The main source of water is the rainfall that filters through to the roots.

Today, these fragile ecosystems are managed for preservation.. One way to protect the dunes is by strategic placement of snow fences to stop erosion. A notch in the top of a dune can funnel the wind and cause the wind to double its velocity. This can cause an increase of erosion and cause the dune to start moving again. Planting beach grass also helps protect and stabilize existing sand dunes.

Human activities such as pedestrian traffic and off road vehicles need to be managed to preserve the dunes. Trails have been constructed so you can visit the dunes and their environment without disturbing the ecosystem. You will also find designated areas for sunbathing and picnic areas so you can enjoy the outdoors without damaging the sensitive parts of the environment.

## Activity- Building a Sand Dune

Materials: For each group

- 2-speed hair dryer
  - 2 flat pans
  - Small grass clumps
  - Angular stones
  - 3 liters of clean sand
  - A dustpan and broom for clean up.
- a. Explain to the girls that this experiment is to determine what factors affect the kinds of sand dunes the wind creates.
  - b. You can break up into groups of two to three girls or you can do the experiment as a whole troop.
  - c. The experiment should be done on a table, the floor or outside.
  - d. Label each pan A and B. Place 1.5 liters of sand in each pan.
  - e. In pan B arrange the stones and grass in different areas throughout the sand.
  - f. Turn the dryer on low speed. Hold it at a 45-degree angle; 10cm from one end of the pan A. Hold it for one minute. Record all observations.
  - g. Repeat the step 6 for pan B.
  - h. Change the dryer speed to high. Repeat step 6 for both pan A and pan B.
  - i. Make a sketch of the appearance of the sand in each pan.
  - j. Level the sand in each pan and repeat step 6 for 3 minutes instead of one minute.
  - k. Record findings and sketch the appearance of the sand in each pan.
  - l. Have the girls share and discuss their findings.

**10. Make a Tide Stick** – Take a four foot stick marked every six inches. Push into sand in shallow water and record where the water level is. Check every half-hour to see how the depth has changed. Chart or graph your results. Learn how to read a tide chart. Find out what the tides are for a particular beach for a week.

**11. Sand Drip Castles** – Be an architect and make sand drip castles. Explore the possibilities of sand saturated with water.

- Materials: Wet Sand and your imagination.
- Procedures: Scoop up a handful of wet sand and allow it to run in streams or drip through your fingers. Try it with 1 or 2 hands. When one handful has run through, get another scoop and add on to your castle. Allow sand to fall, spread and rise naturally. How high can you get your castle to rise?

**12. Sand Casting Paperweight**

- Materials: Plaster of Paris, mixing container, stirrer, decorative items.
- Procedure: 1) Dig a small hole (the size of ½ a tennis ball) in damp sand. Line the hole with beach combed items. 2) Mix plaster of paris (seawater can be used) according to directions and pour carefully into hole. 3) Allow to harden, take it out, turn upside down and carefully and lightly brush loose sand away. Later, when completely dry, glue felt to the bottom and spray lightly with a fixative such as varnish, sealer or hair spray.

## Beach Drift & Beach Wrack Activities

Beaches throughout the world are strewn with drift and debris, both natural and human-made. “Beach drift” is anything that washes up on the beach, whether it came from living or non-living materials. “Beach drift” generally refers to items that wash up on the shore. “Beach wrack” is made up of kelp, other seaweeds, or sea grasses that washes up and often forms a line across an entire beach at high tide.

### **13. Beach Clean-up**

#### **Background Information:**

##### **The “Dirty Dozen”**

The Center for Marine Conservation reports that the twelve types of trash (the “dirty dozen”) most often found in the United States during the 1998 National Coastal Clean Up were, in order of frequency: 1) cigarette butts, 2) plastic pieces, 3) foamed plastic pieces, 4) plastic food bags/wrappers, 5) paper pieces, 6) plastic caps and lids, 7) glass pieces, 8) straws, 9) glass beverage bottles, 10) metal beverage cans, 11) plastic beverage bottles and 12) metal bottle caps.

##### **Nike Shoe Spill in the ocean, 1990**

The Nike shoe spill of May 27, 1990 just southeast of Alaska, was one of the largest releases of human-made drift objects ever with an estimated 60,000 shoes spilling into the ocean . Several months later, Nike sneakers were washing up on the U.S. West Coast. By 1993, the shoes were washing up onto the beaches of Hawaii, many thousands of miles away. Trash, which many nations dump regularly into the oceans, can drift just like Nike sneakers. This is just another indication of the GLOBAL nature of ocean pollution. (Source: The Wealth of Oceans, Michael Weber and Judith Gradwohl, WW Norton and Co., 1995, p. 59)

#### **Clean-up Activity**

Take a field trip to the beach (at a local seashore or river) and conduct a beach clean-up project . Have girls explore the beach and sort what they find into the categories used in this activity. Bring enough plastic garbage bags so that every pair of girls can have one. Divide the pairs in to three collection groups: 1) unbroken glass and cans ; 2) plastic ; 3) paper and other miscellaneous trash . Girls should wear gloves and be warned of picking up sharp or toxic items. If you’re on an ocean beach, you could have all pairs line up from the water’s edge to the dune or cliff area and sweep a half-mile section of beach. Remind girls that they should collect only evidence of humans. Take all the debris they have collected and organize it into categories. If possible, weigh or measure the volume of each. Discuss the differences between biodegradable and non - biodegradable, and recyclable and non - recyclable objects. Point out any collected items that are natural, rather than human-made, and ask girls to return them so that your impact on the eco system is minimized.

- 14. Beach Wrack – Signs of Life:** Gather the girls around a mass of beach wrack and have them look through it carefully to find some of the living organisms of the beach. Others could dig and sift through the sand to find hidden animals such as beach hoppers and sand crabs. Remember to handle these creatures with care and return them to the locations on the beach where they were found, once the girls have had an opportunity to observe them and note some of their characteristics, be sure to note other animals present, such as shorebirds.

### **15. Beach in a Bucket**

You will need empty tubs or buckets, one for every 3- 5 girls. Have them spread out across an area of beach. Ask the girls to collect a variety of items found on the beach. Be sure to caution them not to over collect, and remind them that they will be asked to replace all items of drift where they found them. Remember ... “Leave only footprints.” Encourage girls to feel the sand and pick up pieces of drift and debris in order to observe them closely.

- a. Tell girls that now they will have the chance to explore the “beach.”
- b. Divide the group into smaller groups of three to five girls.
- c. Circulate among the groups. Ask focusing questions, such as:
  - What colors do you see?
  - What do the things on the beach feel like? [fuzzy, rough, prickly, soft, etc.]

- What are some of the shapes of objects on the beach
- Where do you think the items came from?
- What evidence is there of living things?

**Sorting and Grouping** (Follow-up to Beach in a Bucket for older girls)

- After they've made some observations, encourage girls to sort or group the items into categories, based on any observable characteristic of their choice.
- Give groups time to share and describe the categories they devised.
- Explain that often when we go to a sandy shore, we may not see many living plants and animals at first, but if we look closely, we will always find plenty of evidence of living things.
- Next, have girls re-sort the items into the following four groups: evidence of plant life, evidence of animal life, evidence of humans, unknown items (or items about which they can't agree).
- Have the groups share again. Explain that everything in the first two categories is evidence of life (or biotic material). Evidence of humans could be biotic (chicken bones or paper) or abiotic (plastic, aluminum). Can anyone identify the unknown items?

**Supplemental Resources:**

**Roxie's Rough Ride to the Beach**

The Story of a Grain of Sand - From the Surfrider Foundation • Sand Travels

Read aloud story, discussion questions, art activity and drama activity. **See Attachments.**

**Surfrider's Education web page**

Info on beach and ocean topics, Plus "Top 40" links [www.surfrider.org/educational/html](http://www.surfrider.org/educational/html).

**Dune Fun Interactive Educational Activities Online**

Computer animated dune erosion and restoration. Dune Fun was designed to teach students and adults about dune erosion and creation processes. This dune web site is highly interactive and has many animated illustrations.

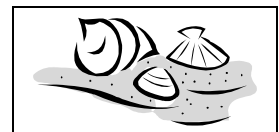
<http://www.cce.cornell.edu/seagrant/glhabitat/dune/edactivities.htm>

**Children's Books:**

1. "Life in a Sand Dune" Malcolm Perry, Raintree/Steck-Vaughn, Sept. 2003, ISBN 1410903508, (ages 4-8)
1. "Sand on the Move: The Story of Dunes" Roy A. Gallant, Franklin Watts, Incorporated, March 1998, ISBN 0531158896 (ages 9-12)
2. "Sand Dunes", Jan Gumprecht Bannan, Carolrhoda Book, May 1989, ASIN 0876143214, (ages 9-12)
3. "Summer Sands", Sherry Garland, Gulliver Books, April 1995, ASIN 0152824928, (ages 4-8)

**ROXIE'S ROUGH RIDE TO THE BEACH**

The Story of a Grain of Sand  
From the Surfrider Foundation • Sand Travels



In this activity, girls learn that sand is created by erosion, and can be transported long distances by streams, rivers, and ocean currents. This activity introduces the concept that

erosion is the gradual wearing away of objects by glaciers, water, wind, or waves. Waves and currents constantly move sand on and offshore and along the coastline to form beaches, which change with the seasons. Construction of structures such as groins, which interrupt natural coastal processes such as the movement of sand along shore, can cause beaches to disappear.

Learning Objectives:

1. Erosion is the gradual wearing away of objects by water, wind, waves, or glaciers.
2. Sand is created by erosion and can be transported long distances by streams, rivers, and ocean currents.
3. Waves and currents constantly move sand on and offshore and along the coastline to form beaches which change with the seasons.
4. Structures like groins can affect sand flow along the shore and cause some beaches to disappear

**Read the story “Roxie’s Rough Ride to the Beach” aloud to the girls. Then follow up with some or all of the supporting activities.**

### **Part 1: High Mountain Winter**

High in the mountains, the lakes and creeks had begun to freeze over for winter. Golden aspen leaves fluttered down along the banks, leaving the white-barked trees in sharp contrast against the blue sky. Already the craggy granite peaks of the mountains were deep in snow. On a ledge by a gnarled lodge pole pine was a small rock named Roxie. Smooth on one side, rough on the other, the rock was about the size of your thumbnail. She had broken off from her mother -- a big mountain boulder and been wedged in a crack on the ledge below for a very, very long time. Year after year, the small rock watched the seasons go by. Once in a while, usually in the spring when the snow was melting, she would hear a clattering from above, and watch as other rocks, large and small tumbled and slid by her down the slope,

but she never moved. She was stuck, she thought, never to see more of the world than the sky, the boulder above and her neighbor on the ledge, the lodge pole pine. But each winter, as rain filled the crack, and then froze with the cold, the ice pushed the crack outward. In the springtime, the roots of the pine tree grew, and the roots were pushing on the crack too. Roxie didn't notice, but very, very slowly, the crack was getting wider. Then one blustery fall day when the wind was blowing very hard, Roxie rattled a tiny bit in her crack! Suddenly she began to feel like she might not stay in her crack on the ledge forever after all.

### **Part 2: The Spring River Run**

One fine morning of the following spring, when the sun was out and shining its warm rays on high mountain snow, a trickle of water crept underneath Roxie. It tickled a little bit and Roxie smiled. The gently moving water was a nice change from the cold, hard ice. As the sun rose in the sky, the little trickle turned to a slow steady stream, and as the day grew warmer, the water began to flow a bit faster, and then even faster through Roxie's crack. Suddenly, Roxie was lifted up out of her crack and swept off over the edge of the granite! Crash, bang! She tumbled down the rocks in the growing stream, and found herself launched into a roaring waterfall. In two seconds Roxie landed at the base of the falls and found herself at the bottom of a deep pool of bubbling, turbulent water. 'Wow!' she thought, 'Cool!' (she was having fun), but she had barely had time to check out her new surroundings before she was whooshed away again, moving fast down a racing river. She jumped and bumped through the raging rapids, catching a glimpse of sky, then the glassy water, then

bumping along the smooth stones on the river bottom, then up again. She rolled and rollicked with the river on and on as it flowed out of the high mountains and through the foothills below.

### **Part 3: Lazy Lagoon in Summer and Fall**

After quite some time and many miles, the river's flow slowed and the river widened out to form a glassy lagoon. Roxie had drifted by leopard lilies in spring and dragonflies in summer. During the dry months of summer the river's flow had lessened to a narrow stream, and Roxie lapped up in the calmer waters and settled on a flat sandy bank, near the edge of a wood. After such an exciting journey, she thought she might just stay there a while and rest. With all the wear and tear of going down the river, she was a little worn down—as a matter of fact she was only about half the size she had been when she was first swept out of her crack on the high mountainside!

And she was now smooth and shiny. The river had polished her sides to a silky smoothness. Her old crack certainly seemed long ago and far away, for she had been many, many places since she had rested there. Roxie spent her days basking in the warming rays of the sun, and watching all of the creatures of the surrounding woods come to drink at the water's edge. One day a striped snake even rested himself against her, as he curled up for an afternoon sun bath. In the evenings, Roxie was lulled to sleep, by the music of the gently flowing water. It was a very pleasant time indeed. As the season turned to winter, Roxie felt chilly in the cold night air. But she didn't mind, for the sky was brilliant with beautiful stars of many colors. One especially quiet night she gazed for hours at the silver dazzling full moon. Then, one early morning, in the quiet of dawn she heard a new sound ... it was so far away, she could barely hear it, but it was there, a rhythmic sort of roaring sound, unfamiliar, but oddly soothing. Roxie was hearing the ocean's waves breaking on the shore.

### **Part 4: The Winter Storm – Roxie Meets the Surf (and gets a little broken up about it!)**

Boom, crack! It was the first big storm of the winter. In the dark of night, Roxie listened to the crash of rolling thunder as rain fell all around her. By the flashes of lightening, she watched the water of the lagoon rise with the rain and tide until it once again reached her on her spot on the sandy bank. The flowing water lapped against her and then with a swish she was once again swept into the current. The water was muddy and brown, and Roxie was not alone in the flow. Branches, leaves, other rocks and even discarded cans and bottles swirled all around her. Just a few hours later, in the light of dawn Roxie was amazed to find that the ocean was at her feet!

It was high tide and winter storm waves were rolling in fast and hard, one right after the other. The ocean looked wild, with white caps as far as she could see. The water was brown and gray where the river flowed into it – not clear and blue green the way she had imagined it would be. Before she knew it, Roxie was washed out to sea in a great churning of stones and sand. She barely caught one last look at the river mouth, where now only big rocks remained on the banks – it seemed that all of the fine sand and small stones had been washed away in the churning water.

Sloshing and grinding, rocks, shells and all manner of objects crashed into each other as they were surged forward with each wave, then swept back to meet the next one. Bit by bit, pieces broke off from Roxie until only a small sand grain was left. Roxie didn't mind this at all, because the smaller she got, the higher she could ride in the waves! She thrilled at the power of the waves and their natural rhythmic motion! Riding the waves was a lot more fun than sitting in that crack on the mountain! For days and days, Roxie tumbled around in the huge ocean, surfing the waves, kissing the shore, sweeping back to ride the next, then sinking down into the silky darkness of the deeper water off shore.

### **Part 5: Spring on the Kelp Wrack**

After a month of gray skies and rain the storms cleared. Roxie washed up on the beach with many other sand grains. She herself was stuck to a big stalk of brown kelp that was tangled and intertwined with a clump of other seaweeds. The air bladder of the kelp had allowed them to ride high on the waves, and they were washed up above the tide line next to a driftwood log. After seeing so many branches and logs in the river during the storm, she wondered if this log might be her old friend the lodgepole pine.

As the sun grew hot, the kelp began to grow slimy and start to rot. Roxie was quite stuck in place, but at least she was never lonely. The kelp wrack was a hub of activity. Snails and limpets who were also attached to the kelp made their way to the underside of it, so that they could stay out of the sun and keep away from predators who might eat them. Flies and beach hoppers nibbled at the kelp, while gulls and shorebirds wandered by, poking into the sand with their beaks. As darkness fell, the crabs sidled their way across the sand to pick and nibble at the kelp and other organisms that had washed in with it. It seemed there was always a party going on at the kelp wrack. Out in the ocean, other sand grains waited underwater on sand bars for their time to join the party.

### **Part 6: The Summer Beaches**

As the days grew long and spring changed to summer, the waves were more gentle, and spaced further apart. Many of the sand grains who had spent the winter and spring resting off shore on a sand bar, were now washed onto the shore, and the beach grew wide and deep. The kelp dried up and Roxie finally fell off onto the beach. She felt free again, as the wind helped her skip over the beach and mingle with other sand grains. People and dogs came by and scuffled the sand. Roxie hitched a ride on someone's toe and found herself at the edge of the ocean again. At high tide she was scooped up in the quiet rocking motion of the wave wash and carried into the longshore current. Here Roxie drifted, pushed along by the ocean, heading slowly south with out much to do except go with the flow.

One afternoon she washed up again onto a shoreline. As she washed in, she got stuck on a dead sand crab, and just as she thought the waves had pushed her in as far as she would go that day, a gull swooped down and grabbed the sand crab. She could hardly believe it as she was lifted high into the air. She could see from the air that this was a narrower beach than the last one she had visited, and there were houses built all along the shore. So this was what was meant by a 'bird's eye view'! But after a moment, her attention was drawn back to the situation at hand. She was about to become part of this gull's afternoon snack! But just then, another gull spotted his buddy with the crab, and flew over to get in on the snack. The gulls swerved and squabbled in the air, and as they maneuvered and argued, Roxie was shaken free.

Down, down she fell, and landed quite far up the beach, above the high tide line. "Well," she thought, "this is much better. Perhaps I will stay here and take in the sun for a while. After all of this traveling, I could use a rest." And that she did

### **Part 7: The Groin**

Roxie was enjoying the summer, mixing with many other sand grains. She had met green and blue grains that had come from glass bottles, grains made from shells, from bone, from just about anything she could think of. Roxie had learned a lot since her days in the crack on the mountain ledge. But she hadn't moved far in a while, and she was beginning to get bored with this high and dry life. Every morning a big machine came along and raked through the sand grains, picking up all the kelp and other items that had washed onto the

shore. There were no lively beach wrack parties here, as it was all picked up and taken away. As usual, however, just as she was beginning to think life was getting dull, Roxie was met with a new surprise. Big machines came onto the beach one morning, bringing truckloads of big rocks. These rocks were not as big as her mother had been, but they were very large indeed. The machines dug a trench and placed the rocks in a line, beginning on the beach very near Roxie, just north of her, and continuing out into the water, where the waves were breaking. Then they filled the gaps between the rocks with concrete. She heard one of the builders tell a person that the structure they were building was called a 'groin' and that it would protect the beach. Roxie felt lucky that she wasn't among the sand grains that had gotten cemented into the groin. Then she'd really be stuck!

As the days grew shorter and the shadows grew long, Roxie knew that it would soon be winter. The waves would get bigger and sweep sand from the beach. But it seemed to her that her beach was changing faster than it should. The waves were still gentle, but the beach was getting narrower and narrower. The sand grains near the water's edge were still being swept out into the longshore current, just as she had been, and moving south, but no new sand grains were arriving from the north. All of the sand grains traveling in the longshore current were getting stuck at the groin. As the beach on the south side of the groin became narrower and narrower, the waves reached farther and farther up the beach toward Roxie, and she knew she would be traveling again soon. By the time the waves reached Roxie, the southern beach was almost gone.

### **Part 8: The Sand Castle**

By the end of the summer, Roxie had traveled quiet a few miles from the kelp wrack beach and the beach south of the new groin. Now she was near a small coastal town by a large point of land. The nearshore current caught her up and pushed her on shore right next to a child building a sandcastle. Scoop! The shovel picked her up and she landed at the bottom of the child's bucket. Splat! The bucket turned upside down and she found herself on top of the castle. She felt the child's warm hands patting her into a beautiful shape. "Oh, how lovely!" she thought. She could see the child smiling, and she was glad to be there -- at least for a while.

### **Follow-up Discussion:**

Question 1: Describe how Roxie left her original mountain home. What made her leave?  
*[The crack widened due to erosion; water, rain and snow carried her away.]*

Question 2: Roxie said it seemed like there was always a party going on in the kelp wrack. Who came to the party, and why do you think it seemed like a party to Roxie?  
*[Flies, crabs, gulls, shore birds came; it was like a party because there were lots of visitors, food, and activity]*

Question 3: During the winter storm, Roxie became smaller and smaller until she was just a tiny sand grain. What caused this?  
*[She was swept into the winter storm waves where she was ground up against other rocks.]*

Question 4: Throughout the story Roxie was kept almost constantly on the move. What forces were moving her?  
*[Many, including winter storms, waves, wind and longshore current, for example]*

Question 5: Remember the part of the story when the storm hit the beach at the same time as the high tide? What happened to Sandy when that happened?

*[She was washed out into the ocean and broken up into smaller pieces.]*

Question 6: Waves in the winter are very different from waves in the summer. How are they different?

*[Winter waves are spaced closer together and are bigger and stronger; summer waves are spaced further apart and are smaller and more gentle.]*

Question 7: How do waves affect the sand on the beach in the winter? In summer?

*[Winter beaches may be just cobblestones, or have a steeper profile because most of the sand has been taken offshore by large waves; summer beaches are wide, deep, and sandy because the smaller waves push sand onto the beach.]*

Question 8: What happened to the beaches north and south of the groin after it was built? Can you explain why?

*[The beach on the north side of the groin grew wider, and the beach on the south side grew narrower. This happened because the groin became a barrier to the longshore current.]*

### **Art Activity: Postcards from the Journey**

(As an alternative activity, you may choose to create a mural or comic strip instead of postcards.)

1. Ask girls if they have ever been on an exciting trip. Sometimes people tell others about a special trip or journey by writing them a postcard. Ask questions, such as: Have you ever written or received a postcard? When do people send them? What types of messages or pictures are on them?

2. If it doesn't come up in the discussion, describe how postcards usually have a photograph or picture on one side to show the friends or family of the traveler scenes from the journey. On the other side of the card, the traveler writes words relating stories about experiences she/he is having, describing what the weather is like, and telling if she/he is enjoying the trip. It can also include information about where the traveler will visit next. *(Bring a sample from home or make a sample Roxie postcard to share with the girls.)*

3. Tell the girls that they are going to imagine they are Roxie and are writing a postcard home describing one part of her journey to the shore. Divide the group as needed to create all eight parts of the story. Give each girl/group a blank 4" x 6" index card. Explain that each of the cards will be a scene from Roxie's journey. Review the eight parts of the story with the class. Girls can address their postcards to whomever they choose. Some options include: their "mother rock," their former neighbor, the lodgepole pine tree, a friend or relative, or themselves.

4. Pass out crayons, markers, or colored pencils to each group. Assign each of the girls / groups a part of the story to illustrate. Tell them to imagine that they are Roxie on her journey and writing a postcard home. Have girls use crayons or markers to draw where they are in their journey, and be sure they include Roxie in each picture.

5. Pass out ball-point pens or pencils. On the back of each card, have girls write a postcard message from Roxie. They could include something about their experiences, what has happened to them, maybe mention the weather, and whether or not they are enjoying the journey. Tell them to be as creative as they can. They can use humor, happiness, loneliness, or other emotions, but they should try to include accurate information about Roxie's location and activities.

Example: "Dear Mom: Hi from the mountains!"

It is really windy up here and I can feel the rock cracking. I keep getting blown into the wall and banging my head. The snow-capped mountains are really pretty.  
Bye, Roxie.”

6. After everyone finishes, ask the girls to share their postcards and read the messages they have written.

**Dramatic Activity:**

Give the groups/girls 15-30 minutes to develop one–to two–minute skits about their parts of the story, and to design simple costumes. Invite the groups to perform their skits in rapid sequence beginning with "Scene 1" until the entire story has been performed. Or, with more time, each group could prepare a dramatic presentation of the entire story. Leaders with access to audio-visual equipment could turn these into slide or even video presentations.