From the Mountains to the Sea

at the

SOUTH CAROLINA AQUARIUM and in the Novel, *No Place Like Periwinkle*

Created as a Pre-Visit SC Aquarium Experience
by Merrie Koester, Ph.D.

Welcome to this preview of the South Carolina Aquarium, a place with over 10,000 creatures from the mist-filled mountains of South Carolina to the depths of the Atlantic Ocean. Use this guide sheet and the SC Aquarium website before and during your visit. Terms and names you should be sure to see during a visit are in bold face type.

SITE ONE: THE GREAT HALL AND THE CAROLINA SEAS EXHIBIT

This floor to ceiling exhibit contains 14, 700 gallons of water. It represents a **hard bottom reef** to be found about 40 miles offshore and is characterized by **rocky outcrops and remains of ancient coral beds**. Real live bottoms will be covered with **bright orange and yellow sponges** (Replicas are in this tank.). Colorful fish abound. Look for the **pork fish** (so called because it grunts like a pig), the **lookdown fish** (who seems to be looking down his nose at you), and the **French angelfish.** You'll also find the **green moray eel** hiding in the crevices. It has to constantly open and close its mouth in order to draw water over its gills. It gets its green color from a thick layer of yellow mucus over its blue skin. Note its very sharp teeth!

SITE TWO: TOPOGRAPHICAL FLOOR MAP AND MOUNTAIN BOG EXHIBIT

As you travel up the escalator, imagine you're traveling to the **Blue Ridge Mountains of SC.** As you look over the railing, you'll see a giant floor map of the SC coastline. The blue tiles (from recycled blue bottles) represent water (over 2000 miles of rivers and wetlands), and the areas of grey granite represent land. You can also see the Intracoastal Waterway and the major rivers which drain into the Atlantic.

The **MOUNTAIN BOG** represents a very rare habitat in SC. Bogs are areas where organic matter builds up faster than it can decompose. This organic material, called peat, is very acidic and often so thick that plants' roots can't reach down to the mineral soil beneath to get the nutrients they need. But some plants have evolved a very crafty way of getting food – they capture insects and digest them! Among these are the pitcher plants, which fill up with water, causing insects that fall into them to drown. The animals in this exhibit are well hidden. Look for the **painted turtles**, box turtles, **toads,** and **salamanders.**

SITE THREE: MOUNTAIN FOREST EXHIBIT

You're now on the edge of a cool, fast-moving mountain stream. Notice that the fish have long, streamlined bodies, which allow them to face the current with the least amount of resistance. All they have to do is wait long enough, and the food comes to them! Here you'll see the brook trout and the **rainbow trout**.

Also in this exhibit, you'll see plants which commonly grow in our state's uplands. Many birds, like the cardinal, are also flying around. What are the names of some of the plants?

Take a right past the stream, and if you're lucky, the **river otters** will be out playing. Members of the weasel family, their streamlined bodies, webbed feet, and water repellent fur makes them well adapted for maneuvering quickly through the water. Their whiskers help them find a meal and their sharp teeth and sharp claws help them catch fish and other prey.

SITE FOUR: PIEDMONT SHOALS AND RESERVOIR EXHIBITS:

The shiners and **darters** of the **Piedmont Shoals** (areas where sandbanks have made the water shallow) have small, streamlined bodies like the trout in order to swim in the fast-moving shallow water. This protects them from larger

predators, who have difficulty swimming in this habitat.

The Reservoir Exhibit is a man-made habitat where there is almost no current and all the fish that live there, like the **sunfish** and **largemouth bass**, are adapted to still water. Their bodies are much larger and rounder than the darters, who would not do well in this habitat. Why?

The reservoirs exist because many upstate rivers were dammed so that their running water could be used to turn the giant turbines in electricity power plants. Name two lakes in South Carolina which were formed as a result of damming the Santee River.

SITE FIVE: SHIFTING SHORELINES EXHIBIT

This map shows how the shore of SC has moved through geologic time. During a very warm time on this planet, tens of millions of years ago, the shoreline was as far inland as the Sandhills of South Carolina. (near Columbia and Orangeburg.) But with the Ice Ages, sea level dropped, making the SC shoreline over 50 miles out from where it is now! This explains why ancient shark's teeth can be found 30 miles inland, and horse skeletons on the ocean floor.

SITE SIX: COASTAL PLAIN GALLERY – BROWNWATER AND BLACKWATER SWAMP /ALLIGATORS!

Brownwater swamps occur when rivers from the Piedmont (that are loaded with sediment from the mountains) flood surrounding forests. These sediments eventually end up as beach sand on the coast.
Blackwater swamps originate in the coastal plain, and their color comes from hardwood leaves that fall into the water release tannins, which stain the water a reddish-black, like tea.

Trees in both types of swamps tend to have trunks which are buttressed (widened, flaring out at the bottom). Both contain **cypress trees** (primarily the bald cypress, or ***Taxodium distichum*)**, well adapted to being partially submerged. Watch the sunfish in this habitat protecting their nests, seen as small depressions in the sand. Note also the **"knees"** on the cypress, whose function, while not completely clear, is thought to range from that of a "snorkel," food storage area, or anchor.

The **longnose gar** feeds on the surface of the water, jerking their heads to capture fish in the sharp teeth of their long, scissor-like jaws. The **shortnose sturgeon,** on the other hand, feeds on the bottom of rivers. They use whisker-like appendages on the their snout to find worms, crustaceans, clams, and other prey.

Alligators in these swamps can easily sneak up on birds, small mammals, and other prey because all but their eyes and nostrils are below the water when they swim. Alligators are **reptiles.**

SITE SEVEN: THE COAST - SALTMARSH AVIARY

The saltmarsh is dominated by a "smooth cordgrass" called *Sporobolous alterniflorus*. The reason it can tolerate the saltwater that covers it at high tide is that it has glands inside it which can remove the salt from saltwater and secrete it outside the plant. You can often see the salt crystals glistening.

Because the saltmarsh is a place where land and sea come together, you will find both types of creatures, as well as many shorebirds. In this exhibit, if you look closely, you will see a **white ibis** and a **great blue heron**, whose necks, beaks, and legs make them well-adapted for wading and catching small fish and other small animals. See if you can find out how each type of bird hunts.

The saltmarsh is flooded twice a day by high tides. Many fish such as **sheepshead, blennies, bass, puffer fish, and pintails** swim in with the tide. You'll also find **stingrays** and many **crabs.** At high tide, **fiddler crabs** go inside their burrows and plug the entrance with mud to keep out the saltwater. **Oysters** close their shells with just enough saltwater inside to keep their gills moist.

SITE EIGHT: SCHOOLING FISH EXHIBIT

There are several reasons fish are thought to school: 1) There is safety in numbers. 2) It confuses predators, who mistake the school for a much larger creature. 3) There are more "eyes" to watch out for predators. 4) They reduce the amount of time and energy needed to seek out a mate and the amount of energy used in swimming.

SITE NINE: CAMOUFLAGE EXHIBIT

At first glance, this exhibit seems uninhabited, but be patient. Let your eyes wander over the flecks of brown and white sand, and soon you'll see the faint outline of the **flounder,** a flatfish with both eyes on one side, scanning upward for small fish, shrimp, squid, and other prey. Flounder can change their color to match their bottom surroundings, from white sand to dark-brown mud.

You'll also find an **octopus** in this exhibit, carefully hidden in the rocks. Along with their other cephalopod cousins, the **s**quid and **cuttlefish**, they can also change their color to perfectly match their surroundings.

SITE TEN: LOGGERHEAD SEA TURTLE EXHIBIT (sometimes not available to the public)

You might notice a difference between freshwater turtles, like yellowbelly sliders and painted turtles, and the **loggerheads** in this tank. The feet of loggerheads have evolved to form flippers that are very effective for swimming but quite cumbersome on land. These turtles' large size (from 200-500 pounds) also makes it difficult to come up on the beach. The female lays her eggs just above the high tide mark, then struggles to make it back to the water. Freshwater turtles only weigh a few pounds and have webbed feet that allow them to walk on land and to swim with equal ability.

SITE ELEVEN: THE SURF ZONE

This narrow rectangular tank gives you a closeup of fish and crustaceans that live quite close to the shore. Perhaps the most unusual here is the **sea robin**, whose large pectoral fins can be fanned out to resemble wings. You'll also see small needle fish and wonderful **hermit crabs,** grazing on the bottom. You can't miss the large long-clawed hermit, scientific name, **Pagurus longicarpus.**

SITE TWELVE: THE OCEAN GALLERY: GREAT OCEAN EXHIBIT / THE JELLIES / SEAHORSES

The **Great Ocean exhibit** is 45 feet deep, 40 feet wide, and contains approximately **330,000 gallons of saltwater!** You will be looking at this huge tank from two different eye levels. You should compare the fish swimming at the top of the Rocky Reef View window with those swimming downstairs at the bottom. **Fish that spend a lot of time swimming in the open** ocean often **have long streamlined bodies with large, forked caudal (tail) fins.** They are in constant motion at the top of the exhibit and include the **Jack Crevalle, tarpon, and nurse sharks**. You'll also notice the schooling behavior of many of these fish. Fish, unlike people, also have the ability to sense what is beside them and behind them without looking. How? Running along the side of the fish from the gill to the tail is a sensory feature known as the **lateral line**. This special sensory organ is a series of pores that are close enough together to resemble a line. These **pores can detect movement in the water** and allow the fish to sense when something is near it. That's why you don't see fish crashing into one another and why schooling fish are able to turn in perfect synchrony.

Reef fish, by contrast, have rounder, less streamlined bodies and are not as active. Some of the reef fish you will see are the **gag grouper,** black sea bass, sheepshead, **triple tail** (it looks like it has 3 tail fins), **Atlantic spadefish,** red **and** vermillion snapper**.** (NOTE: There is a separate exhibit filled with **snappers,** lookdowns, spadefish, surgeonfish, etc. which can be found around artificial reefs growing from submerged wreckage of ships, bridges, etc.) You're also apt to see a barracuda or two foraging for food. These reefs are called **live bottom reefs** because of the carpet of sessile organisms which cover it (spon**ges, sea** whip corals**,** anemones, etc.)

At the very bottom of the reef, be sure to look for the large green moray eels**.** You'll also occasionally see a **nurse** shark

resting on the bottom. These are **one of the few sharks who don't have to swim continuously in order to breathe**. They have special muscles around their gills for drawing in water.

THE JELLIES EXHIBITS

These striking backlit exhibits reveal two types of **jellyfish** (not "fish" at all, but **Cnidarians**): the **harmless moon jelly** and the **sea nettle**, which can give a nasty sting. The sea nettle and most Cnidarians (like the Portuguese Man-o-War) have tentacles armed with stinging cells to sting and capture prey. The prey (fish, shrimp, etc.) are then transferred to the frilly tentacles (called **oral arms**) near the mouth, which is under the bell.

The small, delicate **moon jelly does not have long stinging tentacles.** Instead, it captures its prey (usually small zooplankton), with the mucus on their bell. It then uses small oral arms to wipe off the plankton and bring it into its mouth.

SEAHORSES

Swimming is not the strong suit of the seahorse, the strangest fish of all. Lacking pelvic and caudal fins, a sea horse swims upright, using its earlike pectoral fins with its dorsal fin for propulsion. Because it can so easily be swept away by currents, the seahorse spends much of its time with its tail wrapped around seaweed and seagrass, waiting for small creatures to float by that they can eat. What is unusual about the male seahorse?

SITE 13: Touch Tank

This is a large touch tank, where you'll allowed to handle a variety of invertebrates from 5 different phyla:

Cnidarians – sea anemones and sea whip corals

Mollusks – Gastropods like the knobbed whelk, queen conch, deer cowrie, and tulip snail
– Bivalves like the clam and mussel

Arthropods – the horseshoe crab and crustaceans like the spider crab, hermit crab, and slipper lobster

Echinoderms – tube footed animals with radial symmetry like the sea star, sand dollar, sea urchin, and sea cucumber

Bryozoans – plant like colonies of animals like one called "fat grass"

AQUARIUM ASSIGNMENTS (with suggested grading options)

1. With this preview next to you, go to the SC Aquarium website: https://scaquarium.org/exhibits/. **Go through each of the exhibits from the Mountains to the Ocean**. Be sure to study the floor plan site, too, in order to familiarize yourself with the layout of the exhibits.

2. At the top of the next clean page in your sketchbook, write **ILLUSTRATED FIELD STUDY GUIDE TO THE SOUTH CAROLINA AQUARIUM. (Test grade)**

3. Now, using the written information from the preview I gave you and pictures from the website above (or other picture sources like *Google*), create **an illustrated field guide** pf the aquarium. In this field guide, you will cover the following sites: **1. The Great Hall and Carolina Seas, 3.The Mountain Forest, 4.The Piedmont, 6. The Coastal Plain, 7.The Saltmarsh Aviary on the Coast, 11., The Ocean, and The Jellyfish Exhibit**.

For each site you will include written factual information (which you may take from my notes) as well as gesture drawings (NO TRACINGS!) of at least 3 representative plants and animals from the sites 1, 3, 4, 6, 7, and 11. Be sure to have a good balance of notes, pictures, and white space on each page. You should be able to complete most of this work in computer class.

FIELD TRIP ASSIGNMENT (50 points quiz grade)

First, walk through all of the above sites with your chaperone. Choose **any five exhibits and carefully draw at least one representative specimen from each**. Next to your drawing, write down notes about that habitat and any noteworthy features of the animal you are drawing. Feel free to complete your drawings and notes with more detail later by using a field guide or other source book.

Here are some sample field guide entries made by students: