

## Predation at the Shore

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**\*\*\*Note: Figures may be missing from this format of the document**

### **Abstract.**

This article describes 10 predator/prey relationships that occur at the coast. Predators are compared to criminals and prey to their victims, and details of crime scenes are presented in a tongue-in-cheek manner. Accurate descriptions of the habits and habitats of the criminals are also presented as well as games and activities that feature the relationships between the predators and their prey. **Key words:** mollusks, predator, prey, radula

### **Article:**

The main purpose of coastal exploration is to expose students to the beauty and majesty of the coast. All of the authors have taken students to the North Carolina coast for extended field experiences. At the shore, in addition to closely examining the faunal diversity of that coastal environment, we conduct a number of activities on the wide sandy beaches, which are inundated with high tide waters twice a day. We search for organisms in the intertidal zone twice a day, measure how deep it is necessary for students to dig to find water in the beach sand, and toss grapefruits into the waves to study the speed and direction of along-shore currents. The various activities address biology, environment, and earth science curriculum standards. One of our favorite activities is called Predation at the Shore. Although what takes place at the shore is not actually "murder" as we tend to think of it, predation can be vicious and somewhat resembles our human construct of murder.

Although we tailor the coastal predator activity to the particular age group with whom we are working, the general idea we try to get across to the students is that not all murderers are in jail. If they were, many of the criminals we find at the shore--these aquatic delinquents so to speak--are so small that they would escape confinement anyway. These "criminals" are the marine animals that call the coast their home, and, in fact, they are both predators and prey.

### **Materials**

A coastal shoreline

Gallon-size, plastic Ziplock bags (1 per student)

Large plastic trash bags (to hold items such as dead sea birds, fish skeletons, dead horseshoe crabs, and dead jelly fish)

Digital or regular camera (to take pictures of evidence that is too messy to collect). (Note: If you use a digital camera, you can see pictures more easily right away if you have a computer and printer at the coast. You can also crop or enlarge your pictures and send them to others. In general, a digital camera allows for greater versatility.)

### **Activity Overview**

For the following activity, have the students collect 10 seashells found on a North Carolina beach and then identify these common specimens using *A Guide to Field Identification: Seashells of North America* (Abbott 1986). Talk with the students about criminals and victims and felonies, including murder, and explain nature's parallels of murder in relation to what we consider murder among humans. Then, as the students walk along the

beach, at the scene of these "misdeeds," encourage them to collect items, that is, evidence that would implicate a particular organism. Later, in a central meeting place or back in the classroom, ask the students to share their evidence that an assassination occurred or that organisms were victimized. Usually students find items such as a jackknife clam with a hole, crab legs, crushed mole crabs, scallops, turkey wings, and limpets (see photos). Two ideas for using this theme to develop activities for your students at the beach are for each predator to have its own wanted poster or for each murderer to have an accompanying Make & Take.

### **Preparation**

Note: For the safety of the students, ensure that certain requirements are fulfilled before taking a trip to the coastal shoreline. For example, obtain medical information about each student (e.g., allergies, medications, special dietary needs, etc.) and contact telephone numbers for each student as well as emergency contact numbers. Information regarding nearby medical facilities, business numbers for school or chartered bus repairs on your route, and other emergency information can be helpful should you find yourself in a "need-to-know" situation. Your local school district may also require other information to allow students to take a field trip of this magnitude, so check with them and be sure that you have all the students' permission slips before departure.

### **Meet 10 Predators and Their Victims**

The following information provides descriptions of 10 common murderers (predators) and their victims that we have encountered frequently on our trips to the North Carolina coast.

#### 1. The Atlantic Moon Snail and the Clam

The modus operandi of one of the neatest predators, in the sense that it brands its victims with a small, representative mark, is the moon snail (sometimes called the shark's eye). A beautiful mollusk, the Atlantic moon snail is noted for its splendid egg case that resembles a beige collar studded with sparkling sand. The moon snail slithers up on its victim (the clam). Using its radula, a chainlike structure with rows of teeth, the snail bores a perfectly symmetrical hole in the clam's shell and slurps up its insides--as one of our students might slurp a milkshake (see the moon snail's wanted poster [Figure 1]).

#### 2. The Oyster Drill and the Oyster

Oyster drills, which are mollusks, bore through thick oyster shells with their tonguelike radulas to feed on the soft parts of an oyster. These mollusks (which are, in fact, small snails) contain an acid that aids in the dissolution of the carbonate shell of the oyster. In addition, the motion of the oyster drill's radula as it bores into the oyster weakens the oyster's muscles and pries the oyster's shell open.

The oyster, which is also a mollusk, is essentially a sitting duck for the oyster drill, although the oyster drill is much smaller. Because the oyster is a filter feeder, it attaches itself, depending on the species, to a variety of objects and remains stationary. Its method of protection is its sharp-edged shell. However, because it is unable to move away from its predators, it makes a tasty meal for others besides humans, for example, for the oyster drill.

#### 3. The Ghost Crab and the Loggerhead Turtle

Another "most wanted" coastal predator is the ghost crab, although it is also prey for birds and larger animals. With the aid of a flashlight, you can see ghost crabs if you patrol the beach at night, as police officers do. This luminous, scurrying, nocturnal creature lurks in its sand den waiting for prey to capture. When it catches something, for example, a loggerhead turtle, it uses its claws and mouth to take it apart, literally dismembering it. Ghost crabs attack baby loggerhead turtles on the turtles' trek from their lightbulb-shaped nest to the ocean. The turtles crawl over their siblings to reach the water, where they will be "MISSING" for approximately seven years. Many will simply be missing in action, however, if they meet up with a ghost crab! Few loggerhead turtles make it to the ocean, and even fewer turtles return to lay eggs after their many years away.

#### 4. The Ruddy Turnstone (a Bird) and the Horseshoe Crab

Human lawbreakers would be delighted to have the getaway techniques of another class of unassuming criminals, namely birds. As an example of birds that inhabit beaches and sometimes mudflats, ruddy turnstones can fly from anyone or anything that is wont to interrupt their activities. These medium-sized, short-legged birds have a distinctive calico pattern and orange legs. Their short pointed bills aid them in flipping over rocks in search of food. The male is smaller than the female, and, as is usual with birds, is more brightly colored. The ruddy turnstone is found in many areas of the continental United States.

One animal that is a victim of such a fly-by crime is the horseshoe crab. This gentle-natured crab, which resembles a tank, scavenges the bottom of the ocean for remains left by other marine dwellers. Its shell protects its soft underside; therefore, it does not have many enemies except for those that can swallow it whole and can grind up its body inside their stomachs. However, when female horseshoe crabs head toward shore to lay their eggs and male crabs follow to fertilize them, a feeding frenzy takes place. Birds that during migration have lost as much as 50 percent of their body weight feast on the crabs' eggs.

The horseshoe crab has a tail called a telson that it uses to right itself if it is turned over. If the telson is lost or broken in an accident, and the crab is turned over, exposing its soft underside, the crab becomes dinner for the birds that can fly away from would-be law enforcers such as tourists. The laws of nature rule in this case--not the wishes of the frequently squeamish people who witness such events.

#### 5. The Loggerhead Turtle and the Jellyfish

Another aquatic killer tackles a victim that few of us have sympathy for and many would just as soon never see, except at a safe distance. The predator is the loggerhead turtle, and its prey is the jellyfish. Because the loggerhead is immune to the poisonous stings of the jellyfish, it can demolish this beautiful but usually dangerous creature with impunity. Unfortunately, humans have taken care of this murderer, not by putting it in jail, but by greatly reducing its numbers. A significant decline in turtle numbers has been caused by the disposal of plastic bags in the ocean and elsewhere. The bags drift to the ocean, where the loggerheads mistake them for their favorite food, that is, jellyfish. The bags then clog the turtles' stomachs, which causes the turtles to starve to death (see Figure 2 for a Make & Take activity). In addition, sea turtle populations have declined because of the destruction or degradation of beach nesting grounds and because of the consumption of both turtles and turtle eggs by humans.

#### 6. The Starfish and the Mollusk

The starfish has attributes that many bank robbers would envy: five arms. This spiny-skinned serial killer attacks its victims by attaching itself to their exoskeletons and prying open their shells until their insides are exposed. The starfish then extrudes, or everts (turns inside out), the stomach of its prey and devours its insides (e.g., the mollusk).

Mollusks have the widest range of body shapes of any of the invertebrates. The phylum Mollusca includes gastropods (slugs and snails), bivalves (clams and oysters), and cephalopods (squid and octopi), as well as several other less familiar forms and chitons. The mollusks all have one or more of the following characteristics: a calcium carbonate shell, a horny, toothed ribbon in the mouth (the radula), and a mantle or mantle cavity, which typically has a specific type of gill.

### 7. The Crow, the Whelk, and the Mussel

A crow grasps a whelk in its claws and flies upward carrying it (Sibley 2000). Next, it drops the whelk onto rocks on the beach below, hoping to break open and expose the whelk's soft body so it can feast on it. Should the whelk escape the clutches of the crow, the whelk, in turn, will pry apart the shell of a neighboring bivalve (e.g., a mussel) by wedging the lip of its shell in between the bivalve's two shells. The whelk then inserts its head and uses its raspy tongues or radulas, chainlike structures with rows of teeth, to eat the delicious meat of mussels. What goes around comes around!

### 8. The Oystercatcher and the Oyster

The American oystercatcher is a large bird that has long pink legs and a long orange bill. Oystercatchers can be found on beaches, on mudflats, and on the shores of salt marshes. The birds use their long bills to pry open oysters, mussels, and other bivalves. They also eat barnacles, starfish, crabs, and jellyfish. Oystercatchers stick their bills in the mud of shallow water to probe for food. Female oystercatchers lay two to four eggs in shallow depressions in the sand on the beach. Unfortunately, unless their nests are marked, the oystercatcher's eggs are often destroyed by beach vehicles, that is, by humans.

### 9. Blue Crabs and Mole Crabs

One of the most colorful predators of all is the blue crab. The crab feeds on both dead and live animals. It searches for prey by swimming, and it can deliver a painful pinch with either of its claws. Small crustaceans and fish make up its diet. You can distinguish the male from the female by looking at the apron on the ventral side of the body. The male's apron is shaped like the Washington Monument, and the female's is shaped like the U.S. Capitol building. To complete her coloration, the female has red tips on the ends of her claws.

Mole crabs live at the very edge of the wash from the waves. The crabs have five pairs of legs and always move backwards. Females grow to approximately an inch in diameter, whereas males grow to approximately half an inch. With the wash of the incoming waves at their backs, these crabs collect and eat organic matter and minuscule creatures. The water rushes back down the beach and covers them as the crabs dine. Between tides, mole crabs dig into the sand to hide from the larger blue crabs that would dismember and eat them.

## 10. Homo Sapiens and Many Coastal Creatures

Actually, the greatest threats to the largest number of coastal inhabitants are human beings! Humans build homes on the coast, thereby destroying the habitats of native coastal inhabitants. Humans eat shellfish, turtles, and fish, and they also collect shellfish for table decorations and crafts. The litter that humans throw away indirectly kills many coastal creatures. For example, plastic six-pack rings get caught around the necks of marine animals and choke them, fishing line gets entangled in animals' legs, and plastic bags that float like and resemble jellyfish are consumed by loggerhead turtles. Because the turtles receive no nutrition from the plastic although it fills their stomachs, the turtles starve to death. Plastic jugs, netting, and wood structures have all been found in the stomachs of whales that have starved to death. In addition, many invisible chemical pollutants can kill marine life.

If your students are at least 12 years old, you might want to show them the video *Death of a Whale* (December 1992). The video shows a partial necropsy of a whale that was found on the North Carolina coast whose stomach was filled with just such items. The following quote is from a description of the video. "In December 1992, a 28-foot sperm whale washed ashore at Wrightsville Beach, North Carolina. The emaciated female whale died in the surf. When veterinarians and biologists performed a necropsy, they found the whale's belly full of marine debris, nylon rope, a plastic gallon bottle, a plastic bag, and a fishing float. Veterinarians believe the whale starved to death because it couldn't get enough 'real' food in its stomach. *Death of a Whale* examines why the whale died and the implications of its death for the health of our marine environment. The video turns the whale's death into an unforgettable lesson about the dangers of marine debris. *Death of a Whale* is appropriate for use in junior and senior high school biology, marine science, or environmental study classes, 4-H clubs, scout groups, and college classes."

### **Crime Stoppers**

Luckily, many organizations and a host of laws aid organisms in their struggles against the most powerful criminals of all: humans. These organizations and laws protect and defend organisms against both pollution and habitat degradation. For example, the U.S. Marine Mammal Protection Act, the international ban on plastics dumping anywhere in the oceans (United Nations), the Cousteau Society, and the World Wildlife Fund act as marshals that police those who would harm marine organisms.

### **Not All Crimes Are Murders**

Another crime that happens on the beach is one that a small male creature with one big arm commits. This criminal is the male fiddler crab. It coaxes a female fiddler crab into its burrow where it fertilizes the female's eggs. Then the male closes the female inside the burrow and looks for another female. In the American Justice System, this crab would be charged with bigamy--not to mention being accused of domestic violence and spousal abuse!

### **Not All Deaths Are Murders**

Not all deaths are murders, of course. Some deaths of marine animals occur from aging or disease or even natural disasters such as storms and high winds. Evidence of these deaths abounds on sandy shores. Have the students collect evidence of death from both murders and natural causes and then attempt to distinguish between the two.

Murderers, victims, kidnappings, loss of affection, stealing--all a bit anthropomorphic perhaps and certainly tongue-in-cheek. Nonetheless, children of all ages will find it engaging to discover the coastal crimes that await them.

## **Additional Activities**

In addition to collecting and identifying seashells and collecting evidence of predation on the beach, you can do a number of other activities with your students that they should enjoy.

Beach Bingo, which helps students identify items commonly found at the shore, is very popular (see Figure 3). Classification keys are also popular. Ask students to create a simple, dichotomous classification key, using the information given for the 10 Most Wanted Predators and Their Victims. Branches in such a key might include vertebrates (animals that have a backbone) versus invertebrates (animals that do not have a backbone). Branching off from invertebrates, the students can classify the animals into mollusks and nonmollusks, bivalves and univalves, and so on until each item stands alone.

Another popular game with elementary school students is "20 Questions." With 3" x 5"-index cards and a string, make name-tags and hang a name-tag on each student's back. Everyone but the student will know what his or her name tag says; therefore, he or she must ask 20 questions to determine his or her "identity."

Animals that live on the beach or in coastal waters have fascinating lifestyles that students want to know more about. You can easily conduct a "Tracks in the Sand" activity in which students locate animal tracks and then try to tell a story about what the animal was doing on the basis of the track patterns observed.

"Are You Me?" is a Project WILD activity that focuses on several marine organisms (Western Regional Environmental Education Council, Inc. 1987). The activity involves matching young marine life forms with adult marine life forms. Give the students laminated cards with pictures of the adult and young forms of the following marine organisms: whelks, skates, sea turtles, and porpoises. Then ask the students to match the parents with their young.

You can also observe a number of marine organisms in their natural coastal settings. Whelks are always a favorite, because many students are surprised to discover that seashells are alive. If you like, you can sacrifice a mussel to attract mud snails and watch the snails' feeding behavior.

Two games that are suitable for large class groups are tremendous hits at the coast. The first is called "Sea Turtle Scramble." In this game, designate approximately three fourths of the class to be loggerhead turtle hatchlings. Make an eighth of the class ghost crabs and the other eighth sea gulls. The turtles in the nest hatch and then begin their trek to the water on all four flippers. Ghost crabs scurry after them, hands and feet touching the sand, and sea gulls "glide" on their armlike wings, catching as many turtles as possible. Stop shortly after you reach the surf zone and count the surviving turtles. This game helps students realize why so few loggerheads survive to return to their home beaches to nest.

The other game is called "Honey I Lost the Eggs." The game was developed as part of an Environmental Education Learning Experience at Fort Fisher Recreation Area in North Carolina (N.C. Department of Natural Resources 1993). Have the students paint plastic eggs to resemble eggs of nesting shore birds. Make approximately three fourths of the class shore nesting birds and the rest of the class various predators such as raccoons, feral dogs and cats, foxes, ghost crabs, and sea gulls. First play the game using randomly distributed nests. Let each "bird" start with 4 eggs. When the bird leaves the nest to forage for food, have the predators arrive, grab an egg, and race back with their prey to a home space where they will deposit the egg in their "stomach" (i.e., a plastic trash can). Then, have the predators return for a second round of prey. The eggs in the nests are depleted fairly quickly in this game. During the second round, put the eggs close together in the nest to resemble the way they are arranged in the nests of colonial nesting birds. With this strategy, you will discover

that the predators have a much more difficult time capturing eggs. Some eggs will escape the predators' raids and continue to incubate.

After you play these games with your students, hold a discussion to ensure that they understand the role of predators and prey and adaptations with respect to survival.

### **Conclusion**

The field trips we take to the coast with our classes are among our favorite activities as teachers. We all have students who have spent little time at the coast, although the coast is less than four hours away from where we live in North Carolina. Many students have never seen the ocean. Obviously, numerous activities can be done on the beach. For us, however, a good shelling beach especially offers an opportunity to solve the predation mysteries that we have described in this article.

### **Resource**

Spitsbergen, J. M. 1986. Seacoast life: An ecological guide to natural seashore communities in North Carolina. Chapel Hill, N.C.: The University of North Carolina Press.

PHOTO (BLACK & WHITE): Figure 1. Example of a wanted poster for a predator.

### **Figure 2. Sea turtle Make & Take.**

#### **Discover: How is Discarded Plastic Bags Hurt Turtles**

##### Materials

1. 3 paper plates
2. Toilet tissue paper cardboard roll/tube
3. Small balloon
4. M & M's
5. Markers
6. Staples and/or tape
7. Stapler
8. Scissors (to cut plate to make flippers)

##### **Make**

1. Take 2 paper plates and staple them around the edges, leaving a slot large enough to halfway insert the cardboard tube.

The plates represent the turtle's carapace and plastron, and the tube represents the turtle's head and neck.

2. Using another paper plate, make 4 flippers.

##### **Do**

1. Let the students color the plates or carapace (top) and plastron (bottom).
2. Have students "feed" the M & M's to the turtle.
3. Ask the students to blow up the balloon so it fits snugly against the turtle's "neck."
4. Have the students feed the turtle again.
5. Discuss what happens to the turtle.

##### **What Happens?**

In the wild, sea turtles prey on foods such as jellyfish. Therefore, when turtles see floating plastic bags discarded by humans, they mistake them for jellyfish. When the turtles swallow these plastic bags, the bags clog up their digestive tracts, and the turtles starve to death. Thus, it is critical that humans avoid littering the oceans because sea turtles, such as the loggerhead pictured above, are highly endangered.

PHOTO (BLACK & WHITE): Figure 3 Game board for Beach Bingo.

PHOTO (BLACK & WHITE): The shore

PHOTO (BLACK & WHITE): The Atlantic Moon Snail and the Clam

PHOTO (BLACK & WHITE): The Oyster Drill and the Oyster

PHOTO (BLACK & WHITE): The Ruddy Turnstone (a Bird) and the Horseshoe Crab

PHOTO (BLACK & WHITE): The Starfish and the Mollusk

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## ADDED MATERIAL

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